Modelling the Relationships of Internal Governance Mechanisms on Innovation: Empirical Insight from Utility Tokens

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Thesis Abstract

Innovation is important to social progress and economic growth, for it ultimately reallocates resources to achieve desired goals more efficiently or achieve an entirely new goal that brings value to human life. Accordingly, significant scholarship has been dedicated towards understanding drivers of innovation, which generally focus on country-level indicators, and recent literature also suggests corporate governance may also be important for innovation. Governance can either be external, when out of the organization's control such as media coverage, or internal, which are unique to every organization, such as ownership structure and board structure. While several studies have examined the impacts of various internal governance mechanisms on innovation in single countries, research on conceptual relationships have been split, due to the wide variance of national institutions that influence governance.

The purpose of this paper is to determine the impact internal corporate governance mechanisms have on innovation. This study examines relationships between internal governance mechanisms and innovation in the context of utility token offerings, which is an innovative method of entrepreneurial finance for organizations offering a blockchain-based application. This setting is interesting as there are no notable regulations that apply to utility token offerings as contracts are enforced through smart contracts, on blockchain. Further, it is able to test these relationships in a small to medium sized organizational context of high-technology start-ups, which usually have advisory boards, whereby advisors provide external advice to the top management team, but do not have fiduciary duty as external directors would. This thesis thereby examines the impact of ownership structure and board structure, with respect to advisory boards, on innovation outputs.

The analyses were conducted on 525 utility tokens, which held their initial offerings within a period of three years. Several linear regressions were conducted, with the natural logarithm of pull requests merged as the dependent variable, representing innovation output. Independent variables of interest included elements of ownership concentration, specifically the percentage of tokens owned by whales, referring to those who own 1% or more of a token's supply, the number of institutional investors, and the percentage of the token offered to the public; and elements of board structure including the number of advisors and the technical intensity of advisors. To test potential quadratic relationships, the squared terms of each independent variable was also considered. Controlling variables included disclosure of based country, implementation of a softcap and hardcap on campaign fundraising activities, the number of restricted countries, duration of the campaign in days, and whether or not they had a pre-ICO offering, offered a minimally viable product upon initial offering or provided a bonus for purchasing a high volume.

Findings suggest that ownership concentration, represented by the percentage owned by whales, has an inverse-U relationship on innovation output, which can be seen as rectifying the may positive and negative linear relationships in prior research. Institutional ownership had a strong, positive relationship on innovation output. The percentage of the token supply offered to the public had no significant relationship with innovation output, unlike research on utility token financial performance. The findings also cemented predictions for board structure, namely that the percentage of technical advisors explained more variance for innovation outcomes than the number of advisors, with the former a positive, linear relationship, and the later a mostly negative relationship.

There are several limitations of this study. In terms of its ability to represent the conceptual relationship of innovation and governance, this study is constrained as relationships within utility tokens may not represent the relationship of firms overall. Second, it limited itself to studying innovation outcomes and not innovation as a process, in line with research that examines patent activity as an innovation outcome within traditional firms. Third, utility token holders do not have an ownership stake in the organization per-se like shareholders and boards studied were advisory boards, which unlike boards of directors, have no fiduciary duty. In terms of its application to utility tokens, the study was limited to utility tokens which had a GitHub account, the results cannot be inferred to be representative of all utility tokens.

The findings suggest that regulatory authorities, policy makers and investors should turn their attention to an inversed-U relationship between ownership concentration and innovation. Accordingly, exploring ways to limit excessive ownership concentration should be a feature of good governance and, in the utility token context, bonuses should not be offered for volume discounts of tokens as such bonuses encourage innovation. Its findings of institutional investment suggest that investment by venture capital firms should be encouraged as it has a positive impact on innovation. Advisory boards appear to have similar relationships on innovation as boards of directors in terms of size. Technical intensity accounted for more variance, firms should encourage technical presence on teir advisory boards and boards of directors.

No other research has examined the relationship of governance and innovation in the context of utility tokens. This research bridges the gap and provides a strong foundation for future research.

Dedication

This thesis is dedicated to Dr. Conrad Winn, for his support and encouragement to continue onwards in education with resilience, integrity and hard work. Dr. Winn was a Professor of mine at Carleton University who was instrumental in providing me direction and confidence in my career by introducing me to empirical research as an undergraduate and pushing me to do a PhD in corporate governance. Dr. Winn helped me transform into a confident academic and, without the many times he went out of his way to push me ahead, I would not have even applied to graduate school nor had a genuine interest in research.

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Thank you.

Chapter 1: Introduction

1.1. Context

1.1.1. Situating the Research

Innovation is important to social progress and economic growth (Romer, 1986), for it ultimately reallocates resources to achieve desired goals more efficiently or achieve an entirely new goal that brings value to human life. Interestingly, prior to the early twentieth century, innovation had a negative connotation as it was associated with rebellion from the mainstream and accepted practices (Morck and Yeung, 2001). The modern understanding of innovation, as a valuable improvement to life, followed the work of Josef Schumpeter (1939) who coined the term 'creative destruction' as a process where creative firms invent and market new technology, destroying markets for older technology in the process. As innovation entails that economies can be more efficient and strive towards higher goals, the value of innovation outweighs the cost of the 'destruction' it incurs in terms of overall productivity. While Schumpeter broadly defined innovation processes, Christensen, Craig and Hart (2001) added clarity by introducing two variations of innovation, namely incremental innovations which achieve existing goals with less resources, and disruptive innovations which allow individuals to achieve a new goal. A notable example of a disruptive innovation is how Ford was able to position vehicles as a means of achieving affordable transportation, disrupting the marketplace for horse and buggies. With vehicles, humans can not only achieve local transportation more efficiently than horse and buggy, but the speed of vehicles allowed for longer destinations that ultimately created greater integration in society.

Innovation has since become among the most important policy topics, as finance and strategic management scholars have recognized that innovation can provide firms

longer-term competitive advantage, (Weerawardena and Mavondo, 2011; Di Vito and Laurin, 2010) and economists have recognized that, through innovation, countries are able to achieve long-run sustainable growth (Ahlstrom, 2010; Romer, 1986). Firms which spend heavily on research and development are found to have stronger performance (Kostopoulos, Papalexandris, Papachroni and Ioannou, 2011) and are associated with increased value (Johnson and Pazderka, 1993). Indeed, businesses flourish when they allocate scarce resources to accomplish objectives more efficiently than before. This also impacts economies, as historical economic research finds those who have strongly fostered innovation, perhaps by accident, have also prospered greatly over time (Morck and Yeung, 2001). Behaviour supportive of creative destruction and disruptive innovation has been correlated well to several indicators for quality of life (Gordon, 2018), including life expectancy, GDP per capita, human development and productivity. The increase in efficiency allows humans to allocate more time to more valuable tasks, which is highlighted in the increasing knowledge-based economy.

While innovation provides first-mover advantage over a value network to the innovative firm, such power is temporary and overall, a net benefit for consumers and society. The contention for the centrality of innovation as critical to social progress violates a fundamental assumption of perfect competition in neoclassical economics (Makowski and Ostroy, 2001). This assumption infers that firms are prevented from raising the price beyond covering for the imports, competitive salaries and fair investor returns as innovative firms can charge in excess for the value of the improvement they introduce. However, innovative firms are given first-mover advantage with their new invention; and this advantage generally benefits consumers in the long run as it pushes more efficient

or effective organizations of resources (Fogel, Morck. and Yeung, 2008). Innovation to which the firm has a first-mover advantage would nonetheless need to compete with other innovations that exist in other markets and need to price competitively to gain market share. A visible example can be seen with BlackBerry, which once held the monopoly for handheld keyboard devices. Over time, it became disrupted with touch screen phones, and the company was forced to eventually exit the business of cellular devices altogether (Gans, 2016). It follows, thereby, that in the knowledge-based economy, competition is primarily around innovation, and not necessarily prices, as standard economics poses.

Given the centricity of innovation to growth, wealth of firms, development of nations and social well-being, researchers aim to identify mechanisms that boost innovation and distinguish these from hindering factors. Among the determinants explored are optimal subsidies, firm size, property rights, demographics, political regimes, patent laws, regulations, and relative income equality to name a few (Morck and Yeung, 2001). While the exploration of macro-level determinants of innovation has grown into a large subdiscipline within economics; there are far fewer studies on micro-determinants due to a challenge in available data (Gonzales-Bustos and Hernandez-Lara, 2016).

1.1.2. Governance and Innovation Research

While years of research point to relationships between governance quality and firm performance, only recently has research suggested it as a significant micro-determinant to innovation (Tylecote and Visintin, 2007). Literature in this area generally explores how innovation activity is influenced by external governance and the relationship between such and the firms' comprehension of innovation (Belloc, 2012). With an understanding of the centrality of innovation to growth, scholars have recently began exploring the

relationship between internal governance and innovation by exploring a range of mechanisms which aim to shrink agency costs between management and shareholders.

Organizational governance mechanisms, overall, promote alignment between shareholders and managers of a corporation, such that shareholders can be assured against opportunistic managerial behaviour. With separation of ownership and control, corporate governance has become increasingly important, especially since the collapse of Enron, WireCard and Nortel to name a few. Governance can be largely be separated into internal governance, which are mechanisms for which the company has some control in aligning such interests, and external governance which are mechanisms linked to markets in a broader sense, such as media treatment, which can communicate misalignment (Dyck Volchkova and Zingales, 2004). Internal governance measures oversee decisions taken by the firm regarding its performance and competitiveness and includes ownership structure, board structure, executive compensation and shareholder rights. Given their capacity to influence decisions, both, external and internal mechanisms are shown to provide incentives or disincentives for managers to invest in long-term projects which impacts the ability of the firm to innovate.

1.1.3. Key Problems

With substantial differences in contextual settings, namely differences between countries in investor protection (LaPorta et. al, 2006), and extralegal institutions (Dyck and Zingales, 2004) that, in turn, influence governance and innovation, theoretical and empirical arguments on internal governance and innovation remain inconclusive. Varying property right laws (Lacetera, 2001; Zhao, 2006; Tomizawa, Zhao), use of the Rule of Law (Khanna and Palepu, 1997; Morck and Yeung, 2009), anit-democratic governments

(Morck and Steier, 2005; Burton, Filatotchev, Chahine and Wright, 2010) and varying corporate governance regulations (Ugur, 2013) have all been demonstrated to effect innovation, and the effectiveness of governance mechanisms (Hoskisson, Hitt, Johnson and Grossman, 2000; Bassellier and Ahlstrom, 2020). Major factors of internal governance, namely ownership structure and institutional ownership, have positive, negative and insignificant relationships found (Gonzales-Bustos and Hernandez-Lara, 2016). Mixed findings within this area suggest relationships of ownership concentration and institutional ownership on innovation are sensitive to national contexts where studies are conducted, and board structure for differences in upholding fiduciary duties across nations.

Research on the relationship between governance and innovation has also yet to be explored in a contextual setting outside of large, publicly traded corporations, and controlling for differing technical intensities of sectors. While boards of directors to larger corporations have been subject to significant research some variables remain to be examined that may be more preeminent in smaller and medium-sized technology start-ups. Technology start-ups usually need to attract investment, while also face strong pressure to innovate in order for their firm to appreciate. Many private start-up firms, for instance, utilize advisory boards instead of recruiting independent directors. Advisory boards differ from boards of directors as there is no fiduciary duty and are usually paid less compensation, when compared with formal independent directors. This makes it attractive to advisors and start-ups seeking expert advice for their firm. According to a Deloitte Canada survey (Osry, 2020), 86% of small and medium sized businesses with

an advisory board in Canada said such made a significant and positive impact on the organization' success.

A limited number of studies explore two-way and non-linear relationships, (De Miguel et. al., 2004) however these are limited to specific countries and mechanisms of governance. Non-linear relationships between variables have yet to be tested. Sapra, Subramanian and Subramanian (2016) developed a theory of the effects of external corporate governance on innovation, by studying takeover pressure, and found evidence supporting an inverse U relationship instead of a linear relationship as found by other research in various contexts. This quadratic form of relationship may also explain the contradictory findings between ownership structure and innovation, with respect to ownership concentration, managerial ownership and institutional ownership, remains to be studied empirically.

1.2. Thesis Objectives

This research responds to the key challenges to studying relationship between structures of internal governance and innovation activity, by doing so within the context of utility tokens. Through smart contracts, which are not enforced through country-level institutions but rather through blockchain, such firms are subject to only very limited national regulation, which along with a wealth of open-access data, makes them an attractive laboratory to test conceptual relationships. Furthermore, these findings may also be useful for their contextual setting as entrepreneurial firms, which like other high technology firms, seek investment and need to innovate to appreciate in value.

In particular, this thesis aims to determine the shape, direction and strength of relationships between innovation activity of organizations financed through the issuance

of utility tokens and independent variables, such as the percentage of tokens owned by large token holders, number of institutional owners, advisory board size and technical intensity. This research can, therefore, give clarity to three interrelated problems on the relationship of governance and innovation.

First, it would allow to empirically testing on relationships of internal governance on innovation, namely with respect to ownership concentration, institutional ownership, and board structure, in a context of limited regulation. With limited national influences, studying such relationships in a context like utility tokens, are important for developing the conceptual relationships. Utility tokens may have wide variation in ownership concentration, institutional ownership and board structure and are not governed by formal national institutions. Exploring non-linear relationships in this context can also be fruitful to truly identify the nature of the relationship and can potentially reconcile positive and negative findings from other jurisdictions.

Second, the context of utility tokens would allow for research on smaller high technology start-ups, where the impacts of ownership concentration and institutional ownership may be overlooked by potential owners. This would also allow for empirical study of advisory boards and their relationship to innovation, as these are generally preferred to independent directors among small businesses for their lack of fiduciary duty of directors and less compensation necessary as a result. These prominent features of medium-sized business governance have yet to be subject to much empirical work due to lack of data. With a lack of data, it remains to be empirically tested weather or not advisory boards have similar impacts on innovation to boards of directors. As most utility tokens have advisory boards, this provides a useful context to understand such boards

and their relations to innovation. Further, many findings between board structure and innovation also remain inconclusive due to a wide range of innovation proxies and contextual settings to studies. Innovation activity from some utility tokens can be tracked with open source code repositories, which alongside the lack of formal regulations applying to advisory boards of these blockchain-based organizations, characteristics of advisory boards to utility tokens may also provide some fruitfulness to advance understanding the overall conceptual relationship between board structure and innovation.

Third, as ownership structure and board structure are the two major factors of internal governance, such research allows for development of a holistic theory of internal governance on innovation. To date, most research operationalize governance as only one its major mechanisms, such as ownership concentration, ownership structure or board structure and do not explore non-linear relationships. Exploring ownership concentration and board structure a part of a single, conceptual framework that accounts for potential non-linear interaction on innovation is important. With many differing conceptualizations and operationalizations of innovation, this thesis can also study these governance mechanisms against the same measure of innovation, and among the same sample of firms that mitigate national influences, being in the context of utility tokens. Altogether, this research aims to bring empirical clarity on these three interrelated problems with insight from a unique, empirical setting.

1.3. Research Setting

This research is set within the empirical laboratory of utility tokens. Utility tokens are licenses to use applications on a distributed ledger, for which these applications are

made by individual organizations. The difference between application on a utility token and software, is its base on a distributed ledger. A distributed ledger is a database, called a ledger, that is distributed across a network of several machines with no central administrator. These machines power popular BitCoin, Etereum and FileCoin, and utility tokens aim to use these machines to solve problems for a wide range of sectors, similar to software. Proponents issue tokens to those who buy them, which represents a license to use the technology eventually developed, and there are usually a fixed supply of available licenses.

Utility tokens begin with an initial coin offering (ICO), which are a type of fundraising method for a start-up using blockchain. ICOs use the decentralized feature of 'smart contracts' to create an agreement between investors and entrepreneurs. There are two major forms of ICOs, namely security token offerings (STOs) and utility token offerings (UTOs). Whereas security tokens are digitalized securities and can largely be thought of as investments as token holders become investors in the organization, utility tokens are licenses to their technology. During a UTO campaign, investors purchase tokens at a predefined price by a specified end date, directly from the utility token, in order to provide early stage financing available directly and immediately (Fisch, 2019). The funds raised from the UTO are to finance technological development of the utility token. As tokens are only sold by the organization at the point of UTO, these token holders can then sell their tokens on an exchange and can be traded to other investors or end users who are interested in the technology the token provides, once developed. Hence, some token holders who purchase tokens during the UTO phase may want the token to appreciate in value such that it can then be sold on an exchange, at a later date, for a higher price to

either investors or end consumers. While usually issuing most of the tokens for sale to the public, utility token founders also retain some tokens for their own purposes to reward themselves on development (Chen, 2017).

While most security laws apply to security token offerings (Mendelson, 2019), similar to traditional initial public offerings (IPOs) on the stock market, utility tokens are not subject to any notable regulation (Crosser, 2018). This is because UTOs as they resemble 'corporate coupons' often found in traditional crowdfunding campaigns where investors do not attain dividends, but instead gain a discount on the product or service the company offers. An example of a traditional utility token would be ***Filecoin***, which raised $257 million in token sales, in return for granting funders access to decentralized cloud storage. Interestingly, research reveals that investors in utility tokens generally hope that their tokens appreciate in value in a manner similar to security tokens (Crosser, 2018), and that token issuers describe their offerings as utility tokens to avoid attracting regulations imposed on security tokens. As utility tokens are not classified as securities, most ICOs take the form of a utility token to avoid heavy regulation, despite investors of both desiring ultimately for the token to appreciate in value and treat their ICO holdings as investments. Hence, both security tokens and utility tokens act as a medium of value exchange and investment. Holders of security tokens look for dividends, and utility token holders hope that the organization develops and innovates its offering, and in doing so appreciate the value of the token, which they could then sell in a secondary market at a higher price. As UTOs are unregulated and therefore information asymmetry is heavier as proponents and promotors to not disclose at all, or disclose only irregularly, information about their platform (Kaal, 2018).

To put ICOs in context, their rise in popularity in 2017 led them to achieve over $30 billion in aggregate trading activity between 2017 and 2019 (Price Waterhouse Coopers, 2020); though have declined significantly throughout 2019 as security token offerings (STOs) gained in relative popularity compared to utility token initial coin offerings due to their greater regulation providing more confidence to investors. Nonetheless, the strong activity of utility token ICOs from 2017 to present provides a wealth of investor data that could provide useful insights into the broader phenomena and within initial coin offering governance itself.

Altogether, utility tokens provide a fruitful laboratory to test the relationship between governance and innovation due to their light regulation and limited external influence over their governance and innovation activity. Although many legal scholars call for stricter regulations, and despite recent changes in the US in Fall 2019 (SEC, 2019), utility tokens remain very lightly regulated worldwide and hence have limited formal institutions influencing governance. While different social structures impact investor and firm behaviour in different countries (La Porta, Lopez-de-Silanes, Shleifer and Vishny, 2000), investor behaviour does not influence external governance structures of utility tokens. Internal governance of utility tokens is voluntary, as each offering only adopts those governance mechanisms necessary to convince investors the organization's token offering is worth funding and is safe (Johnson and Yi, 2019).

Research from EY (2018) shows just under 50% of ICOs were successful in fundraising, a mere 16% have a prototype, 13% have a working product, 86% are below their listing price within a year, and 30% lose almost all value. Hence, the wide variation yet great importance of both, innovation activity and governance standards, along with

limited regulation and formal country-level institutions influencing governance, present utility tokens as an ideally laboratory to test the relationship of governance and innovation in a global context that measures innovation activity consistently and encompasses all major aspects of internal organizational governance. Recent data also shows that a mere 44% of ICOs survive after four months (Benedetti and Kostovetsky, 2018).

Governance of utility tokens is different from that of traditional firms. In the case of utility tokens, founders are generally 100% owners of their organization and, instead of selling shares, sell tokens instead of shares on an 'crypto exchange'. Accordingly, token holders, who purchase tokens, have similar interests to shareholders as they are financing a venture to gain a future profit with appreciation of the business, or in this case technology, within the traditional agency theory model.

1.4. Motivation

This research is primarily motivated by the need to better theorize the conceptual relationships of internal governance mechanism on innovation and empirically explore such. Research on the relationship between governance and innovation has yet to be explored in a contextual setting that mitigates influence from country-level regulations and institutions that influence governance, and also in contexts outside of large, publicly traded corporations. Additionally, relationships between key components of governance structure, such as ownership concentration, institutional ownership, management ownership and board structure, have yet to be extensively tested for non-linear relationships, which may explain the mixed findings studied in various national contexts.

Therefore, the true conceptual relationship between internal governance mechanisms, namely ownership structure and board structure, remains to be found. A

conceptual understanding would be important to guide future scholarship as it would clarify the interaction of several internal governance mechanisms and innovation activity, and potentially pave the way for future scholarship to identify external and national-level factors that influence innovation. Major reasons underpinning the inconclusiveness are the differing technical intensities of individual sectors and legal differences surrounding the obligations of boards of directors in different countries. Controlling for these factors requires a significant sample size of firms within a specific industry and within a specific country with accessible data on innovation and governance, which the utility token context provides.

Second, this research is motivated to respond to the need for governance and innovation scholarship within the area of high-technology start-ups. These organizations often seek outside investment and face similar governance decisions to major corporations yet have some differences. These firms need to innovate for firm appreciation, and may use advisory boards over independent directors. Given their significance to economic growth, yet also recognizing well-known failure rates of such firms, examining governance within such context can be important for improving practices and hence for better investment decisions. Altogether, regulatory authorities, investors and policy makers seeking economic growth through strong governance design in developed and developing nations, would benefit from research addressing governance and innovation at a conceptual level and within a technology start-up context.

Third, this research also aims to contribute meaningfully to the debate of regulating utility tokens and UTOs. The SEC's Investor ***Alerts and Bulletins*** (2019) argues that ICOs may serve as fair and lawful investment opportunities but warns that scammers could

exploit these new technologies and financial products associated with ICOs to improperly entice investors with the promise of high returns. In response, some research suggests regulatory authorities need to better regulate governance of utility token ICOs to protect investors (Howell, Niessner and Yermack, 2019) while others suggest it may defeat its disruptive potential (Johnson and Yi, 2019). Accordingly, regulatory authorities would need to understand the optimal level of external governance that would best promote innovation, should they decide to implement regulations surrounding utility token ICOs to protect investors. Potential utility token holders also should understand how governance impacts their potential return through innovation activity to optimize the use of their funds and potential return.

Current research examining relationships between governance mechanisms in initial coin offerings remains extremely limited however may be crucial to understanding drivers of appreciation in value, through innovation. To date, no study in initial coin offerings accounts for ownership structure, which given its influence on IPO literature, may be a fruitful area of future research. Further, most studies within this context examine governance on fundraising success, however with 40% of new ventures financed and only 4% developing working technology, this is not necessarily correlating with appreciation in intrinsic value of the token offering, a major motivation of most investors. Studies examining governance also usually do so using a wide range of proxy measures, which usually measure innovation inputs or throughputs, and hence this variation may lead to significant problems in measuring results accurately.

Studies examining governance in the ICO context also usually do so without a theoretical foundation of governance literature, and hence fail to account for factors such

as identity of large shareholders. As Fish and Momtaz (2020) empirically show, ownership structure could be a critical area that impacts performance. Accordingly, investigating other variables of ownership structure would be important, along with other internal governance mechanisms. This research would provide a model that uses many proxies collectively forming strength in internal governance mechanisms, on real outcomes for ICOs, namely through innovation.

1.5. Limitations

The research is limited to utility tokens, which have different organizational structures to traditional firms which may limit the external validity of the study results to other forms of entrepreneurial finance. In a utility token, firms promise development of technology using blockchain through selling a token, which may appreciate in value and be either sold in a secondary market or kept for its utility to a token holder. Traditional firms sell shares of a to investors in public markets, who then gain an equity stake in the firm, and many times, earn a dividend. As the firm establishes, their shares appreciate in value and can be sold in the market. In a utility token, the firm is held by its individual investors and generally, its founders. Investors purchase tokens for appreciation of value, similar to the use of shares in a traditional firm, however investors do not get ownership right in the context of utility token. Further, utility tokens generally prefer use of advisors over independent directors, which while still seeking external opinions, the former are not bound by a fiduciary duty as the latter. This is similar to other high-technology start-up firms. Although there are also many striking similarities, potential results should be taken with some caution when extrapolating results to traditional firms in a traditional context.

1.6. Organization of the Study

This study proceeds in six further chapters. The proceeding chapter provides a review of literature pertaining to both, works surrounding the relationship of governance and innovation and the study of governance and innovation within the context of initial coin offerings. Within this chapter, propositions are drawn from the literature, at a conceptual level. In Chapter III, a detailed discussion of sources and collection of primary and secondary data and a methodology for analyzing such data is outlined. A model is presented with hypotheses in Chapter IV, which draws on findings from the literature within the empirical setting. The empirical analysis and results are then presented in Chapter V, complete with relevant tables. A discussion of the results is then followed, with implications for methodology, theory and practice and limitations within Chapter VI. Lastly, Chapter VII sums up the thesis as a conclusion with recommendations for further research.

Chapter 2: Literature Review

2.1. Internal Governance as a Determinant to Innovation

2.1.1. Introduction

While there is a wealth of research on corporate governance and its relationship to financial performance, research on governance and innovation is comparatively much smaller and is inconclusive yet increasing in importance with the growing knowledge intensity of the economy. Governance, through its provision of ownership structure, and the structure of the board of directors, guides decision making, power and authority between corporate management bodies (Jensen and Meckling, 1976). Accordingly, governance can provide incentives to management to invest resources towards research and development. As firms vary widely on their governance structures, governance may be a significant micro-determinant to innovation (Tylecote and Visintin, 2007) and can explain why firms facing similar external conditions could have different outcomes on innovativeness. External governance mechanisms, such as market for corporate control has been studied rigorously, namely with Sapra, Subramanian and Subramanaian's (2007) finding of an inverted-U between takeover pressure and innovation. However, research between internal governance mechanisms and innovation remains understudied. Accordingly, this chapter reviews literature on the relationship between internal governance mechanisms and innovation, and offers propositions based on the reviewed literature, throughout.

2.1.2. Effect from Ownership Concentration

Positive and negative relationships have been found within empirical literature studying ownership concentration on innovation in a range of settings. With potential to greatly influence management, ownership concentration is an important internal

governance mechanism, referring to the concentration of shares a specific investor or subset of investors, within an organization. Positive relationships between ownership concentration and innovation activity have been found in the United States (Baysinger, Kosnik and Turk, 1991; Lacetera, 2001) and Europe (Munari, Oriani and Sobrero, 2010); whereas negative relationships have been found within the contexts of Canada (Di Vito, Laurin and Bozec, 2010), China (Chen, Li, Shapiro and Zhang, 2010) Italy (Battaggion and Tojoli, 2000), Switzerland (Brunninge, Nordqvist and Wiklund, 2007) and Germany (Czarnitzki and Kraft, 2009) among others.

Studies showing positive relationships principally suggest larger shareholders are most concerned with the market value of the firm, and therefore, become more inclined to invest in long-term investments that will generate value (Belloc, 2012). Seeking to attract more shareholders and gain exponential return in the long run instead of individual profit in the short-run, firms with concentrated ownership are positioned to increase firm stability in order to do so. As innovation increases firm stability, as shown in Lee, (2005) larger shareholders would influence management to invest in innovation activities.

Those finding a negative relationship generally suggest that as ownership concentration increases, large shareholders influence the company to maximize their personal and private short-run profit (Su, Xu and Phan, 2008), and become more risk averse, which minimizes long-term innovation projects. Using agency theory as a framework, Denis, Denis and Sarin (1999) and Denison and Mishra (1995) suggest that owners become increasingly more risk averse with the greater concentration of their shares tied within one firm and hence desire more conservatism. As innovation is a risky activity that may only pay in the long term, firms with higher ownership concentration are

also said to participate in less strategic renewal, and hence are less innovative (Hill and Snell, 1988).

There may be several explanations for differences between jurisdictions on ownership concentration and innovation; and many cross-country studies conclude that results are largely variable depending on nations studied. Property rights, the Rule of Law democracy, governance regulations, socio-economic mobility, protectionism, freedom from the press, and freedom of expression have all been well documented as relating to innovation processes (Khanna and Palepu, 2000; Hoskisson, Hitt, Johnson and Grossman, 2000; Rigobon and Rodrik, 2005, Carson, 2008) and corporate governance effectiveness (Morck, 2007). As these vary widely across countries and are hard to model, research remains inconclusive as a result. Lee and O'Neill (2003) studied ownership concentration on research and development expenditure, finding a positive relationship for the US yet one insignificant for Japan. In a study of France, Germany and Italy with largely concentrated ownership and the US and UK with largely dispersed ownership, Hall and Oriani (2006) interestingly find that for all countries except Italy and France was investment in research related to market value. However, this did hold true for firms in Italy and France who did not have high levels of concentrated ownership. Countries vary widely on legal protection for minority shareholders (Young, Peng, Ahlstrom, Bruton and Jiang, 2008), and on pressure from external investors for disclosure and strategic renewal (Carney, 2005), implying limitations on examining the causality of ownership concentration on innovation. Further, causality is also limited in most studies for their exclusion of other governance mechanisms which may arise concerns of endogeneity.

Some studies examine inverse U-shape relationships in areas such as China (Chen, Li, Shapiro and Zhang, 2013). Although China has very weak institutions of governance, these findings may pave the way for a broader conceptual relationship. Indeed, an inverse U shape relationship can reconcile existing positive and negative findings, which is to say that, to a particular point of concentration, firm aims to strengthen their market value for appreciation and ensure funds are going to their optimal use, yet past a point, owners become entrenched and expropriate resources for personal benefit which diminishes innovation activity.

> ***Proposition 1:*** Ownership concentration and innovation are related in the form of an inverse-U.

2.1.2. Effect from Ownership Identity

Major shareholder identities may influence the results found within studies of ownership concentration and innovation. Research on institutional ownership, has been very mixed and largely dependent upon the preferences of institutions within particular geographies. Positive arguments suggest institutional owners are better enabled to achieve economies of scale, as they have tolerance for long-term investment (David and Kochar, 1996) and a supervisory ability that provides needed oversight to ensure funds are allocated to innovative investments that have reasonable prospects of success (Aghion, Bacchetta, Ranciere and Rogoff, 2009; Choi, Lee and Williams, 2011). However, other evidence suggests a negative relationship as such institutional ownership drives takeover pressure, and the pressure from institutional investors to managers for reporting short-term profits, lowers their liking to long-term investments (Turk, 1992).

Family ownership (Bozec and Di Vito, 2019, Block, 2012, Latham and Braun, 2009; Czarnitzki and Kraft, 2004) has been subject to a plethora of research, for which suggests several potential moderators to the relationship between innovation and governance. In particular, firms that are controlled by families or decedents, aside from those which began with a lone founder, are shown to innovate less. The potential underlying reason for such is that lone founders are passionate about their offering while hiers and other family members wish to be risk averse and protect the capital accumulated (Su and Lee, 2008; Di Vito, Laurin and Bozec, 2010). In a study of 303 TSX listed firms controlled by their founders or their heirs, Bozec and Di Vito (2018) find that only lone founder firms, without excess voting rights, have the willingness and ability to invest in research and development, and hence invest more than their counterparts in such activities. As some countries have a larger percentage of controlling shareholders being families or heirs, this may impact the results in some countries. For example, "the Canadian disease" refers to Canada's heavy percentage of families controlling its major corporations (Morck, Strangeland and Yeung, 2000) and may explain why ownership concentration was found negatively correlated with innovation in such countries, whereas it was positive in the neighbouring United States.

Bank ownership is popular in many developed countries, where banks are the larger shareholders. Bank ownership has been argued to be mostly negative on investment in research and development, (Xiao and Zhao, 2012; Tribo, Berrone and Surroca, 2007) as banks prefer to minimize uncertainty on their investments hence leading to lower levels of innovation. State ownership, also popular in many developing countries, is generally found to also be either negative or insignificant on investment for

research and development (Munari, Oriani and Sobrero, 2010; Zhao, Gao and Zhao, 2017).

While studies of bank, government and family ownership on innovation leans towards a negative relationship, overall research of institutional ownership is shown to be positive. In some countries, institutional owners could be weighted more towards bank ownership and government ownership, such as in China (Shapiro, Tang, Wang and Zhang, 2015) or families, such as in Canada (Morck, Wolfenzon and Yeuing, 2005) which may impact aggregated findings with institutional ownership. It is thereby conceivable that expectations would be more related to specific identities, such as regulated banks and governments who may have more short-term expectations given their generally transient investment behaviour for investing with expectations for short-term profit (Bushee, 2001). As aggregated studies examining institutional ownership would include owners of each of varying identities, an understanding for how venture funds behave remains to be isolated. Institutional ownership with respect to venture funds, can thereby be argued as positive, given the due diligence towards investments and general commitment within the medium term.

> ***Proposition 2:*** Institutional ownership of venture funds have a positive relationship to innovation.

2.1.3. Effect from Management Ownership

Research on management ownership is rather limited though generally suggesting a positive relationship. Studies finding a positive relationship claim that management ownership reduces agency costs as managers have greater voting power which guarantees job stability to reduce risk aversion (Hill and Snell, 1988). Latham and Braun

(2009) find that, as management ownership increases, so too does the likelihood to take decisions that maximize shareholder profit which includes investments in innovative projects. Francis and Smith (1995) suggest firms with high managerial ownership, namely 30% or more of ownership shares, are more innovative than those with widely held stock. Indeed, studies comparing shareholding ratios of management to R&D intensity report a strong positive correlation (Hosono, Tomiyama and Miyagawa, 2004; Aghiton, van Reenan and Zigales, 2009). Lerner and Wulf (2007) show firms with centralized research and development teams who are given with stock options, also correlate with patent citation, awards for innovation and patents of greater originality. Management ownership therefore has strong potential to be used as a tool that promotes alignment of interests between management and owners and this could result in greater innovation.

Studies examining the broader phenomena of managerial ownership and financial performance, however, have mostly discovered non-linear relationships (Morck, Wolfenzon and Yeuing, 2005; Shleifer and Vishney, 1997, Adams, Hermalin and Weisbach, 2010), which imply that when managers face a strong potential loss of compensation or job security, they become more risk averse leading to less investment in innovation. Empirical research on entrenchment and innovations shows entrenchment offsets incentives for innovation beyond a certain point, implying that high concentration, managerial ownership or institutional ownership will negatively affect performance beyond the point of inflection. Correlating management ownership and Tobin's Q, a ratio between a firm's market value and their asset replacement cost, most find inflection points of an inverse-U relationship between 35% and 65% (McConell and Servaes, 1990; Gugler, Mueller and Yurtoglu, 2008). Based on a sample of British SMEs, Cosh, Fu and

Hughes (2007) demonstrate that CEO ownership positively effects innovation efficiency at low levels until peaking between 65% to 68%, when it then becomes negative.

Inverse-U relationships have been tested between managerial ownership and research and development expenditure (Beyer, Czarnitzki and Kraft, 2012), amoung Belgian firms. Hence, to a particular point, managers are more interested in increasing market value of their firm and putting resources towards innovation for such appreciation, yet beyond such point, become entrenched and use firm resources for personal benefit leading to less innovation.

2.1.4. Effect from Controls and Incentives

Surprisingly, little attention has been paid to the role of incentives, such as CEO compensation structure, on innovation activities; though studies are generally in congruence with respect to managerial incentives and innovation. Most theoretical arguments (Carpenter, 2000; Lewellen, 2006) draw on agency theory, which suggest managers may under-invest in innovation activities due the high probability of failure (Holstrom and Tirole, 1989) which would reduce compensation and potentially lead to job loss (Zwiebel, 1995). However, there is also some incentive for management to over invest in innovation given potential for firm growth which may lead to higher compensation, power and prestige (Baker, Jensen and Murphy, 1988). Empirical literature generally finds positive relationships between value of incentives and innovation (Genus and Coles, 2006; Lerner and Wulf, 2007). Manso (2011) analyzed optimal incentive schemes to motivate innovation; and found that those rewarding long-term success and having high tolerance for early failure are best. Incentive schemes have

also been analyzed (Chow and Liu, 2007; Kim, Li and Zhang, 2011) with similar results found.

2.1.5. Effect from Board Structure

The structure of boards of directors, through their role as the ultimate decision making authority in the firm and formal linkage between owners and managers (Fama and Jensen, 1983) has been suggested to have strong linkage to strategy, and hence innovation activity, despite limited evidence (Balsmeir, Buchwald and Stiebale, 2014) and many potential factors effecting such relationships. Baysinger, Kosnik and Turk's (1991) analysis of board characteristics on innovation, concluded with finding a relationship between the number of internal board members and research and development expenditure per employee. Since then, literature has shown a number of other characteristics influencing innovation activities, including their size (Guest, 2009; Driver and Guedes, 2012), educational level of directors (Gang, Zezhong, Travlos and Hong, 2007) composition (Balsmeir, Buchwald and Stiebale, 2014), meeting frequency (Wincent, Anokhin and Ortqvist, 2010) and CEO duality (Lhuillery, 2011).

Empirical literature on the relationship between board size and innovation is relatively mixed yet leans towards a negative relationship. Research finding a positive relationship generally draw from the perspective that each additional director will increase the human capital resources, such as experience, information and advice, to which the company can use. Accordingly, conceptually, it is suggested that larger boards have a stronger capacity to deal with uncertainty in the external environment (Pfeffer and Slancik, 2003; Jackling and Johl, 2009) by offering of more external financial and technical resources than would otherwise be available, and are essential for innovation (Shapiro,

Tang, Wang and Zhang, 2015). Conceptually, this would enhance the success of research and development projects which would increases firm value through innovation (Goodstein, Gautam and Boeker, 1994; Yermack, 1996; Haynes and Hillman, 2010). Recognizing that, along with a greater size comes greater diversity of opinions, which at some point, may lead to conflict and mistrust, several empirical studies find a negative relationship between board size and innovation that examine other board characteristics (Zona, Zattoni, Minichilli, 2009; Ruigrock, Peck, and Keller, 2006; Goodstein, Gautam and Boeker, 1994). This infers that other board characteristics may be more important than board size. Interestingly, some scholars such as Shaprio, Tang, Wang and Zhang (2015) do not find a significant impact on number of new patents. Similarly, Driver and Guedes (2012) also does not find any significance between board size and research and development expenditure. These insignificant studies may be due the contexts they were studied in, with weak institutions and more corruption in emerging markets having been suggested by several scholars, as accounting for the variance.

Human capital of directors, through individual educational attainment and experiences, are important dimensions of the relationship between board strength and innovation in firms. Educational attainment determines directors' cognitive complexities (Wally and Baum, 1994) which can allow for greater comprehension of new ideas and possibilities by the board overall. Educational level is also an important dimension to adoption of new behaviour, ability to define problems and creatively ideate solutions (Bantel and Jackson, 1989). As shown within the governance context, higher educational attainment of directors increases innovation processes and understandings, strengthens external analysis and correlates to greater implementation of innovation (Lacetera, 2001).

Hence, educational attainment, is an important dimension to board quality and the ability of the board to positively contribute to firm innovation.

Attaining a balance between internal directors with deep product knowledge and external directors with diverse experiences, is important to achieve innovation outcomes. External directors, who bring senior experience from other organizations to the table, are shown to positively contribute to strategic change within a firm and better supervise management, that together fosters innovation (Brunninge, Nordqvist and Wiklund, 2007; Shapiro, Tang, Wang and Zhang, 2015). In studying external directors with engineering leadership experience on patent applications for German firms, Balsmeir, Buchwald and Stiebale (2014) finds a positive correlation. Collectively, external directors are able to bring their human capital resources to reduce agency conflicts by enhancing conflict resolution and independently evaluating agendas (Yoo and Sung, 2015).

Internal directors are more likely to adopt strategies for new product and service innovation if they have deep knowledge of the firms' products or services. This detailed knowledge allows them to perceive less uncertainty and risk (Hoskinson, Hitt, Johnson and Grossman, 2002). Being less dependent upon the options of external directors, Baysinger, Kosnik and Turk (1991) senior executives on the board positively linked to investment in risky projects, however only if not penalized for poor returns (Baysinger and Hoskisson, 1989). Accordingly, board quality would be enhanced with a balance between external directors who bring extensive industry experience and internal directors who understand the services or products.

More frequent meetings are likely to result in a more efficient (Vafeas, 1999) and effective board (Chiang and He, 2010), being a facilitator to time devotion from directors,

on firm strategy and supervision of management. Both functions are very important for allocating scarce resources (Forbes and Milliken, 1999) to build on opportunities and address threats in the external environment, increasing potential resources for innovation (Hsu, Lien and Chen, 2009). Board meetings, as a facilitator to discussing strategic alternatives, allows the firm to also reduce uncertainty and lead to stronger integration of activities that promote innovation (Wincent, Anokhin and Ortqvist).

Mixed results are found on whether or not duality negatively or positively contributes to innovation processes. Duality refers to situations where the Chair of the Board and the CEO are held by the same person (Fama and Jensen, 1983). There is some empirical research suggesting duality promotes innovation by ensuring greater strategic integration between the board and management. In a study of duality on research and development budgets among firms in France, Lhuillery (2011) concludes with results suggesting a positive and strong relationship. This work has been repeated in the UK (Driver and Guedes, 2012) with similar findings. Nonetheless, there is also studies pointing to firms with duality allow for agency problems to arise due to information asymmetry between management and the board. Evidence supports duality leading to unfavourable shareholder returns and unfavourable stakeholder expectations (Petra and Dorata, 2008). Further, empirical research also shows separation between the Chair and President would increase decisions to invest in projects with long-term potential (De Villiers, Naiker and van Staden, 2011) and increase monitoring capacity of innovation activities by the CEO (Crossland and Hambrick, 2007). Accordingly, while duality may lead to greater investment in research and development, a lower degree of success from those projects may also follow.

With the mixed findings of governance and innovation, it is likely that board quality is more important than board size for innovation. Conceptually board size is only positive due to the greater resources of board members each add to the table and diversity of their opinions; otherwise it would be negative due to disagreement on direction and lack of coordination. Research on board structure that considers other characteristics than size, generally find negative relationships of board size (Zona, Zattoni and Minichilli, 2013). This is interesting as most studies focus on size as the only variable.

Insight on board size is mixed, yet there is a clear relationship with more internal technical directors driving innovation. This infers that the clear driving force behind governance and innovation is its technical intensity. Having a greater portion of directors from technical backgrounds will allow directors to better evaluate strategic decisions, and do so more confidently, when involving technology and thereby make strengthening investment in innovation.

Only practitioner studies have studied advisory boards, which do not carry a fiduciary duty onto the advisors yet still serve the purpose of providing external advice. In particular, these are highly popular with privately-held technology firms. Practitioner evidence suggests advisory boards can enhance innovation through providing advice to managers. In a Deloitte survey, 86% of Canadian medium-sized businesses suggest. It had a positive impact on their organization and 25% of these businesses experienced 20% sales growth, compared to 11% sales growth without advisory boards (Osry, 2020). While advisory boards may be positive, such would be conceptually driven by the quality of advice they provide and hence be driven by technical intensity of the advisory board. Research Board size and innovation overwhelmingly points to a negative relationship, as

compromise is more difficult in larger groups which becomes problematic when discussing complexity and riskiness, face coordination problems and directors may feel less valued given lower individual impacts on group outcomes. Despite not having fiduciary duty, the relationship of advisory boards on innovation is conceivably similar to boards of directors, which is an inverse-U yet largely negative.

> ***Proposition 3a:*** The proportion of directors or advisors from technical backgrounds would have a strong, positive relationship on innovation.
>
> ***Proposition 3b:*** Controlling for the proportion of technical advisors, advisory board size will have a negative relationship on innovation past a smaller, critical point.

2.1.6. Theoretical Frameworks

In the context of governance and innovation, agency theory has underpinned many studies pointing to a positive relationship, as it views managers having divergent interests to shareholders and hence a great need for strong governance to protect against opportunism. Agency theory formally stems from the work of Jensen and Meckling (1976), however the agency problem can root back to Adam Smith (1776), and his concern that if a firm was controlled by a person who was not the owner, than the owners' interests may become diluted and not fully fulfilled. Agency problems occur when a principal party, such as an owner, engages another agent party, such as a manager, to perform decision making. In the context of public markets, agency costs can be seen in the form of monitoring costs, such as audits, which limit opportunism by the agent, bonding costs

which limit power contractually of the agent, and a residual loss in terms of reduced welfare. To address this, firms adopt internal governance mechanisms such as a board of directors, carefully craft executive compensation and influence on ownership structure.

As agency theory views owners as having divergent interests to managers, studies using such as a perspective are those which found a need for very strong governance mechanisms to ensure funds are being put forth to innovation over private benefit. This can be seen as it is the main theoretical framework in studies finding relations of innovation between a concentrated ownership structure, high management ownership and a large and diverse board of directors. Contra agency theory, stewardship theory assumes that managers will generally act as responsible agents, or stewards, of assets they control but not own. Using stewardship theory as a theoretical framework, some scholarship supports duality as beneficial for firms given shared values and goals (Donaldson and Davis, 1991), and that the need for strong governance mechanisms depends on the relationships between the steward and the principal.

2.1.7. Assumptions, Underpinnings and Gaps for Future Research

While inquiry on governance and innovation has starting nearly three decades ago (Goodstein and Boeker, 1991), three critical assumptions that underpin inconclusiveness also expose gaps that exist within research on governance and innovation.

Most studies are limited to specific jurisdictions and are not generalizable to other areas, hence leaving a gap for a conceptual relationship and theory for aspects of internal governance structures on innovation. While there are many strong relationships between aspects of governance and innovation, these are limited to specific contexts. Accordingly, most studies assume that studying innovation and governance in one jurisdiction can be

inferred at the conceptual level, though that is flawed given the wide variance in findings for both, ownership structure and board structure. As countries vary widely in laws and institutions that protect investors and hence influence governance (Dyck and Zigales, 2004; Djankov, La Porta, Lopez-de-Silanes and Shleifer, 2006), empirical studies are mixed and become largely dependent upon the jurisdiction they are researched within.

Studies attempting to show the relationship as close to the conceptual relationship would need to exclude national influences of firm governance, such as differences in laws surrounding governance by domestic governments. What may appear as positive in one country may appear negative in another, such as how ownership concentration on innovation appears as positive in the United States (Lacetera, 2001) yet negative in Canada (Di Vito, Laurin and Bozec, 2010) due to external institutions effecting governance in each country (Morck, Strangeland and Yeung, 2000). As almost all research in the area only involves data from one country, the ability to understand the conceptual relationship between the ownership structure or board structure on innovation is highly limited. Accordingly, future research that addresses the jurisdictional limitations would be essential to understand a theoretical foundation of the relationship, which can be used as a foundation in countries and modelled to properly identify variables that maximize or stifle innovation.

Since most research focusses on larger, publicly traded firms, advisory boards have not been subject to any research. Many innovative, high-technology start-up firms use advisory boards instead of independent boards of directors as compensation can be lower and there is no fiduciary duty. The lack of empirical literature within this area is likely due to a lack of data given most of these firms are privately held. However, it remains

strongly important as these firms seek external investment, face steep failure rates, and investors rely on their ability to innovate for appreciation of these firms. Empirical research on weather or not advisory boards have similar effects on innovation to boards of directors would be very important.

Second, most studies assume that mechanisms of internal governance and innovation are related linearly, however a non-linear relationship may explain the wide range of findings. This could be especially important of the widely researched area of ownership concentration on innovation. At low levels of concentration, firms will have an incentive to invest in innovation for appreciation of shareholder value; yet at the other extreme, may be risk averse and have a greater desire protect their investment with modest appreciation. A similar parallel can be made with board size, with one extreme having too little to form creative ideas and the other having too many people to arise at consensus. Non-linear relationships have been tested for external governance mechanisms which reconciled the opposite linear relationships by others, such as Sapra, Subramanian and Subramanaian's (2007) inverse-U between takeover pressure and innovation. Accordingly, research that tests relationships with non-linear models would be important in understanding the relationship.

Third, a major underlying assumption to inconclusiveness is the lack of construct clarity of "innovation" which influences the proxy variables chosen. Strategic management scholars contend that innovation does not have a single, agreed-upon definition (Baregheh, Rowley and Sambrook, 2009) and can take many forms largely drawn into either process as innovation, and innovation as process (Martin-de-Castro et. al, 2011). The former views a process of research and development leading to an innovation, with

an innovation representing a new or improved commercialized product or service, while the later views innovation as happening at various moments and that progress on projects becomes innovation. With a multitude of measures for innovation competing findings may be found and limit ability to conduct meta-analysis.

Commonly, innovation inputs such as research and development spending is used as a proxy for innovation, though it may not necessarily be reflective of innovation output despite it being the desired goal. Patents have also been used to measure innovation in studies of governance and innovation, however there are significant industrial limitations to their use. Scherer (1982) first employed successful patents as a proxy for innovation, however not all patents have equal economic value nor utility. To address this, other studies use patent citations which signals the value each patent provides in generating future cash flows. While patents and citations may realistically show innovation in some industries (Aghion, Reenen and Zingales, 2009), this may not be the case for industries which rely on business model innovation or keep trade secrets instead of issuing patents. Organizations in the later category would appear less innovative and play a role in results in the case of studies of firms from multiple industries (Klienknect, van Montfort and Brouwer, 2002). Accordingly, future studies need to define innovation clearly and use that definition to guide their proxy measure.

2.2. Governance and Innovation in Initial Coin Offerings

2.2.1. The Emergence of Initial Coin Offerings

ICOs are a relatively new method of entrepreneurial finance, with some parallels to crowdfunding (Pietrewicz, 2017) in their need to signal to investors legitimacy to overcome risk of underinvestment (Vismara, Benaroio and Carne, 2017). As an

alternative to public offerings, venture capital or equity financing, crowdfunding refers to raising capital through a web platform as an intermediary, like IndiGoGo, who simply charge a fee, yet overall costs less than traditional forms of finance and expands the base of potential investors. The primary purpose of intermediation in crowdfunding is to ensure campaigns raise at least enough capital to develop its technology, known as a soft cap, otherwise it does not release capital held in escrow to proponents; which provides investors security in their investments only being used should the firm have the threshold resources to achieve its objectives.

Utility tokens have no intermediation and hence can conceptually reduce costs of raising capital even further than crowdfunding. As utility token are blockchain based, smart contracts power the management of the flow of the funds and sometimes also involve crypto wallets or escrows to ensure minimum thresholds are met for the project to continue. While some early ICOs developed their own blockchain, most now use an existing blockchain, most notably that of Ethereum. The Ethereum blockchain allows entrepreneurs to conduct an ICO, which technologically allows users to design smart contracts. Hence, users can create proprietary tokens that can exist on a platform and on the Ethereum blockchain. Wang, Ouyang, Yang, Ni, Han and Wang (2018) suggest smart contracts as a concept that can increase contractibility and facilitate exchange of money, property or value without conflict. Smart contracts have also been shown to maximize overall welfare through disintermediation which lowers transaction costs (Catalini and Gans, 2019). Utility tokens however, do not make any enforceable commitment to disclosing information at regular intervals with token holders, as most use smart contracts solely for financial exchange.

Proponents of UTOs issue whitepapers to communicate the potential viability of their offering to potential investors, (Chen, 2017) that describes the project in terms of the business case, technological development, token rights and sometimes organizational information such as the advisory board or development team. Zetzsche, Buckley, Barberis and Arner (2018) finds that only 14.2% of papers include important information as to how funding will be pooled or segregated. The market price of tokens is generally measured in terms of a cryptocurrency, such as BitCoin or Ehtereum instead of fiat currency. Some UTOs begin by raising capital in a presale phase, which may give volume bonuses for early contributors (Giudici and Adhami, 2018), followed by a mainstream campaign over a period of time. Airdrops also exist where some UTOs generate awareness, better understand users and inspire loyalty by giving away a limited number of tokens for free. Among others, proponent must generally set the minimum amount of capital necessary for the project and the maximum that would be needed, designate a total number of tokens that would be distribute and their price, rights associated with the token and designate rules for allocating tokens to management, founders, the advisory board and the general public.

Research suggests utility token investors are similar to investors in the public stock market, as they hope to the token will appreciate over time, and this depends on the utility token team's ability to innovate. Interestingly, research shows the hoped future sale of tokens for a higher price as the most important reason behind token holders of utility tokens, far above use of the token for its utility function and attaining a long-term equity stake in the organization (Fisch, 2019). When contributors receive the token, they are then allowed to trade these tokens in cryptocurrency exchanges, similar to secondary

markets, which position utility tokens similar to public offerings as investors hope for appreciation in their investment and can use such as a form of exchange (Cong, Li and Wang, 2019). While 47% of ICOs achieve success in meeting their minimum requirement of capital, 26% become listed on an exchange (Howell, Niessner and Yermack, 2018) which is significant. This distinguishes utility tokens and UTOs from other forms of entrepreneurial finance for it adds a speculative dimension (Fisch, 2019; Lyandres, Palazzo and Rabetti, 2019). Accordingly, the investment is not necessarily for management using resources to make incremental profit, but on whether or not management develops a technology that becomes useful and popular. Hence, the risk investors of utility tokens incur, is on technological development and the degree of utility to innovation (Ankenbrand and Bieri, 2018).

While there are similarities between utility tokens and public offerings, there are also some significant differences. In literature on public offerings, after-market financial performance proxies are used as indicators of success, and not necessarily technological development. Whereas public offerings provide a share of ownership, utility tokens do not give ownership and are generally in their early stages in contrast to established firms on the mainstream stock market. With greater disintermediation among UTOs, this leads to relatively smaller transaction costs (Howell, Niessner and Yermack, 2019). Aftermarket prices for tokens are very volatile and can be classified as a high risk-return holding (Lyandres, Palazzo and Rabetti, 2019).

2.2.2. ICOs as an Empirical Setting for Governance and Innovation

The utility token context allows for a strong empirical setting to study the theoretical relationship between governance and innovation for its ability to show greater causality.

First, remaining largely unregulated, there are few jurisdictional laws and institutional factors that could affect their adoption of governance mechanisms, as all governance mechanisms adopted by utility tokens are entirely voluntarily. Second, there is wide variation among utility tokens in their strength of governance, reflected in their variation of disclosure of white papers. As there are no audits nor standardized disclosure practices, most utility tokens do not discuss policies for appointing advisors, meeting frequencies, and are not required to meet any threshold of reporting project activities, objectives or teams they developed. Third, as start-up ventures proposing to develop a technology, essential for appreciation of the token value, there is a clearer cause-and-effect with success in innovation causing token values to appreciate. Innovation in utility tokens is also relatively standardized, being blockchain-based application or protocol development, and hence can be studied using the same proxy measures.

While there are differences between organizations that issue utility tokens and traditional firms, there are striking similarities in power dynamics as there is relatively little power of individual token holders, like retail investors, due to a high dispersion of investors leading to low individual influence (Giudici, 2016). Despite relative decline after reaching its peak in 2018, UTOs nonetheless provide a wealth of data as an empirical laboratory, with overall funding volumes far exceeding crowdfunding with the largest utility token, Bitfinex, raising over $1 billion in funding. The ICO context, which includes utility tokens, has been used to as an empirical setting to test theoretical relationships involving scam behaviour in markets (Deng, Lee and Zhong, 2018) and owner retention (Davydiuk, Gupta and Rosen, 2019).

Research on governance for utility tokens is also important, for there is a major power imbalance between utility token proponents and token-holders, as proponents retain total control of funds raised after successful campaigns and raises several challenges to regulators on whether or not regulation is needed and how regulation may proceed (Zetzsche, Buckley, Barberis and Arner, 2017). The power imbalance has led many to classify utility tokens as controversial in their legitimacy as means of entrepreneurial finance, for their unregulated nature that allows start-ups to raise huge capital without any from compliance or intermediation, and hence poses a higher risk of fraudulent potential (Hornuf and Schwienbacher, 2018; Lyandres, Palazzo and Rabetti, 2019; Chen and Bellavitis, 2020; Momtaz, 2020). Without third-party intermediation nor any ownership rights, investors cannot be protected from misappropriation of funds by management, as tokens do not provide any voting rights nor counter value (Howell, Niessner and Yermack, 2019). Altogether, the lack of intermediation provides lower costs to raising capital yet also creates immense potential for moral hazard.

Investors, as a result, are left on their own to evaluate the quality of ventures from proponents and ensure the governance features each venture boasts would not lead their funds to be misappropriated. As several poor quality utility tokens take advantage of quality signals (Momtaz, 2020) and exaggerate their true value, some jurisdictions have since banned utility tokens, including China. In 2017, the Securities and Exchange Commission in the United States issued a warning to potential investors about these risks, though also did point to the innovative potential (SEC, 2017). Ventures attempting to signal quality hence adopt strong governance structures, including escrow accounts to

provide greater protection to investors; however stronger governance protections overall in other forms of initial coin offerings have led to the relative decline of utility tokens.

Research of governance on utility tokens is also important for considerations of blockchain, its underlying technology, which can have very disruptive potential to governance functions in the near future. Blockchain technology is a decentralized infrastructure, that certifies information and securely stores information on the internet. As organizations are, essentially, a 'nexus of contracts' between the firm, its shareholders and its stakeholders (Posner, 2004), the development of 'smart contracts' in blockchain have disruptive potential. Smart contracts are those certified using hashing, a cryptographic process, to output an irreversible fixed-length alphanumeric string and recorded on a distributed ledger that offers security, accuracy, immutability and anonymity (Yuan and Wang, 2016). The contract is hence bound to the web and not to any specific jurisdiction. Bitcoin and Ethereum both rely on blockchain technology as their foundation. Commercial financial applications such as payments, loans and other forms of exchange are being experimented. Many large banks, including in Canada, are investing in blockchain also for its opportunity to disintermediate financial transactions.

2.2.3. Characteristics of Initial Coin Offerings

Identifying key trends in behaviour of utility token investors is contextually important for research on identifying factors that can optimize their success and hence position utility tokens as a legitimate form of venture finance. In examining motives of investors to utility tokens, Fisch (2019) surveyed motivations for investors of blockchain start-ups and found that ideological and technological motives are equally important. In evaluating data sources, Boreiko and Vidusso (2019) explores reputations of data

sources for ICOs, pointing to how ICOs can buy reviews and rankings that can convey trust, highlighting potential for fraud and the challenge to find reliable reviews. Chen (2020) found different types of signals are processed differently depending on the stage of utility tokens. In particular, it was found that at the crowd sale level, highly credible signals that are easily interpreted are most commonly discerned by inventors; that signals lower in credibility yet easily interpreted are most commonly used at listing, and that when signals are not easily interpreted, they lose their value. In addition, the study also revealed that investor comments on social media play an important role in information surveillance of the signals by the proponent.

To drive better analysis of the unique market of utility tokens, scholarship has also begun identifying underlying contextual characteristics. Garratt and Oordt from the Bank of Canada show the major reason behind the decline of utility tokens, was regulatory pressure, presence of fraud, and relatively poor performance. Catalini and Gans (2018) examine ICO productivity, and find platform productivity is reflected in the token price and network size. Research suggests that market prices are not meaningful in the analysis of utility tokens, given they are highly volatile and easy to manipulate. When market price is used, research can become skewed towards some successful ventures; however Howell, Niessner and Yermack's (2018) study of liquidity in the secondary market for tokens, was not nearly as skewed as others for proceeds or returns, when expressed in logarithmic terms.

Studies of jurisdictions where ventures are based reveals that the greatest number of proponents is from the United States, followed by Russia, China, India and Western Europe (Howell, Niessner and Yermack, 2018). Kostovetsky and Benedetti (2018)

examined underpricing using a sample of over 4000 ICOs, which unveiled an average return of 179% from the first day market price. While there are few external conditions to success, there have been some dimensions explored which include capital gains in cryptocurrencies relative to fiat currency, market dynamics, social media networks and media sentiment, the latter two of which represent external governance.

2.2.4. Governance of Initial Coin Offerings

Governance of utility tokens have become an increasingly important domain of research for its perceived value to better legitimate such tokens as a means for entrepreneurial finance. Legal scholars generally argue for increased governance on utility tokens, viewing such as a medium to exchange value in black markets (Hardy and Norgaard, 2016; Abramowicz, 2016), prevent its use in money laundering (Brenig and Müller 2015) and properly draw taxable revenue. Due to concerns about the lack of universal regulation, over twenty-five countries are considering comprehensive cryptocurrency regulations (Kaal and Dell Erba, 2017). Foley et al (2019) estimates 46% of Bitcoin is linked to illicit activities and calls for more regulation. However, others from an Austrian School orientation argue against universal regulation as it would make utility tokens lose some of its competitive advantage through disintermediation. In particular, they suggest that making governance standards totally voluntarily allows utility tokens to use governance mechanisms as value-enhancing, for universal standards may reduce their value on ensuring utility tokens are legitimate.

Empirical research focussed on identifying key success factors to utility tokens generally have a governance orientation. Hsieh, Vergne and Wang (2017) study internal and external governance of some cryptocurrencies which focussed on examining

management ownership vis-à-vis disclosures of token allocations in white papers, formalized fvoting, and social media reputation. Several working papers show that total supply, the percentage of tokens retained by founders, having a base on Ehtereum, lengthy white papers and a presence on GitHub are related to investor confidence and signal quality (Amsden and Schweizer, 2018; Deng, Lee and Zhong, 2018; Adhami, Giudici and Martinazzi, 2018). Presence on GitHub or Telegram can be seen as a utility tokens technical transparency, as they normally post source code on one of these two sites to show and prove their progress. Whitepaper length can be seen as a utility tokens' disclosure, varying greatly due to little regulation about what needs to be included, and founder token retention resembles management ownership, representing a portion of the value that the organization is able to build. Availability of the source code on GitHub or Telegram with lengthy white papers have also been studied to correlate with success in becoming listed and reach stated fundraising goals (Guiduci and Adhami, 2018; Bourveau, De George, Ellahie and Macciocchi, 2018) implying for potential relationships with innovation. An, Duan, Hou and Xu (2019) tests the effects of disclosure on human capital founder background and team on ICO outcomes.

Two published empirical papers focus on governance, in a broad sense, as a success factor to utility tokens. Adhami, Giudici and Martinazzi (2018) investigate determinants of ICO fundraising success, and their research suggests that the availability of project code and disclosure of legal jurisdiction are strong predictors as they facilitate transparency and can provide for legal action against founders. Interestingly, provision of a white paper was insignificant. In a follow up paper, Adhami and Giudici (2018) solely investigate governance signals on fundraising success and find that advisory committee

size positively and significantly correlates with financial performance; and that the fraction of tokens retained by insiders and managers are also significant. In studying determinants of capital amounts raised, Fisch (2018) finds a lengthy white paper, US location and base on Ehtereum were the strongest predictors of such success with the price of bitcoin and pre-sale factors as insignificant.

Recent studies of various topics of token ownership have pointed to possibly significant outcomes. Boreiko and Risteski (2020) studied investor behaviour and demonstrated that serial investors, overall, contribute early, however are less informed than general retail investors and pick lesser quality utility tokens as a result. They also find that only large serial investors which are within the top 1% of investors, actively invest more in campaigns that raise more funds, attract contributors and reach hard caps.

There is limited research on ownership structure in the context of initial coin offerings. One study provides some initial insight into direction and magnitude of their influence on ICO success, with success defined as post-ICO financial performance. Fisch and Momtaz (2020) studied institutional backing of ICOs and find it is generally associated with higher post-ICO financial performance after considering selection and treatment effects. They used a database from cryptofundresearch.com to see lists of institutional investor backing, which included 750 institutional investors and the UTOs they invested in.

2.2.5. Theoretical Frameworks

There are very few papers which make specific reference to a theoretical framework, however some employ signalling theory when discussing the role of governance of utility tokens on performance. Signals are observed variables, sent from

an informed party to a less informed party, which in turn discloses characteristics of a business, including trust and perceived risk of ventures (Wells, Valacich and Hess, 2011). This framework has mostly been applied to examining variables disclosed in white papers including social capital signals including utility token founder backgrounds, team size, description of projects, and awards grants and patents of utility tokens by external agencies (Guiduci and Adhami, 2018). Implicitly, most research also stems from institutional transaction cost theory, which states economic efficiency can be gained through institutions that minimize transaction costs, such as search costs, enforcement costs and decision costs (North, 1993). Accordingly, it assumes bounded rationality instead of complete rationality in agency theory, in that agents act as rational as they can based on available information. However, like agency theory, assumes that all parties act in self-interest behaviour. Transaction cost theory can be applied to the justification of utility tokens and UTOs as a means to entrepreneurial finance, by minimizing transactions, and through the signalling literature where principals provide information to agents, they enable agents to make more rational decisions. It also assumes that investors bear search costs to seek relevant information, which can be gleaned from with research of utility tokens that explore internal controls, information disclosure and the advisory board.

2.2.6. Areas for Future Research

There are several gaps of research on governance of utility tokens. First, most literature exploring governance within this realm does not consult broader literature of governance, and accordingly, has missed several key variables in governance. Most scholarship focusses solely on governance protocols, and studies exploring ownership

and the board are very limited. To date, there has been no study exploring ownership concentration, arguably the most important internal governance mechanism, nor have any studies examined the advisory boards in detail. With available data for both and given their heavy influence in traditional firms, a more theoretically robust model accounting for key areas of internal governance would be important, as it may uncover key areas that relate to the performance of the venture. A comprehensive model accounting for most major areas of internal governance should be developed in order to better understand the value of major mechanisms of governance.

Second, as with the general case of governance and innovation, most studies only explore for linear relationships. Given the lack of theoretical foundations from which work on utility token draw, models were created only linearly to explore different dimensions of internal governance, however this may not be expected given the many positive and negative findings that also appear when applied to the utility token setting.

Third, a greater focus on innovation as a success metric should be paramount. Given utility tokens only appreciate in real value if the technological innovation they develop succeeds, such should become of greater importance in its use as a success metric. While prior literature attempts to measure success factors, most use proxies for meeting fundraising goals or listing status, this may not concur with technological development or innovation and only 4% survive after two years. There is an exception in Deng, Lee and Zhong (2018) which included technological development activity in their model. Altogether, it is acknowledged that governance of utility tokens have significance on a range of outcomes, and future research should consider a greater foundation of literature in governance, greater exploration of governance mechanisms

comprehensively, seek non-linear relationships and use innovation activity as a more frequent proxy of success.

2.3. Conclusion

This literature review was conducted to provide context for marrying the theoretical framework of innovation and governance with the empirical setting of utility tokens. As demonstrated, governance and innovation research is in its early stages and is presently inconclusive of the direction and strength of a number of internal governance mechanisms and their relation with innovation. As jurisdictional settings are a major underpinning to inconclusiveness, and utility tokens are not tied to specific jurisdictions hence not being subject to national-level institutional and regulatory influences on governance, they can provide for an innovative setting to examine aspects of the conceptual relationship. While data for advisory boards of privately held traditional high-technology firms would be challenging to access, such is widely available for utility tokens including an ability to investigate innovation from open source repositories. Further, governance research of utility tokens have not examined its relationship to innovation, which is key to its appreciation nor consulted the broader governance to guide empirical study. While many studies of utility tokens examine the relationship with fundraising campaign or listing success, their relation to innovation is fertile ground and important as innovation is directly linked to their long-term token holder value. Altogether, studying utility tokens as an empirical setting for the conceptual relationship between innovation and governance appears fruitful and could drive some innovative insights into the broader theory and to the important and current situation of utility tokens.

The literature review was limited by space and time and accordingly not all works discussing innovation, governance or utility tokens was discussed. While works were selected for their relative influence and importance to the situation at hand, other research exists and could also be consulted in the future. Additionally, several papers of governance in the utility token setting are only in the working paper stage; however, were included as their insights are meaningful and have been cited themselves in prominent, published articles in the discipline.

Chapter 3: Methodology and Research Design

3.1. Philosophical Approach

The philosophical approach that would lead to the most fruitful insights in testing research hypotheses based on the propositions offered in the preceding section, would be that of post-positivism. This framework assumes that an objective reality exists between the constructs of internal governance mechanisms and innovation, to which empirical research can access. While the specific reality of how internal governance mechanisms interact with innovation can only be approximated, statistics can nonetheless model an approximation for its interaction which would be useful for improving understanding. By relying on a theoretically informed model, large sample size, and quality statistical analysis, this paper aims to have optimal validity and reliability for this factor within the relationship.

Using a quantitative approach, this thesis hopes to understand how the constructs of internal governance and innovation relate, by using the context of utility tokens, which is not only useful for understanding an important dimension in the novel method of entrepreneurial finance, but also for showing how the constructs relate given that contracts bound by smart contracts are not influenced by national-level variation sin the political environment. Data from utility tokens about their internal governance and innovation activity are widely available on the internet and within databases. Accordingly, the particular epistemology of statistical analysis and model building is the most appropriate. Models can approximate the impact of how the constructs relate to one another conceptually, and statistical analysis of empirical data applied to the models would show support or rejection.

3.2. Initial Coin Offering Data

This study is based on a sample of 525 utility tokens, based on Ethereum and identified as having started their fundraising campaign initiated prior to January 2016 and ended before December 2019, had met their fundraising goal, and had a complete profile on ICOBench.com, etherscan.io and a working GitHub account. The start date of January 2016 was chosen as there was very little utility token offering activity prior to 2016. With most activity occurring in 2018 and ensuring at least six months of post-ICO technological development can be captured, the end date of December 2019 was chosen, as the sample was downloaded in July 2020. In total, this provides three years of data.

This study first downloaded a sample of utility tokens from ICObench (www.icobench.com), a major database with wide coverage of utility tokens (Huang et. al., 2019). This database is useful as it provides comprehensive information about a range of utility tokens. Some pieces of useful information provided for each token include the characteristics of the utility token and its campaign description, sectoral tags, milestones for projected technological development, information about the top management team and information about advisors. External links to social media profiles, including GitHub for the utility token and LinkedIn profiles for the team and advisors, are also provided. In addition, the website also aggregates several rankings from experts who rank token projects. This provided an initial population of 1,855 utility tokens. One limitation of using ICObench is they delete some accounts which were unable to meet their fundraising floor, known as a softcap, whereby utility tokens would refund any investment if they do not reach such level and not proceed further. However, this study was only focused on those

which did meet their fundraising goal to study post-ICO relationships between governance and innovation and such limitation of the database was thereby not relevant.

To capture data related to technological development and innovation activity, the study narrowed itself to those UTOs which had an active GitHub account (www.github.com). GitHub is a source code management software that allows collaboration in creating code for programs. In GitHub, utility tokens upload their original source code to a repository, for the blockchain application they eventually wish to further develop. Utility tokens may have more than one repository, but generally only have one main repository which then references the sub-repositories as necessary. Through GitHub, one is able to study innovation activity as records are made each time a proposal for code modification is made, known as a pull request, and eventually accepted, known as a merged pull request. Tokens not having a Github account have been demonstrated to be a major variable indicative of the utility tokens being a scam (Bourveau, De George, Ellahie and Macciocchi, 2018). As Github accounts are necessary for studying innovation in the utility token context, it is noted that the sample drawn would not be representative of all ICOs but rather imply those with a GitHub account. Links to each Github account were retrieved from hyperlinks on their ICObench profiles and were manually checked to ensure they were active. Of the 1,855 tokens remaining in the sample, 641 had links that leading to 404 errors, indicating inactive accounts. Accordingly, the sample was then narrowed to 1,214 tokens.

Ownership data for each token was then gathered from etherscan.io, where each token in the sample was cross searched. Etherscan (www.etherscan.io) provides a list of each transfer of tokens Ethereum-based tokens, recording specific blockchain addresses.

The website provides a “holders” tab which then displays the percentage of tokens distributed and owned tokens held by different addresses.

While owner identities are anonymous, each token holder has a unique address it uses to buy and sell tokens. Some tokens had multiple profiles load for similarly named tokens without an exact match appearing or did not show up at all as they may have changed their name from listing on ICObench. The major limitation to this database is that, in some cases, a token holder can technically have multiple addresses if they want to hide their activity, however this cannot be tracked and searched. For reliability purposes, the study is limited to tokens which had a clearly identifiable and active Etherscan.io profile, being those with the exact same name and website domain of the token as ICObench and having at least one transaction. These token profiles that were unclear on whether or not they were the same token as that from the existing sample did not appear to have any different data hence positioning this as a random error. Of the remaining 1,214 tokens in the sample of those with an ICObench listing and an active Github account, a total of 525 had a clearly identifiable and complete listing on etherscan.io, which then became the final sample.

For data on institutional ownership, the *Original Crypto Fund List* database from Crypto Fund Research (www.cryptofundresearch.com) was used. It was purchased and downloaded as at September 10, 2020, to provide a relatively up to date listing of over 800 crypto funds for which all are either hedge funds or venture capital firms. The database lists the various tokens each fund has investment within. While it is noted as the most comprehensive list of crypto funds (Fisch and Momtaz, 2020), it is possible that other funds and venture capital firms may exist and are not captured by this database.

Further, the database simply lists the tokens each fund is invested in, and does not quantify the percentage owned in each token which limits the ability to assign weights of institutional ownership beyond a count of funds invested within.

To measure any informal national effect, country-level data was recorded for tokens which disclosed a country. Three measures were used, namely the ***Democracy Index*** by the Economic Intelligence Unit, the United Nations ***Human Development Index***, sourced from the United Nations website, and ***OECD Membership***, sourced from the OECD website.

Accordingly, the final sample is of 525 utility tokens, and represents a large sample to find relationships between governance and innovation, with respect to the propositions the study intends to operationalize. As noted by others, samples examining post-ICO performance are generally greatly reduced than the population of tokens for a specific time period with a final sample of around 500 tokens (Fish and Momtaz, 2020, Lyandres et al, 2019; Benedetti and Kostovetsky, 2018). This study by Benedetti and Kostovesky (2018) is similar, as the original sample of tokens over time period was over 1,800 from listings on ICObench; and the reduced sample of 525 presents a rather large sample to study the post-UTO variables of interest.

3.3. Dependent Variable

The concept aimed to be operationalized as the dependent variable for this study is innovation outcomes. According to Schumpeter (1934), innovation can be defined as the introduction of a new product, process or system and the process to reach this introduction. The perspective of innovation as a process has been defined as an idea's introduction, application and implementation (West and Farr, 1990; van de Ven, 1986)

which is contra the perspective of innovation as an outcome, which focusses on the actual introduction of a product, process or system considered new to the environment to which it is introduced (Damanpour, 1992; Pennings and Harianto, 1992). Traditionally, operationalizing innovation as output has been rather difficult. Some scholars have used patents and the percentage of sales driven from these patents (Shaprio, Tang, Wang and Zhang, 2015), however this is limited as some firms may express innovation differently. As noted by van den Berg (2007), "accounting, as it is currently practiced, has lost much of its ability to inform as businesses have become more and more knowledge intensive," referring to issues in measuring intellectual capital. Indeed, measuring knowledge is an onerous task (van den Berg, 2013) as many firms may experience different outcomes of research and development spending and some inputs may be more successful to others. As this study uses the context of utility tokens, which all develop applications on blockchain to solve problems in a wide range of industries, similar to software, innovation outcomes can be measured consistently as incremental developments towards their technology.

Innovation activity for utility tokens is observed from activity on their GitHub repositories. Contributors, which are mostly employees and founders of utility tokens though can also be the general public, process modifications to a code to either add, delete or modify certain elements and add a feature or improve some element and create a ***commit.*** It may take a number of commits to form a single feature, where multiple commits necessary to accomplish the same goal are formed together to a single pull request, that developers propose for merger into the source code and become activated.

A moderator of the account then decides if the open pull request would become a part of the source code, and usually tests the code to ensure it works and examines it to ensure it adds value to the project. If it does work and add value, the moderator, who are normally the founders, will accept the pull request and make the feature available by merging it into the source code. If not, they can comment on why it was not accepted for merging and sometimes suggest revisions if there is value in the intent of the code but errors within it. Once a pull request is submitted by the developer, it is known as an ***open pull request***, if examined and not merged is known as a ***closed pull request***, and if merged into the code, becomes a ***merged pull request***.

As this study uses the definition of innovation as outcome, and thus focusses on introduced applications within the context of utility tokens, it operationalizes innovation as merged pull requests. Merged pull requests have been used as one of five proxy indicators of technological development by a small number of researchers in general (Vasilescu et. al, 2015) and within the ICO context (Deng, Lee and Zhong, 2018). In the later, other variables included the number of contributors, commits, and the number of ***stars*** and ***forks***. Stars are the number of times someone subscribes to a GitHub account's feed to receive updates on changes, and forks are when the code is copy and pasted likely to create a commit. Given the availability of innovation data, merged pull requests can be suggested to best exemplify the output of innovation. The data on pull requests merged was downloaded by scraping the Github accounts for all repository URLs, selecting the main repository as indicated by having the highest number of forks, and scraping the total for the number of merged pull requests, using the "Pulls" tab, and filtering each to be "is:pr is:closed is:merged".

Given a high degree of standard deviation, the natural logarithm of pull requests merged is taken which presents the strongest transformation (*LNPULLSMERGED*) to best normalize the variable. It is taken as:

$$LNPULLSMERGED = LN(1+PullsMerged)$$

Like prior research (Deng, Lee and Zhong, 2018), which focused on activity on the main repository to a GitHub account, which would usually represent its final code. Some accounts have multiple repositories, however those that are implemented would be referenced in the main repository. While observing pull requests merged only to the main repository, this study hence becomes limited as it excludes merged requests to other repositories. However, many of the other repositories may not be referenced in the source code and used for experimentation, hence exclusion of the few that are referenced is the best, consistent method to capture merged pull requests.

3.4. Independent Variables

The concept that guides independent variables is internal governance, and in particular, the two major elements of internal governance being ownership structure and board structure. To capture ownership structure of utility tokens, the study operationalizes two major concepts of ownership structure, namely ownership concentration which measures the percentage of shares held by large investors, and institutional ownership, which refers to the degree of ownership by institutions, notably hedge funds and venture capital firms in the utility token context.

Ownership concentration was measured as the percentage of utility token supply owned by those who hold at least 1% of the total owned supply. These token holders are colloquially named as “whales”, (*PWHALE*). This variable was gleaned from

downloading the first five pages for ownership data from Etherscan, and calculating the sum of percentages owned by any investor with over 1% in the token. To test the proposition for a quadratic relationship for an inverse U, a Herfindahl measure was taken, as consistent with previous research, which squares the ownership concentration term. Accordingly, ownership concentration was defined as follows:

$$PWHALE = \sum (PWh_1 + PWh_2 + \cdots PWh_n)$$

$$\textit{where PWh represents the percentage owned by each whale}$$

$$PWHALESQ = (1 + PWHALE)^2$$

To capture institutional investment (*INST*), this study counts the number of times each token appears within the CrytoFund Research database. This method indicates the number of institutions that are invested in each token, which is the best measure possible considering the database does not give the percentage of tokens each fund owns.

$$INST = \sum (Institutions\ Invested)$$

An additional measure for the percentage of the token supply distributed to the public (*PDIST*) was also captured as a context-specific measure of ownership concentration, whereas token founders reserve a percentage of the token supply for their own purposes. This could be for proceeds in terms of team bonuses, developer incentives, investments in marketing, referral programs or other expenditures. It was captured as it was reported as a significant variable towards listing success, financial performance and meeting specified softcaps. This variable was gleaned from ICObench. To test potential quadratic relation, the squared term was also considered, accordinglywhere:

$$\text{PDIST} = \textit{(Percentage Distributed)}$$

$$\text{PDISTSQ} = (PDIST+1)^2$$

To measure board structure, this study counts the number of advisory board members (*NADVISOR*) as listed on ICObench. To measure technical intensity of the board directors the number of advisors with a technical background is first taken. This is defined as counting the number of advisors (*NTECHADVISOR*) with a degree posted on their LinkedIn profile in the field of computer science, engineering or technology, and then dividing it by *NADVISOR*. To test quadratics, squared terms of both the number of advisors (*NADVISORSQ*) and percentage of technical advisors (*PTECHADVISORSQ*) were calculated. and Therefore,

$$PTECHADVISOR = \left(\frac{NTECHADVISOR}{NADVISOR}\right)$$

$$NADVISORSQ = (NADVISOR)^2$$

$$PTECHADVISORSQ = (PTECHADVISOR)^2$$

3.5. Control Variables

A range of control variables were recorded as they may have influence the number of pull requests merged, and could influence ownership structure and board structure. Weather or not a token disclosed its based country was recorded as a binary variable, (*COUNTDISC*) where 1 indicates they disclose their country and 0 is recorded for those which do not. Offering a prototype or minimally viable product (*MVP*) at the utility token offering stage was also recorded on a binary scale, with 1 suggesting there was a prototype or minimally viable product available during the UTO stage, and 0 indicating there was not. It is assumed that if their token already has a minimally viable product, they would need to do less to achieve their desired state. Binary variables for specifying a softcap (*SOFTCAP*) and hardcap (*HARDCAP*) were also recorded as binary with 1

indicating the token had one specified and 0 indicating they did not. A UTO's softcap is the campaign floor, or minimum amount of tokens that need to be sold in order for the project to be funded, as they need a certain amount of funds to develop their token. In general, if a softcap is not met, funds are returned to the purchases and the project is deemed as unsuccessful. In contrast, a hardcap is the campaign ceiling, or maximum amount a project can be funded. These decisions are made by creators to create a sense of scarcity and drive the price of their token by limiting quantity. These were found significant in research exploring technical development of UTOs technological development (Deng, Lee and Zhong, 2018).

Ratings are reported from ICOBench, for which the aggregate, overall rating of each recorded (*ICORATING*). Ratings may act as a vetting of the proposition of the utility tokens. Accordingly, one with a higher ranking may be more successful at achieving investment and driving expectations for it to perform. The duration of the campaign was recorded as the number of days the token was in ICO (*DURATION*). The number of countries to which the token was restricted were counted recorded (*NRESTRICTED*) which could impact, among other things, the number of potential owners.

To ensure the lack of jurisdictional influence, the country was recorded as a nominal variable from ICOBench and their characteristics were operationalized by relying on three scales. First, the Human Development Index by the United Nations (*HDI*) was used, which measures life expectancy, education and other variables on a per capita basis. The raw ranking was recorded, which was on a 0 to 10 scale. OECD membership (*OECD*) was recorded on a binary scale with 1 showing membership, and 0 if not. The Democratic Ranking (*DEMRANK*) by the Economic Intelligence Unit measures

democracy and is captured as the raw ranking of that country, on a 0 to 10 scale. This metric is important as democratic institutions are positioned to be a significant factor to innovation. Ideally, these would not be significant which shows variance is captured in other variables. Nominal countries and Industry were also recorded nominally to observe distributions among key variables of interest.

3.6. Descriptive Statistics

Variable definitions of all variables, including the dependent, independent and control variables, are provided in Table 3.1. Descriptive statistics, including the minimum, maximum and mean averages along with standard deviation is provided in Table 3.2. In this table, it is shown that the average percentage owned by whales, who are those that own more than 1% of a single token, is nearly 80% (Table 3.2), which indicates tokens, overall, have a high degree of ownership concentration. Tokens within the sample have an average of .38 institutional investors. Digging deeper into the data, most do not have any institutional investment with 476 of 525 having no institutional investment. Among those that do, the median is 1 institutional investor with only 7 having more than 10 institutions invested within their token (Table 3.2).

The average percent of the token supply distributed in UTO is just over half, at 54.99% (Table 3.2), which means that the token team itself generally keeps just under half for its own purposes. As tokens can do many things with the number of tokens, they reserve for themselves, such data is only available in the white papers and was not recorded for the purposes of this study.

The average number of advisors was 6 (Table 3.2), which represents a reasonable number comparable to sizes of most high-tech start-ups' number of external board of

directors, which average at 4.75 (Clarysse, Knockaert and Lockett, 2007). Of these, just over a quarter (28.5%) have a technical background (Table 3.2). Other positions that may comprise the remaining advisors include lawyers, accountants, and crypto businesspeople and general business leaders.

Tokens have anywhere from 0 to 1549 pull requests merged (Table 3.2), which is a substantial range. Given the high standard deviation, this variable was normalized to the best it could through a transformation using the natural logarithm, which is the most powerful transformation. The high standard deviation implies that some merge lots of pull requests, while others don't. A deeper dive into the data reveals that a substantial number of repositories had 0 activity, thus the data is zero-inflated with 395 merging 0 pulls. This is normal with most studies which also use patents as a dependent variable for studies of traditional firms (Chen, Li, Shapiro and Zhang, 2014) and usually leads these studies to use a zero-inflated poison distribution.

57% of tokens studied had a hardcap implemented (Table 3.2), which represents a mechanism to cap fundraising after a certain amount is raised within the campaign. This ensures that funds will be used towards innovation and not for profit of the management team who are expected to profit off of the tokens they do not distribute to the public. Interestingly, only 26% specified a softcap (Table 3.2), or minimum for the campaign to proceed. If campaigns do not surpass the softcap, funds are refunded to investors and this could act as protection for them not investing in a token that would not otherwise have funds to innovate their project. Other notable descriptive statistics is that an ICO campaign lasts just over two months at 69 days, and 29% disclose a base country to where they operate.

The average human development index of countries to the tokens included in the sample is over 87% (Tab le 3.2) which represents those within the sample and are disclosed, are mostly well-developed countries. Similarly, average democratic ranking is high at just over 7, which is strong and implies that less UTOs with active GitHub accounts are based in non-democratic countries. 53% of the utility tokens disclose being based in a country with OECD membership, representing an even split between members and non-members. This may not be true of all utility tokens, however since this sample was limited to those with an active GitHub account. Those without that account would be more likely to be a scam token. Further, while the tokens declare a certain country as their base, the founders may all be located elsewhere and hence they may choose more developed countries on purpose, implying significant limitations in reading statistics of this variable.

Some interesting findings can be discerned by examining variances by declared country (Table 3.3). Most UTOs in the sample are based out of Singapore (62), USA (54), the UK (48), Estonia (37), Russia (40), and Switzerland (24). While USA, the UK and Russia are very large countries, Singapore, Estonia, and Switzerland thereby have a disproportionate number of declared countries for UTOs.

In terms of concentration, of countries with over 8 utility tokens, those based in France have the lowest average concentration, at 64.96%, whereas those based in India and Hong Kong have much higher levels at 99.41% and 89.23% respectively. Institutional investment also varies widely in countries, with the highest average number of institutional investors in Canada at 2.13 amoung countries with 8 or more UTOs (Table 3.3). The USA is second with 1.5 average institutional investors, a stark contrast from Singapore at 0.38,

Russia at .3, the UK and India at .1, Hong Kong at .12, Gibralter at .11 and and Estonia at 0.03. As Canada and the UK do not differ much in terms of laws as they are both Commonwealth nations, this may mean that UTOs whose founders are from elsewhere target the later countries as the bases for their utility token.

Surprisingly, the number of advisors is relatively consistent, with those of 8 UTOs or more having between 5 and 7.25 advisors (Table 3.3). The percentage of technical advisors is also fairly standard, with India having the least at 16.78% and those based in France having the most at 38.36% (Table 3.3). The natural logarithm of pulls varies widely across countries, with the lowest number among those with 8 UTOs or more, reporting their base as Germany at .1, and the highest in the USA at 1.29 and France at 1.35, on average.

Interesting observations can also be drawn from variance across multiple industries (Table 3.4). Among industries with 5 UTOs, the percentage of whales is generally consistent with those in tourism seeing lowest concentration at 66.78% and those in media the most concentrated at 92.16%. Approximately half of the industries had no institutional investment, such as charities, gambling, education, energy, health, manufacturing, realty, retail, sports, tourism and virtual reality. Only two industries have an average number of institutional investors above 1, specifically banking at 1.36 and infrastructure at 2.07. This may reflect sectoral preferences of institutional investors.

The number of advisors is relatively consistent, with the lowest number on average in education at 3.4 and highest number in software at 9. The percentage of technical advisors ranges with many at the lower and higher ends of the scale. The lowest percentage of technical advisors can be found in charity at 12.5%, and the highest number

being present in energy at 42.06% aside from those classified as other, which was reported at 48.01%. The natural logarithm of pulls merged is relatively consistent with a small number of outliers. On the low side, charity, health, energy, electronics, education, legal, manufacturing and virtual reality sectors averaged 0, while sports, infrastructure, software and media all averaged over 1 with sports at 2.99. Small sample sizes for each industry limits ability to concretely analyze sectoral influence, however the variances are nonetheless noted.

3.7. Research Design and Model Specifications

The relationships between internal governance and innovation of utility tokens was examined using ordinary least squares and is supported by stepwise regressions and a zero-inflated poison distribution. As two variables were tested for quadratic relationships, the method of ordinary least squares was employed for its ease in interpreting results from quadratic relationships. Regressions were conducted within SPSS using ordinary least squares. As quadratic relationships were attempted to be tested, an OLS model was selected for its ability to model such relations.

In all OLS models, the dependent variable was the natural logarithm of pulls merged. All variables were first explored for bivariate correlations and a correlation matrix was produced. Curve Fits were then explored using the Curve Fit function on SPSS, where testing was for linear, quadratic and exponential relationships. If the p value was <0.05, then that type of relationship was significant.

In Model I, control variables were examined in order to establish a baseline and measure subsequent explanatory power, from the change in the adjusted R^2 values. This included the rating (*RATINGICO*), duration (*DURATION*), whether or not a minimally

viable product was developed at time of campaign launch (*MVP*), a hardcap (*HARDCAP*) and softcap was implemented (*SOFTCAP*), the number of restricted countries (NRESTRICTED), and variables relating to the disclosed base country, if needed (*HDI, DEMRANK, OECD*).

$$Model\ I: LN(PullsMerged)_i = \beta_0 + \sum(\beta_j ControlVariables_j) + \varepsilon_i$$

In the second to fifth model, ownership structure was examined. In Model II, the dependent variables included all the control variables in addition to the percentage of whales (*PWHALE*) and its squared term (*PWHALESQ*), which collectively represent ownership concentration. For Model III, the control variables and the variable for institutional ownership (*INST*) were regressed. In Model IV, the percentage of tokens distributed (*PDIST*) and its squared term (*PDISTSQ*) were tested along with control variables. In each model, the change in the Adjusted R^2 values compared to Model I were noted. In Model V, all variables of ownership structure, including those representing ownership concentration (*PWHALE, PWHALESQ*), institutional ownership (*INST*) and the percentage of tokens distributed (*PDIST*) were entered along with control variables to observe change in adjusted R^2 compared to control variables to reflect total explanatory power of ownership structure on the natural logarithm of pulls merged.

$$Model\ II: LN(PullsMerged)_i$$

$$= \beta_0 + \beta_1'(PWhale) + \beta_1'(PWhaleSq) + \sum(\beta_j ControlVariables_j) + \varepsilon_i$$

$$Model\ III: LN(PullsMerged)_i = \beta_0 + \beta_1'(INST) + \sum(\beta_j ControlVariables_j) + \varepsilon_i$$

$$Model\ IV: LN(PullsMerged)_i$$

$$= \beta_0 + \beta_1'(PDIST) + \beta_1'(PDISTSQ) + \sum(\beta_j ControlVariables_j) + \varepsilon_i$$

$$Model\ V: LN(PullsMerged)_i$$

$$= \beta_0 + \beta_1'(PWhale) + \beta_1'(PWhaleSq) + \beta_1'(INST) + \beta_1'(PDIST)$$

$$+ \beta_1'(PDISTSQ) + \sum(\beta_j ControlVariables_j) + \varepsilon_i$$

To examine board structure, the number of advisors (***NADVISOR***) and percentage of technical advisors (***PTECHADVISOR***) were in entered in Model VI along with control variables in Model I. The difference in Adjusted R^2 value compared to Model I, which consists only of controls, would reflect the explanatory power of board structure on the natural logarithm of pulls merged.

$$Model\ VI: LN(PullsMerged)_i$$

$$= \beta_0 + \beta_1'(NAdvisor) + \beta_1'(NAdvisorSQ) + \beta_1'(PTechAdvisor)$$

$$+ \beta_1'(PTechAdvisorSQ) + \sum(\beta_j ControlVariables_j) + \varepsilon_i$$

In Model VII, variables for both ownership structure and board structure were regressed among controls, against the natural logarithm of pulls merged. This model thereby allows both to be combined and, by analyzing the standardized coeffecients,

understand which variables remain significant and to what degree. Very little research to date has not completed a model accounting for both, ownership structure and board structure, hence this acts as a test to see if anything changes compared to them being tested independently.

$$Model\ VII\colon LN(PullsMerged)_i = \beta_0 + \beta_1'(PWhale) + \beta_1'(PWhaleSQ) + \beta_1'(INST) + \beta_1'(PDIST) + \beta_1'(PDISTSQ) + \beta_1'(NAdvisor) + \beta_1'(NAdvisorSQ) + \beta_1'(PTechAdvisor) + \beta_1'(PTechAdvisorSQ) + \sum(\beta_j ControlVariables_j) + \varepsilon_i$$

For reliability, stepwise regressions using backward elimination of the variables of least significance ($0<p<0.05$) were also conducted. Stepwise regressions enter variables one at a time and stop once all variables were tested with a model of only significant variables. While they are likely similar as the ones done using the "enter" method, some interesting conclusions can nonetheless be drawn. This is because sometimes coefficients increase as a result of taking insignificant variables out, and adjusted R^2 values may also increase. Hence, Models VIII to XIV repeat Models I to VII using the stepwise method.

Zero-inflated poisson distributions have been used in other studies, however, are problematic for interpreting marginal effects of quadratics. Nonetheless, to verify the findings in OLS, a zero-inflated poisson distribution was ran in Stata, given its wide use among studies of innovation outcomes, such as patents, which do not test quadratic functions. All independent and control variables were tested against the raw number of

pull requests merged. This type of model looks at each event, in this case, pull request merged, as independent from others even if within the same token.

3.8. Tables

Table 3.1: Variable Definitions and Sources

Variable	Description	Data Source
	DEPENDENT VARIABLE	
Innovation Output		
PULLSMERGED	Number of Pull Requests Merged.	Github (Main Repository)
	INDEPENDENT VARIABLES	
Ownership Concentration		
PWHALE	Percent owned by Whales.	Etherscan.io
PWHALESQ	$PWhale^2$ to test quadratic.	Transformed variable
INST	Number of Institutional Investors.	CryptoFundResearch
PDIST	Percent of the coins distributed in the initial coin offering.	ICOBench
PDISTSQ	$PDist^2$ to test quadratic.	ICOBench
Board Structure		
NADVISOR	Number of advisors.	ICOBench/ Whitepapers
NADVISORSQ	$NAdvisor^2$ to test quadratic.	ICOBench/ Whitepapers
PTECHADVISOR	Percentage of advisors with a technical degree, measured by the number of advisors with a technical degree, divied by the total number of advisors.	ICOBench/ LinkedIn
	CONTROL VARIABLES	
RATINGICO	Ratings from ICO experts.	ICOBench
DURATION	Length of ICO.	ICOBench
COUNTDISC	1 or 0, for weather or not they record if the country has been disclosed.	ICOBench
MVP	1 or 0, for weather or not they have a minimally viable product.	ICOBench
HARDCAP	1 or 0, for weather or not they have a hard cap on funds.	ICOBench
SOFTCAP	1 or 0, for weather or not they have a hard cap on funds.	ICOBench
NRESTRICTED	Count number of countries the UTO is restricted.	ICOBench
HDI	Score from 0-10 on human development.	United Nations Development Programme
DEMRANK	Score from 0-10 on level of democratic institutions.	Economist Intelligence Unit
OECD	1 or 0, for weather or not their disclosed country of is a member of the OECD.	OECD

Table 3.2: Summary Statistics of Variables

Descriptive Statistics				
	Minimum	**Maximum**	**Mean**	**Std. Deviation**
PWhale	0.00%	100.00%	79.9245%	.2504855
INST	0.00	30	.38	2.282
PDist	3.00%	100.00%	54.8329%	.1928825
NAdvisor	0.00%	19	6.07	3.665
PTechAdv	0.00%	100.00%	.28534325 6985451	.262251687796025
PullsMerged	0.00	1549	23.64	118.043
Hardcap	0.00	1	.57	.495
Bonus	0.00	1	.62	.485
MVP	0.00	1	.46	.499
Softcap	0.00	1	.26	.437
Duration	0.00	615	69.34	79.004
RatingICO	1.5	4.7	3.681	.5143
CountDisc	0.00	1	.29	.454
NRestricted	0.00	46	1.12	3.502
HDI	.000	.954	.87471	.114647
DemRank	1.08	9.87	7.1895	1.77609
OECD	0	1	.53	.500
Valid N. (listwise)	**525**			

Table 3.3: Pulls Merged by Base Country of ICO

Country	N. Obs.	PWhale	INST	N. Advisor	PTechAdvisor	LN(PullsMerged)
Argentina	1	99.99%	0	1	0.00%	0
Australia	15	89.69%	0	5.33	31.87%	0.23104906
Austria	4	63.90%	0	6.25	38.06%	1.1358237
Bahamas	1	48.43%	0	9	66.67%	3.52636052
Belarus	1	45.35%	0	5	20.00%	0
Belize	8	87.29%	0	5	24.03%	0.83176907
Bermuda	2	93.05%	0	10	20.20%	0
Brazil	4	69.59%	0	5.25	45.14%	0.40235948
Bulgaria	2	90.79%	0	9	44.44%	0
Canada	8	78.16%	2.13	7.25	29.01%	0.63594954
Cayman Island	23	76.77%	0.17	7	17.78%	0.22161022
China	3	84.94%	6	5	38.41%	2.13341915
Colombia	1	80.13%	0	10	50.00%	0
Costa Rica	2	99.88%	0	1	100.00%	1.94591015
Croatia	1	69.46%	0	3	0.00%	0
Cyprus	6	89.20%	0	4	27.50%	0.67384188
Czech Republic	3	93.67%	0	4.33	26.67%	0
Denmark	2	98.47%	0	7	31.11%	0
Ecuador	1	99.18%	0	0	0.00%	1.09861229
Egypt	1	88.01%	0	5	20.00%	0
Estonia	37	82.81%	0.03	6.49	24.40%	0.40739834
France	10	64.97%	0	5.7	38.36%	1.35864294
Georgia	3	63.18%	0	3.67	24.44%	0
Germany	13	86.91%	0	5.54	23.42%	0.10663803
Gibralter	9	62.26%	0.11	6.78	29.84%	0.75729333
Hong Kong	16	88.41%	0.12	6.56	22.46%	.1903
India	10	89.23%	0.1	5	16.78%	0.62614917
Indonesia	2	99.74%	0	8.5	28.57%	0.34657359
Ireland	4	95.40%	0	9.75	46.73%	0.1732868
Isle of Man	1	98.41%	0	3	0.00%	0
Israel	5	86.94%	0.2	3.8	40.00%	1.73034482
Italy	1	99.80%	0	3	0.00%	0
Latvia	3	73.48%	0	4.33	26.67%	0
Liechtenstein	3	71.66%	0.67	6.33	27.41%	0
Lithuania	4	82.22%	0	4	18.39%	0.62122666
Luxembourg	1	100.00%	0	12	75.00%	0

Malaysia	2	87.92%	0	6.5	11.11%	0
Malta	10	63.19%	0.1	6.9	35.65%	1.25277938
Marhsall Islands	2	84.88%	0	4.5	6.25%	0
Mauritius	1	97.88%	0	12	25.00%	0
Mexico	3	81.20%	0	4.67	49.49%	0.3662041
Netherlands	9	86.75%	0	6.33	18.09%	0.32715989
New Zealand	1	96.17%	0	8	25.00%	0
Nigeria	5	79.41%	0	6.6	21.22%	0.13862944
None	3	97.54%	0	3.67	9.52%	0
North Korea	1	95.20%	0	10	50.00%	0
Norway	2	48.19%	0	7.5	29.17%	0
Panama	2	97.77%	0	3	16.67%	0
Philippines	1	96.30%	0	5	40.00%	0
Poland	2	63.38%	0	3	0.00%	0
Portugal	1	95.64%	0	5	40.00%	0
Romania	4	83.82%	0	4.75	25.56%	0.1732868
Russia	30	85.90%	0.3	6.8	27.21%	0.31745634
Saint Kitts	1	76.42%	0	4	0.00%	0
Saint Kitts	1	99.65%	0	10	40.00%	0
Samoa	1	82.39%	0	4	0.00%	0
Serbia	3	97.64%	0	7	27.50%	0
Seychelles	5	91.11%	0	4.6	15.39%	0.49698133
Singapore	62	80.76%	0.38	6.05	31.82%	0.74860552
Slovenia	5	74.28%	0	6.4	33.72%	0.84969905
South Africa	2	86.57%	0	2	0.00%	0
Spain	3	47.01%	0.67	4.33	31.75%	4.08727947
Switzerland	24	69.58%	0.83	6.17	38.44%	1.54013337
Taiwan	1	70.70%	1	3	100.00%	1.60943791
Turkey	2	53.27%	0	4.5	22.50%	0
UAE	9	72.48%	0	8.33	25.09%	0.39181784
UK	48	77.75%	0.1	5.37	24.83%	0.63216844
Ukraine	2	98.53%	0	5	20.00%	0
USA	56	78.08%	1.5	6.52	32.81%	1.29425308
Venezuela	1	91.77%	0	7	28.57%	0
Virgin Island	9	66.53%	0.56	5.89	31.30%	0.71654327
Total	525	79.92%	0.38	6.07	28.53%	0.68686907

Notes:
LN(PullsMerged) = Natural Logarithm of PullsMerged.

Table 3.4: Pulls Merged by Industry of ICO

Industry	N. Obs.	P. Whale	INST	N. Advisor	P. TechAdvisor	LNPullsMerged
Total	525	79.92%	0.38	6.07	28.53%	0.68686907
Art	7	89.81%	0.14	4.43	19.59%	0.48104226
Artificial Intelligence	35	83.03%	0.03	6.09	26.85%	0.1233568
Banking	22	81.21%	1.36	6.45	29.61%	0.25740729
Big Data	17	71.83%	0.06	6	39.84%	0.68086899
Business services	53	78.99%	0.38	7.11	31.56%	0.58335541
Casino & Gambling	7	74.83%	0	4.43	19.84%	0.74025479
Charity	2	100.00%	0	3.5	12.50%	0
Communication	16	84.16%	0.37	6.56	34.60%	0.61946598
Cryptocurrency	74	82.68%	0.22	5.54	28.96%	0.79069903
Education	5	64.57%	0	3.4	33.71%	0.60890449
Electronics	3	85.80%	0	6.33	19.39%	0
Energy	2	68.46%	0	8	42.06%	0
Entertainment	24	76.46%	0.04	6	38.78%	0.88690553
Health	10	81.04%	0	7.8	33.73%	0
Infrastructure	14	76.18%	2.07	7.21	33.57%	1.62692334
Internet	12	82.12%	0.08	6.33	34.38%	1.42046245
Investment	27	87.44%	0.04	6.11	20.86%	0.23302108
Legal	4	71.39%	0.25	9.25	19.08%	0
Manufacturing	5	91.36%	0	5.6	14.47%	0
Media	11	92.16%	0.18	6.64	27.80%	0.9825555
Other	12	87.19%	0.08	5.17	48.01%	1.42127805
Platform	114	75.76%	0.65	5.63	25.09%	0.8054689
Real estate	12	75.39%	0	6.42	21.88%	0.26483782
Retail	9	87.21%	0	3.78	19.07%	0.62608773
Smart Contract	11	83.07%	0.55	7.18	22.30%	0.6814129
Software	9	73.63%	0.89	9	30.83%	1.41904294
Sports	2	84.81%	0	5	25.00%	2.99448071
Tourism	5	66.78%	0	5	20.00%	1.19220107
Virtual Reality	1	58.53%	0	5	20.00%	0

Chapter 4: Hypothesis Development

The first proposition suggests that ownership concentration and innovation outcomes would be related to each other in the shape of an inverse U. While extant literature is relatively limited and split between finding positive and negative results between such and innovation, most empirical studies nonetheless support a significant relationship (Balsmeir, Buchwald and Stiebale, 2014). Those finding a positive relationship suggest they are concerned with the market value of the firm to attract further shareholders (Belloc, 2012), while most finding a negative relationship suggest that, as ownership concentration increases, so too does the opportunity for large owners to become opportunistic and coordinate activities that can maximize short-term profit (Su, Xu and Phan, 2008). Given these studies are constrained by examining the phenomena with data subject to national-level institutions, such structures may influence the relationship to be more on one side of the U.

Some news services of utility tokens suggest "few people realize just how concentrated [token] ownership is" (Finestone, 2018), with a small set of addresses apparently controlling upwards of 90% of a token's value. Addresses are made for each wallet and are made public, so some investors may have multiple addresses, or some may be a small group of inventors, however, nonetheless is a strong measure of ownership concentration. As tokens do not report revenues per-se, prices of tokens are made public. As some investors buy tokens to finance their development with the aim of selling them to end users for their utility value on exchanges, they want their sales price of tokens to be as high as possible and hence concentration of ownership may be an important perspective. In UTOs, ownership concentration has not been explored

academically, however, drawing on literature of innovation and governance in traditional firms, arguments can be made for its behavior.

To a particular point, ownership concentration can be argued to enhance innovation as these owners are looking to attract further investors which will increase the token value; however, at higher levels of concentration, this effect could weaken and become negative due to entrenchment. Literature suggests entrenchment by large owners can only be possible with ability and willingness (De Massis, Kotlar, Chua and Chrisman, 2014). Accordingly, this would be near or around 50% concentration, as this gives agency to the large owners and, should they be willing to coordinate moves, can then put resources towards maximizing their private and immediate benefit, instead of towards long-term innovation projects. Most large investors to tokens are known to each other and sometimes actively coordinate activities, such as when a large holder unloads their coins and the public is left to absorb the sell orders, known as a "pump-and-dump" (Li, Shin and Wang, 2019).

H_1: The percentage of tokens owned by whales will be related in an inverse-U shape with the natural logarithm of pulls merged.

Institutional ownership on post-ICO performance and found a positive relationship while testing for multicollinearity (Fisch and Momtaz, 2020). While not yet tested against technological development in the context of utility tokens, Proposition 2 suggests institutional investors from venture capital funds, could provide necessary building blocks for long-term incentives of innovation. As most institutional owners of utility tokens are from venture funds and hedge funds, it is estimated that the relationship will be positive.

H_2: Institutional ownership will positively relate to the natural logarithm of pulls merged.

The percentage of tokens distributed to the public market has been affiliated with financial performance, listing status and technological development. As tokens not distributed are retained by the founding team, they can be used for a variety of purposes including rewarding the technical team, investor marketing, and rewards for the founders. In some may, this may resemble management ownership. Literature in management ownership suggests relates with innovation either in a positive or negative way. This may suggest that the percentage of tokens distributed may, not necessarily positively correlate positively as found in previous literature, but may do so within the shape of an inverse U.

H_3: The percentage of the token distributed positively relate to the natural logarithm of pull requests merged.

One of the largest and most important governance mechanisms is its board of directors, and hence, a significant body of literature focusses on such and its relationship to innovation. Proposition 3 suggests advisory boards will have similar impacts on innovation as boards of directors, as despite not carrying judiciary, they are both involved in providing external advice to the strategy process. Further, it was also suggested that the proportion of technical directors would account for more variance than board size.

H_{4a}: The percentage of advisors of a utility token that come from a technical background will have a positive impact on the natural logarithm of pulls merged.

H_{4b}: The size of a utility token's advisory board will have a negative relationship on the natural logarithm of pulls merged.

Chapter 5: Results

5.1 Bivariate Analysis

To examine bivariate correlations, a Pearson correlation matrix was run on each of the raw independent variables collected and the dependent variable, being the natural logarithm of pull requests merged (Table 5.1). It reveals the natural logarithm of pulls merged is significantly and positively related to the percent of the percentage of whales (*PWHALE*), number of institutional owners (*INST*), percent of technical advisors (*PTECHADVISOR*), and the ranking of democracy for their base country (*DEMRANK*); and significantly and negatively related to the provision of a bonus for volume purchases (*BONUS*), development of a minimally viable product (*MVP*), and the duration of the campaign (*DURATION*). The strongest correlation is with the percent of technical advisors (.437) and institutional ownership (.334).

5.2. Ownership Structure and Innovation Outcome

Model I (Table 5.2) shows a linear regression with the dependent variable of interest being the natural logarithm of pulls merged, and the independent variables being controls. It finds that approximately one-eighth of the variance in the dependent variable can be explained by the controls. In particular, the significant positive control was whether or not the token discloses the country to which it is based (*COUNTDISC*) and is negatively related to the provision of a volume discount (*BONUS*), offering a minimally viable product within the ICO stage (*MVP*) and the duration of the campaign (*DURATION*). The stepwise regression, in Model VIII (Table 5.6) which regresses the same control variables against the same dependent variable suggested some similar results, with *MVP*, *DURATION*, and *BONUS* having similar effects and accounting for approximately 11 percent of the variance. While *COUNTDISC* was not a significant

variable, whether or not the base country had *OECD* membership was significant as was the rating of the ICO (*RATINGICO*).

To examine whether or not the percent of token supply owned by whales (*PWHALE*) was related to the natural logarithm of pulls merged was either linear or quadratic format, a curve fit test was conducted (Figure 5.1). In this model, a negative linear relationship was significant ($p < .001$) and accounts for approximately 3.6% of the variance in the natural logarithm of pulls merged (Adj. $R^2 = 0.036$). Further, a quadratic relationship was also found significant ($p < .001$) and accounts for more variance than the linear relationship at 11.2% (Adj. $R^2 = 0.112$). Accordingly, both the raw number of the percentage owned by whales for each token (*PWHALE*), was tested for a linear relationship and its squared term (*PWAHLESQ*) was tested for a quadratic relationship.

Model II (Table 5.3) introduces *PWHALE* and *PWHALESQ* as a measure of ownership concentration to the model. From this model, it appears that *PWHALE* and the and *PWHALESQ* have significant positive correlates ($p < .001$). This infers an inverse-U relationship between concentration of tokens held by whales and the natural logarithm of pulls merged. *DURATION* and *MVP* remained significant controls, inferring those with longer campaigns and entering with a minimally viable product already developed merge a smaller number of pull requests. Altogether, the model then explains 15.6% of the total variance, marking an increase of 6% from the control variables. Very similar effects are found when conducted in Stepwise format, as shown in Model IX (Table 5.7) with the same controls being significant, similar coefficients on all variables and a similar marginalized explanation of variance.

Model III (Table 5.3) examines the impact of the number of institutional investors (*INST*), with the set of control variables, on the natural logarithm of pull requests merged. It finds a significant and positive relationship with *INST* ($p<.001$) which infers that the number of institutional investors has a positive relationship with the number of these investors. Furthermore, *INST* also has the greatest standardized coefficient in the model. Similar effects, with respect to a positive, and significant relationship was observed under the stepwise regression method, in Model X (Table 5.7), with institutional ownership also having the strongest standardized coeffecient. The significant control variables were different under stepwise than the enter method. In the enter method, significant controls *MVP, DURATION* and *RATINGICO*, which were similar as those under Model II, while those in the stepwise Model X, *MVP, DURATION* and *DEMRANK* were significant which was similar to what was found in stepwise Model IX. The difference from the control models were 8.6% and 7.8% for the Model III and Model X respectively, showing approximately similar results between both models. Altogether, this indicates that the number of institutional investors is positively related and strongly related to the natural logarithm of pull requests merged.

In Model IV (Table 5.3), the dependent variables of interest were the percentage of the token supply distributed to the public and its squared term. In this regression, the only variables of interest were control variables identified in Model I (Table 5.1), meaning *PDIST* nor its squared term were significant. The same findings were found within the stepwise method of Model XI (Table 5.7) with the only significant variables being the control variables identified in Model VIII (Table 5.6). Thus, unlike its relations the percentage of the token supply distributed in the ICO was not a significant variable on the

natural logarithm of pulls merged. Accordingly, both Model IV and Model XI showed no change in the explanatory power from the control models.

Model V (Table 5.3) modelled all measures of ownership concentration against the dependent variable, which thereby regressed *PWHALE, PWHALESQ, PDIST, PDISTSQ,* and *INST* on the natural logarithm of pulls merged. In this model, *PDIST* and *PDISTSQ* remained insignificant. The standardized coefficients for *PWHALE, PWHALESQ,* and INST were similar to when they were regressed independently, and accounts for 14.8% additional explanatory power on the natural logarithm of pulls merged. Similarly, Model XII (Table 5.7), *PDIST* and *PDISTSQ* were insignificant and others had similar standardized coefficients, and in the stepwise model, accounts for slightly less variance more than the control variables at 13.8%.

5.3. Board Structure and Innovation Outcomes

Board Structure in Model VI (Table 5.4), and the stepwise Model XII (Table 5.8) were modelled with the dependent variables of interest being the number of advisors (*NADVISOR*), its squared value (*NADVISORSQ*), the percentage of technical advisors (*PTECHADVISOR*) and its squared value (*PTECHSQ*) with control variables, against the natural logarithm of pulls merged. In this model, *NADVISOR, NADVISORSQ* and *PTECHADVISOR* were found as significant, with *PTECHADVISOR* accounting with the greatest standardized coefficient. The U-shape infers that at low size, innovation outcomes are fostered as there is likely little debate on technical direction and at very large sizes, there are enough individuals to mediate conflict; however, within the mid-size boards suffer from a lack of consensus. However, if this relationship were to be modelled,

the relationship appears generally negative, and as reflected in standardized coefficients, the linear relationship is stronger than the U relationship in terms of its explained variance.

The standardized coefficients are strongest for the technical intensity. The additional variance this model accounted for, over controls, was 19.7%. Similar results were found when conducted in the Stepwise method within Model VI (Table 5.8) with a change in control variables were 19.6% which speaks to the validity of these results. In both models, the standardized coefficient for *PTECHADVISOR* was stronger than that of size. Also, in both models, the linear relationship between the natural logarithm of pulls merged was negatively related to the size of the advisory board.

5.4. Internal Governance and Innovation Outcomes

Model VII (Table 5.5) and stepwise Model XIV (Table 5.9) models internal governance on the natural logarithm of pull requests merged, where all variables of interest were entered. From the results, *PWHALE, PWHALESQ, INST, NADVISOR, NADVISORSQ* and *PTECHADVISOR* were found as significant. The same results can be found using the stepwise method within Model VII (Table 5.5) and Model XIV (Table 5.9). The final results suggest, therefore, that ownership structure and board structure are important concepts towards a utility token's innovation output in terms of the natural logarithm of pulls requests merged. In particular, it reveals that concentration of whales is related in the shape of an inverse-U, that the number of institutional investors positively relates to innovation, that the number of advisors is U-shaped, though mostly negative considering the mean and standard deviation of most advisory boards in the tokens studied and that the technical intensity of advisors matters strongly for innovation within a token. Total variance explained by internal governance mechanisms was 27.9%

according to the enter model (Model VII Adj. R^2 above controls = .279) and 28.1% in stepwise, (Model XIV Adj. R^2 above controls = .281) inferring approximately 28% of the variance. An additional 10% in both cases were explained by the control variables used.

A zero-inflated poison distribution was executed as Model XV (Table 5.10.1), with the dependent variable being the number of pull requests merged and all independent and control variables included. All variables included were significant. McFadden's Adjusted R^2 of .448 (Table 5.10.2) suggests the model explains 44.8% of the variance in the raw number of pulls merged. The zero-inflated poison model is useful, as it assumes each pull request merged, irrespective if the firm has merged a pull request before, is an independent event. While this model is useful for that reason, it is limited in its ability to show quadratic relationships and hence is to be interpreted as a supporting model, in consultation with the ordinary least squares models otherwise presented.

5.5. Tables

Table 5.1: Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. PWHALE	1																
2. INST	0.005	1															
3. PDIST	-.113**	-.125**	1														
4. NADVISOR	-0.08	-0.033	-0.014	1													
5. PTECHADVISOR	-.109*	.156**	-.107*	.436**	1												
6. HARDCAP	0.058	-0.034	0.025	0.065	0.045	1											
7. BONUS	.089*	-.120**	.089*	-0.029	-0.058	.087*	1										
8. MVP	.148**	-0.053	-0.029	0.027	-.151**	.110*	.125**	1									
9. SOFTCAP	-0.011	0	-0.047	-.086*	-0.083	-.629**	-0.012	-0.028	1								
10. DURATION	.133**	-.109*	0.076	-0.024	-.099*	.120**	.102*	.240**	-0.082	1							
11. RATINGICO	0.01	0.018	-.108*	.138**	0.038	0.071	.086*	.406**	-0.006	0.074	1						
12. COUNTDISC	.115**	-0.023	-0.036	0.063	0.011	-0.027	-0.043	.092*	-0.01	0.057	0.048	1					
13. NRESTRICTED	0.038	.087*	-.096*	0.026	0.024	-0.057	0.014	0.065	-0.025	-0.041	0.043	-0.086	1				
14. HDI	-.104*	0.034	-0.069	0.049	0.039	.091*	0.041	0.001	-0.029	-0.004	0.06	0.073	0.044	1			
15. DEMRANK	-0.083	0.002	-.092*	-0.007	0.048	0.041	-0.014	0.018	0.022	-0.009	.097*	0.041	0.029	.386**	1		
16. OECD	-0.051	0.054	-0.034	-0.016	0.048	0.075	-0.003	0.006	-0.008	0.057	0.048	0.001	-0.043	.324**	.653**	1	
17. PULLS MERGED	-.189**	.334**	-0.081	0.003	.437**	-0.015	-.141**	-.234**	-0.015	-.214**	-0.003	0.039	-0.02	0.077	.087*	0.081	1

Notes:
N=525
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 5.2: Linear Regression of Control Variables on Pull Requests Merged

MODEL I	**Standardized Coefficients**	**Unstandardized Coefficient**
(Constant)	-0.443	
HARDCAP	0.006	0.002
BONUS	-0.318*	-0.101*
MVP	-0.694***	-0.227***
SOFTCAP	-0.111	-0.032
DURATION	-0.003***	-0.167***
RATINGICO	0.303	0.102
PREICO	-0.066	-0.019
COUNTDISC	0.177*	0.053*
NRESTRICTED	-0.001	-0.003
HDI	0.566	0.043
DEMRANK	0.023	0.027
OECD	0.163	0.054
MODEL STATISTICS		
R	.341	
R^2	.116	
Adjusted R^2	.096	
F Statistic	5.625***	

Notes:
N=525
***p<0.001, **p<0.01, *p<0.05

Table 5.3: Linear Regressions of Ownership Structure on Pull Requests Merged

Model	**Model II**		**Model III**		**Model IV**		**Model V**	
	Unstandardized Coefficient	Standardized Coefficient	Unstandardized Coefficient	Standardized Coefficient	Unstandardized Coefficient	Standardized Coefficient	Unstandardized Coefficient	Standardized Coefficient
(Constant)	-0.345		-0.465		-0.232		-0.132	
HARDCAP	0.074	0.024	0.041	0.013	-0.001	0	0.106	0.034
BONUS	-0.252	-0.08	-0.224	-0.071	-0.307*	-0.098*	-0.149	-0.047
MVP	-0.57***	-0.186***	-0.67***	-0.219***	-0.695***	-0.227***	-0.541***	-0.177***
SOFTCAP	-0.081	-0.023	-0.088	-0.025	-0.126	-0.036	-0.071	-0.02
DURATION	-0.002**	-0.122**	-0.003***	-0.136***	-0.003	-0.163	-0.002	-0.087
RATINGICO	0.186	0.063	0.252**	0.085**	0.284*	0.096*	0.114	0.038
PREICO	0.008	0.002	0.039	0.012	-0.065	-0.019	0.117	0.035
COUNTDISC	0.229	0.068	0.205	0.061	0.17	0.051	0.261*	0.078*
NRESTRICTED	-0.001	-0.002	-0.019	-0.043	-0.003	-0.007	-0.019	-0.044
HDI	0.245	0.018	0.432	0.032	0.544	0.041	0.072	0.005
DEMRANK	0.022	0.026	0.044	0.051	0.018	0.022	0.036	0.042
OECD	0.107	0.035	0.068	0.022	0.168	0.055	0.018	0.006
PWHALE	4.046***	0.724***					4.116***	0.684***
PWHALESQ	-4.431***	-0.894***					-4.334***	-0.874***
INST			0.201***	0.301***			0.202***	0.302***
PDIST					0.002	0.023	0.006	0.079

PDISTSQ			-0.006	-0.075	-0.009	-0.123
MODEL STATISTICS						
R	0.422	0.45		0.345		0.518
R^2	0.178	0.203		0.119		0.269
Adjusted R^2	0.156	0.182		0.096		0.244
Δ from Control	0.06	0.086		0		0.148
F Statistic	7.9***	9.997***		4.927***		10.954***

Notes:

a. N=525
b. Dependent Variable: LN(PullsMerged)
c. ***p<0.001, **p<0.01, *p<0.05

Table 5.4: Linear Regressions of Board Structure on Pull Requests Merged

Model VI	Unstandardized Coefficients	Standardized Coefficients
(Constant)	-0.371	
HARDCAP	0	0
BONUS	-0.268*	-0.085*
MVP	-0.457***	-0.149***
SOFTCAP	-0.035	-0.01
DURATION	-0.003***	-0.13***
RATINGICO	0.269*	0.091*
PREICO	-0.016	-0.005
COUNTDISC	0.187	0.056
NRESTRICTED	-0.008	-0.018
HDI	0.673	0.051
DEMRANK	0.003	0.004
OECD	0.114	0.038
NADVISOR	-0.236***	-0.567***
NADVISORSQ	0.01**	0.354**
PTECHADV	2.932***	0.504***
PTECHSQ	-0.006	-0.001
MODEL STATISTICS		
R	0.561	
R^2	0.315	
Adjusted R^2	0.293	
Δ from Control	0.197	
F Statistic	14.582***	

Notes:

a. N=525
b. Dependent Variable: LN(PullsMerged)
c. ***p<0.001, **p<0.01, *p<0.05

Table 5.5: Linear Regression of Internal Governance on Pull Requests Merged

MODEL VII	Unstandardized Coefficients	Standardized Coefficients
(Constant)	-0.074	
HARDCAP	0.085	0.027
BONUS	-0.143	-0.045
MVP	-0.382**	-0.125**
SOFTCAP	-0.004	-0.001
DURATION	-0.001*	-0.076*
RATINGICO	0.147	0.05
PREICO	0.116	0.034
COUNTDISC	0.257*	0.077*
NRESTRICTED	-0.02	-0.046
HDI	0.28	0.021
DEMRANK	0.019	0.022
OECD	0.014	0.005
NADVISOR	-0.208***	-0.501***
NADVISORSQ	0.01**	0.338**
PTECHADV	2.27**	0.39**
PTECHSQ	0.211	0.029
PWHALE	2.882***	0.473***
PWHALESQ	-3.094***	-0.624***
INST	0.161***	0.241***
PDIST	0	-0.006
PDISTSQ	0	-0.001
MODEL STATISTICS		
R	0.632	
R^2	0.4	
Adjusted R^2	0.375	
Δ from Control	0.279	
F Statistic	15.94***	

Notes:

a. N=525
b. Dependent Variable: LN(PullsMerged)
c. ***p<0.001, **p<0.01, *p<0.05

Table 5.6: Stepwise Regression of Control Variables on Pull Requests Merged

MODEL VIII	**Unstandardized Coefficients**	**Standardized Coefficients**
(Constant)		0.282
MVP	-0.226***	-4.834***
DURATION	-0.162***	-3.772***
BONUS	-0.105*	-2.505*
RATINGICO	0.106*	2.327*
OECD	0.086*	2.062*
MODEL STATISTICS		
R	0.33	
R^2	0.109	
Adjusted R^2	0.1	
Δ from Control	12.703***	

Notes:

a. N=525
b. Dependent Variable: LN(PullsMerged)
c. ***p<0.001, **p<0.01, *p<0.05

Table 5.7 Stepwise Regression of Ownership Structure on Pull Requests Merged

	MODEL IX		MODEL X		MODEL XI		MODEL XII	
	Unstandardized Coefficient	Standardized Coefficients	Unstandardized Coefficient	Standardized Coefficients	Unstandardized Coefficient	Standardized Coefficients	Unstandardized Coefficient	Standardized Coefficient
(Constant)	0.595*		0.778*		0.137*			
PWHALESQ	-4.812***	-0.972***					-4.545***	-0.917***
MVP	0.048***	0.791***	-0.573***-	-0.187***-	0.691***	0.226***	-0.475***	-0.155***
PWHALE	4.818***	-0.158***					4.435***	0.723***
DURATION	-0.002**	-0.118**	-0.003**	-0.135***	-0.003***	-0.162**	-0.002*	0.090*
BONUS					-0.33*	-0.105*		
RATINGICO					0.314*	0.106*		
OECD					0.261*	0.086*		
INST			0.207***	0.309***			0.205***	0.306***
DEMRANK			0.076*	0.089*				
COUNTDISC							0.274*	0.082*
MODEL STATISTICS								
R	0.397		.429		0.33		0.505	
R^2	0.157		0.1840		0.109		0.255	
Adjusted R^2	0.151		0.178		0.1		0.247	
Δ from Control	0.051		0.078		0.0		0.147	
F Statistic	24.257***		12.703		29.309		29.606	

Notes:

a. N=525
b. Dependent Variable: LN(PullsMerged)

c. Independent Variables:
    a. Model IX: PWHALE, PWHALESQ
    b. Model X: INST
    c. Model XI: PDIST, PDISTSQ
    d. Model XII: PWHALE, PWHALESQ, INST, PDIST, PDISTSQ
d. ***p<0.001, **p<0.01, *p<0.05

Table 5.8: Stepwise Regression of Board Quality on Pull Requests Merged

MODEL XIII	**Unstandardized Coefficients**	**Standardized Coefficients**
(Constant)	0.255	
DURATION	-0.002**	-0.123**
MVP	-0.454***	-0.149***
NADVISOR	-0.234***	-0.563***
PTECHADV	2.951***	0.508***
NADVISORSQ	0.01***	0.353***
RATINGICO	0.285*	0.096*
BONUS	-0.275*	-0.087*
MODEL STATISTICS		
R	0.522	
R^2	0.305	
Adjusted R^2	0.296	
Δ from Control	0.196	
F Statistic	32.407***	

Notes:

a. N=525
b. Dependent Variable: LN(PullsMerged)
c. Independent Variables: PTECHADV, PTECHADVSQ, NADVISOR, NADVISORSQ
d. ***p<0.001, **p<0.01, *p<0.05

Table 5.9: Stepwise Regression of Internal Governance on Pull Requests Merged

MODEL XIV	**Unstandardized Coefficients**	**Standardized Coefficients**
(Constant)	0.716*	
INST	0.162***	0.243***
PWHALESQ	-3.318***	-0.669***
PWHALE	3.114***	0.512***
MVP	-0.312**	-0.102**
NADVISOR	-0.213***	-0.512***
NADVISORSQ	0.01***	0.353***
PTECHADV	2.462***	0.423***
COUNTDISC	0.265*	0.079*
DURATION	-0.001*	-0.077*
MODEL STATISTICS		
R	0.626	
R^2	0.391	
Adjusted R^2	0.381	
Δ from Control	0.281	
F Statistic	36.808***	

Notes:

a. N=525
b. Dependent Variable: LN(PullsMerged)
c. Independent Variables: PWHALE, PWHALESQ, INST, PDIST, PDISTSQ, PTECHADV, PTECHADVSQ, NADVISOR, NADVISORSQ
d. ***p<0.001, **p<0.01, *p<0.05

Table 5.10.1: Zero-Inflated Poisson Regression of Pull Requests Merged

MODEL XV PullsMerged	Coef.	Std. Error	Z	P>|z|	95%	95% CI
PWHALE	5.335461	.3046265	17.51	0.000	4.738404	5.932518
PWHALESQ	-4.099716	.227953	-17.98	0.000	-4.546496	-3.652937
INST	.0491966	.0016122	30.51	0.000	.0460367	.0523566
PDIST	1.360665	.245834	5.53	0.000	.8788395	1.842491
PDISTSQ	-.6951615	.2464536	-2.82	0.005	-1.178202	-.2121214
NADVISOR	.0909694	.0092945	9.79	0.000	.0727525	.1091864
NADVISORSQ	-.0021521	.0004459	-4.83	0.000	-.0030261	-.0012782
PERCENTTECHADV	2.66242	.1986181	13.40	0.000	2.273136	3.051704
PTECHSQ	-.9492886	.1742239	-5.45	0.000	-1.290761	-.6078159
HARDCAP	.3724056	.0219034	17.00	0.000	.3294757	.4153356
MVP	-1.383228	.0365132	-37.88	0.000	-1.454792	-1.311663
SOFTCAP	.457188	.0235407	19.42	0.000	.4110491	.503327
DURATION	-.0164531	.0005516	-29.83	0.000	-.0175341	-.015372
RATINGICO	.2353822	.0215453	10.92	0.000	.1931542	.2776103
COUNTDISC	.5880185	.0203921	28.84	0.000	.5480508	.6279862
_cons	.0624277	.1406912	0.44	0.657	-.213322	.3381775
Inflate						
PullsMerge	-49.02951	30301.79	-0.00	0.999	-59439.44	59341.38
_cons	25.58476	18844.86	0.00	0.999	-36909.65	36960.82

Notes:

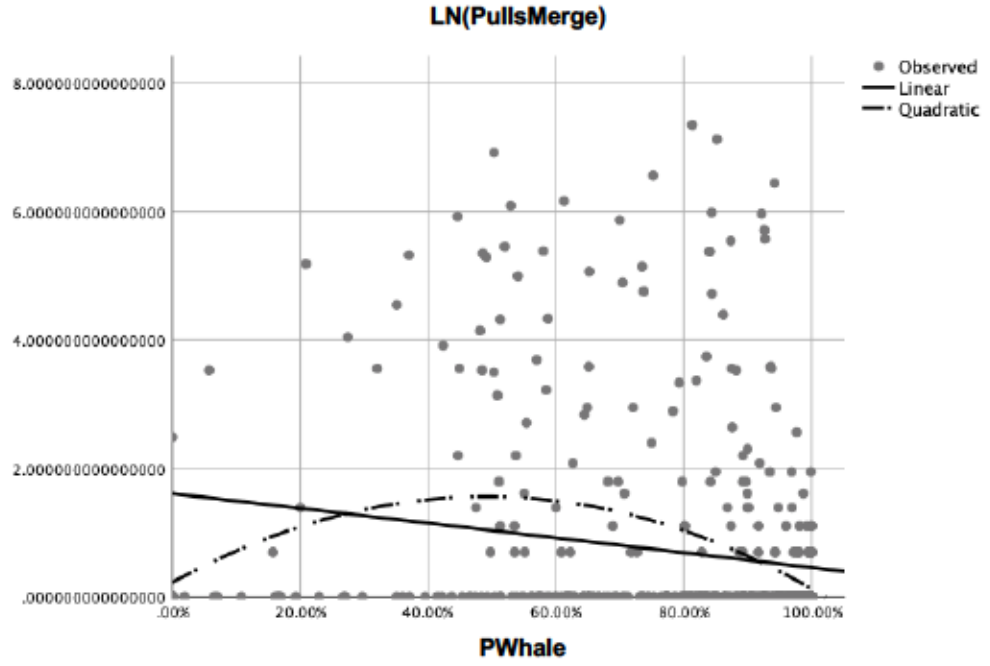
a. N=525
b. Dependent Variable: PullsMerged
c. Independent Variables: PWHALE, PWHALESQ, INST, PDIST, PDISTSQ, PTECHADV, PTECHADVSQ, NADVISOR, NADVISORSQ

Table 5.10.2: Model Statistics for Zero-Inflated Poisson Regression of Pull Requests Merged

Statistic	Value
Log-Lik Intercept Only	-17542.409
Log-Lik Full Model	-9667.511
D(507)	19335.022
LR(16)	15749.796
Prob > LR	0
McFadden's R2	0.449
McFadden's Adj R^2	0.448
Maximum Likelihood R^2	1
Cragg & Uhler's R^2	1
AIC	36.897
AIC*n	19371.022
BIC	16159.479
BIC'	-15649.582

5.6. Figures

Figure 5.1: Curve Fit of Ownership Concentration on Innovation



Notes:

Equation	Model Summary					Parameter Estimates		
	R Square	F	df1	df2	Sig.	Constant	b1	b2
Linear	0.036	19.354	1	523	0	1.606	-0.012	
Quadratic	0.112	32.957	2	522	0	0.225	0.054	-0.001

The independent variable is PWhale.

N=525

Chapter 6: Discussion

6.1. Introduction

The results of this study shed some empirical light on unresolved and previously unexamined relationships between internal governance and innovation. Accordingly, the results have significant theoretical, managerial and methodological implications. While he research was subject to a number of limitations, its findings nonetheless pave the way for a fruitful research agenda.

6.2. Implications

6.2.1. Theoretical

The findings of this study extend theory on internal governance mechanisms and innovation by exploring its conceptual relationship, and to the streams of literature of governance and innovation in start-up business, financial technology and emerging market contexts. As inconclusiveness from empirical and theoretical arguments rests upon the contextual settings of the nations studied within research (Gonzales-Bustos and Hernandez-Lara, 2016), this paper studies such in the environment of utility tokens, which their use of smart contracts entails they are exposed to minimal formal institutional influence.

First, its findings advance research by demonstrating that the conceptual relationship between ownership concentration and innovation may be in the shape of an inverse U (Table 5.5), given the ability of the utility token environment to better expose conceptual relationships for their lack of formal national influence on governance. Institutional effects influence governance and innovation through their impact on the efficiency of factor markets, accountability and the upholding of the Rule of Law within legal national governance and strength of property rights to grant incentives for innovation

(Morck and Steier, 2005). Findings from the models show that the percentage owned by whales was related in an inverse-U shape with the natural logarithm of pull requests merged, show support for *Hypothesis 1*. In particular, both linear and quadratic relations were significant which, together, account for 6% of the variance in innovation (Model II Change in Adjusted R^2 from controls = 0.06) Accordingly, the study provides support for *Proposition 1*, which was that ownership concentration would have an inverse-U relationship with innovation outcomes.

To model this relationship in the context of utility tokens, Figure 6.1 shows the relation using coefficients from Model VII. Accordingly, the inflection point was identified at 47%, suggesting the optimal level of ownership concentration is near the 50% cut-off that may allow entrenchment. Research modelling this relationship similarly in the context of China (Chen, Li, Shapiro, and Zhang, 2014), where there are weak institutions influencing governance.

This suggests that, as with studies finding a positive relation, large owners aim to increase the value of their shares by increasing firm value through innovation, to a certain point, and then, as studies finding negative relationships suggest, larger owners become entrenched and expropriate firm resources for individual benefit. Altogether, results from the examination of ownership concentration on innovation, within the context of utility tokens, can extend theory by providing early evidence suggestive of an inverse-U relationship, as expected by some research, in terms of its conceptual relationship.

Second, this research adds to literature of institutional ownership on innovation (Kochar and David, 1996; Aghion, van Reenen, and Zinglaes, 2013). In line with research showing contextually dependent findings on institutional investment, again due to the

myriad of institutions influencing governance and ownership identities, this study examines the relationship in a unique setting that may better expose the conceptual relationship for venture capital and hedge fund investors as the institutions invested in utility tokens are exclusively within these categories. Data from the Model IV (Table 5.3) shows a positive relationship between the number of institutional investors and the natural logarithm of pulls merged which support *Hypothesis 2*. The finding of a positive relationship between institutional ownership by venture capital funds and innovation, supports *Proposition 2*, specifically that institutional investment from venture capital funds are positively related to innovation.

Third, this study found that what may encourage financial performance may not necessarily encourage innovation outcomes. Previous research on campaign success and financial performance, suggests that the percentage of tokens distributed would influence innovation, supposedly in a similar manner to managerial ownership. In an innovation context, founders would be incentivized to innovate with the more stake they have in ownership. This paper also examined for potential quadratic effects whereby, after a certain point, they can become entrenched. Both variables, explored independently and together, reveal no significant relationship on the natural logarithm of pull requests merged as shown in Model III (Table 5.3). This infers that *Hypothesis 3* is not supported, and thereby, advances applied scholarship on initial coin offerings in showing off-chain governance mechanisms matter more for innovation.

Fourth, this study advances the growing body of literature on entrepreneurship and start-up governance (Ingley and McMaffrey, 2007; Stromsten and Waluszewski, 2012) by conducting a large *N* sample study on advisory boards, which have surprisingly not

been subject to much research in any setting despite growing prominence within small and medium-sized enterprises. Advisory board directors differ from external members of boards of directors in that, while being able to advise the business with external advice, there is no fiduciary duty for advisors and accordingly, compensation for them is less. This research provides some empirical evidence towards understanding the potential impact of technical intensity of the board on innovation outcomes. Models suggest that there is a strong relationship between the proportion of technical directors and innovation (Table 5.5). The model also tested for quadratic relationships, which were not significant. The data thereby support *Hypothesis 3a* for a positive, linear relationship between the proportion of technical directors and innovation outcomes. This finding also supports *Proposition 3a*, which states technical directors are better able to assist the board with providing reliable and trusted insight to assign value to innovation projects and thereby make better innovation decisions with more confidence into what otherwise would be unknown. This paves the way for future scholarship on investigating board influence on innovation through the proportion of technical directors.

Fifth, as expected in *Hypothesis 4b,* accounting for the technical intensity of advisors, the size of advisory board was shown to have an overall negative relationship on innovation outcomes (Table 5.5). The supporting data for this hypothesis thereby also supports *Proposition 3b*, which draws on literature of boards of directors. Hence, this research shows that advisory boards could behave similarly to boards of directors. Interestingly, with significance of the quadratic for the number of advisors, very small and very large boards have better impacts than mid-size boards, extending theory that, while

the relationship may be negative at first, it may eventually become positive. Further empirical study of advisory boards is recommended.

6.2.2. Managerial

Findings of this research provide a significant number of managerial implications, particularly for boards of directors to firms, investors, regulators in general, in the small to medium size business arena and within the utility token market.

Boards seeking to grow firms through innovation should be aware of the inverse-U relationship of ownership concentration and innovation. Indeed, there are benefits that concentrated ownership bring to innovation, namely influence to growing the firm and ensuring resources are put to their best use; however, there are is also a risk of entrenchment that negatively influences innovation as the concentration approaches 50%. Many large owners know one another and can coordinate moves to expropriate resources, and with agency, appear to do so. Accordingly, boards should closely examine their firms' ownership concentration on an ongoing basis, and steer initiatives that encourage diversity within ownership structure. Investors should also examine closely the ownership structure of the firms they wish to invest within or have holdings therein. As innovation is necessary for optimal growth, and should be encouraged, investors looking at firms with strong innovation prospects should examine the concentration of ownership upon decisions with their investments. This also has impacts for regulators, where ownership concentration should not be limited per-se, but instead designed such that such is promoted until large owners have collective have agency.

Second, as institutional ownership from venture capital funds was found to positively relate to innovation (Table 5.5), this infers that firms should actively seek institutional

investment from venture funds. As theorized in proposition 2, these funds provide for strong impacts on innovation for their ability to have patience in their expectations for a long-term outcome, with hopes of significant appreciation in a few of their investments. Further, it should be understood that institutional ownership is not a unitary concept, as different identities of institutional investors have different impacts on innovation, with that from venture funds being positive. This finding could encourage investors to examine the specific institutions with investment in the firms they are considering for investment.

The finding that advisory board size is generally negatively related to innovation outcomes, though in the form of a U-shape, while its technical intensity (Table 5.5) is positive is a very important finding for a range of stakeholders. Boards looking to maximize innovation within their firms, should thereby place emphasis on the proportion of technical directors within its board. Having a large proportion of technical directors on boards would provide knowledge resources that are important in making innovation decisions, for which can increase the confidence of others in committing to specific innovations. It is also important as the setting studied were advisory boards, and not boards of directors. Many start-ups in the high technology sector have advisory boards, and this points to important dimensions of how advisory boards should be structured to promote innovation, specifically with a focus on technical intensity and not size per-se. Investors looking to maximize innovation from their investment, government programs supporting small and medium sized enterprises and founders looking at maximizing firm value, should ensure advisory boards, if in place, are promoted to be structured with a large proportion of technical individuals.

As the research was done in the setting of utility tokens, it also has a strong number of specific implications for investors, founders and regulators within this space. This research clearly shows that off-chain internal governance, referring to concentration of token holders, institutional ownership of tokens and advisory boards, clearly matter. For investors of utility tokens, attention to the concentration of whales in tokens would be important, where such is beneficial until a particular cut-off where these whales have agency over the token and can coordinate moves such as "pump and dump" scams. Founders looking to maximize the innovation outcome of their token should also be aware of the impacts of ownership concentration and institutional ownership. The practical implication of most importance to facilitate this, is to not offer bonuses to investors that buy large volumes of tokens or cut them off after a specified amount of token supply. These bonuses act as discounts to volume buyers but can easily lead to excessive ownership concentration as it promotes large owners, which at excessive levels, negatively relate to innovation. Regulators should also be aware of these implications and be encouraged to limit tokens with excessive concentration and inform investors of the impacts to such.

With positive implications on innovation from institutional investment (Table 5.5), investors should consult data on institutional owners of their investments, if they are planning to invest a substantial amount in a token. As access to the list of institutional investments does cost money, but as this study shows, is also a very important dimension to innovation, investors should consult this list in their choice of tokens, understanding such promotes innovation outcomes. Founders looking to maximize innovation should actively seek ownership from venture fund institutions, for these organizations have

capacity to absorb losses from unwise investments, and their relatively longer expectations of holding specific tokens allow them to have patience for long-term results from innovation.

Findings related to the advisory board also have a range of implications. technical intensity in advisory boards also pos a number of managerial implications for token investors, and founders. Founders should aim to structure advisory boards to be small yet with a large proportion of technical advisors. Investors should also examine advisory boards carefully and pay special attention to their technical intensity if innovation is what they are concerned with.

6.2.3. Methodological

Methodologically, this paper advances scholarship through the ability to use utility tokens to test relationships that can otherwise not be tested could be done so through the setting of initial coin offerings. As national institutions, such as property rights regimes, the Rule of Law and democracy effect factor markets, innovation activity, and motivations behind investors, relations on these concepts will likely to continue to be mixed and dependent upon the nations to which they are studied. Initial coin offerings enforce contracts as smart contracts through blockchain technology, which eliminates national institutional influence. Initial coin offerings also provide a wealth of relatively accessible data on innovation, ownership concentration, institutional ownership and advisory boards making them an idyllic area to study topics of these concerns.

6.3. Limitations

The principal limitation of the findings from this research is its generalizability, as the research setting was utility tokens, which may not necessarily be generalizable to a

traditional firm context. As utility tokens have significant differences from traditional firms, as discussed throughout the paper, the variables may interact with each other differently in the utility token context than among traditional firms. As the population of utility tokens studied also had certain characteristics (see Chapter 3), they are also not generalizable to the utility token context. Hence, research should investigate the propositions within this study, in other contexts to make findings generalizable. Such context could be a study of firms across several countries, where institutional characteristics are somehow controlled.

Second, this research is limited as it concerns itself with only two mechanisms of internal governance, being ownership structure and board structure; and one measure of innovation, namely innovation outcome. Internal governance can cover a very wide range of mechanisms within firms, including ownership structure, board structure, managerial incentives, audits, policies and executive compensation and oversight. This paper only explored the major two of those. Further, innovation is a largely abstract concept which could encompass many activities towards introducing something new, within the view of innovation as process, and the physical introduction of something new, with innovation as an outcome. This study, in examining the natural logarithm of pulls merged, merely studies innovation as an outcome. Studies wanting to fully explore relationships between internal governance and innovation should thereby explore a wider complement of internal governance mechanisms and examine innovation activities in the view of innovation as a process, and not just an outcome.

Third, the findings from this research are limited as the data collected does not allow to indicate causality from governance mechanisms on innovation output. Using OLS

was necessary to explore relationships of linear and quadratic nature, this study showed that there are clear associations between internal governance mechanisms and innovation, with assumptions made about the causation. To indicate causation, longitudinal studies are recommended where a sample of coins are examined and their ownership concentration, institutional investment, and advisory board structure are recorded with at multiple different times, and correlated to the innovation activity of those tokens for that time period. While this is desirable, gathering data for such would be a very intensive process and hence likely would examine a considerably smaller sample of tokens. Altogether, the limitations suggest that results of this study should be interpreted with caution, yet nonetheless paves the way well for future research.

6.4. Delimitations

Several measures were taken to minimize the impact of the limitations. To minimize the challenges of studying utility tokens to reveal conceptual relationships, the population of tokens was sampled to best capture the concepts of internal governance and innovation. By selecting the two most widely used measures of governance and a consistent proxy for innovation outcomes across all tokens studied in the sample, it is hoped that the study would have explored the most foundational relationships from which future studies could build. In understanding the desire to show reasonable relationships, this study used a large N sample (N=525) to best unravel relationships not caused by fluke and rely on strong theory from other studies to inform its model.

6.5. Future Research

This study paves the way for a very fruitful, multi-disciplinary research agenda exploring conceptual relationships between innovation and governance and using utility

tokens as an empirical laboratory to model other conceptual relationships. First, future scholarship should explore how internal governance influences financial performance, with its influences on innovation as a mediator. The relationship between governance and financial performance remains inconclusive with significant gaps on how the concepts relate. The impacts of internal governance on innovation are surely relevant for investors, boards, firms, policymakers and regulators. Similar studies exploring economic growth can also be conducted, as firm governance is thought to be an underexplored mechanism of economic growth within countries. Both studies could use the propositions of governance advanced in this study, and further theorize how these, and other mechanisms, influence innovation.

Second, research could explore interactions between multiple governance mechanisms by exploring mediation and moderations and drawing from strong theory. It has been suggested that ownership concentration reduces the negative impact of a large bord size due to their abilities to better coordinate the board and work towards finding consensus. However, no empirical studies have examined this, likely due to a very small number of studies exploring more than one governance mechanism against innovation. Other metrics may investigate other mechanisms such as institutional ownership influence board structures, which may include the technical intensity of boards of directors, and not necessarily be limited to size.

Third, further scholarship could further advance a more comprehensive model of internal governance and innovation. Board structure is a large concept, and many variables were not included in this study that could be important, such as gender, nationality, and diversity of thought. Similarly, there are many other ownership identities

than those explored in this study and hence may be helpful in developing a more inclusive model. Other internal structural variables that should be studied alongside governance for its influence on innovation, could include cultural dimensions, the top management team, disclosure, and media reputation. Utility tokens can be used as an empirical laboratory as these additional variables can be reasonably explored and, if fruitful, can be explored in a more research-intensive study of traditional firms. It is recommended that future studies also consult white papers, which may reveal how distributions of retained tokens are divided, and also provide some insight into its relationship to innovation.

This research also suggests that advisory boards, as prominent features of start-ups in the technology sector and other private businesses, should be the attention of more theory and explored with more empirical data. As discussed in the paper, members of advisory boards differ from independent directors on boards, in that only the later have a fiduciary duty and are usually compensated accordingly, while both provide external advice and resources to the firm, to direct their innovation activities. While the paper discusses the many ways in which advisory boards are similar to boards of directors in their influence on innovation, it is also conceivable there are many differences. Thus, empirical research and theoretical work on advisory boards, and their influence on innovation and financial performance, should be considerably advanced. Within the rapidly growing entrepreneurship literature, (Tang and Zhao, 2016) advisory boards are a considerable gap, further underscored by the importance of start-up technology firms grows in the knowledge intensive economy. With a wide range of open and relatively accessible data to advisory boards available for utility tokens, it may be a fruitful laboratory

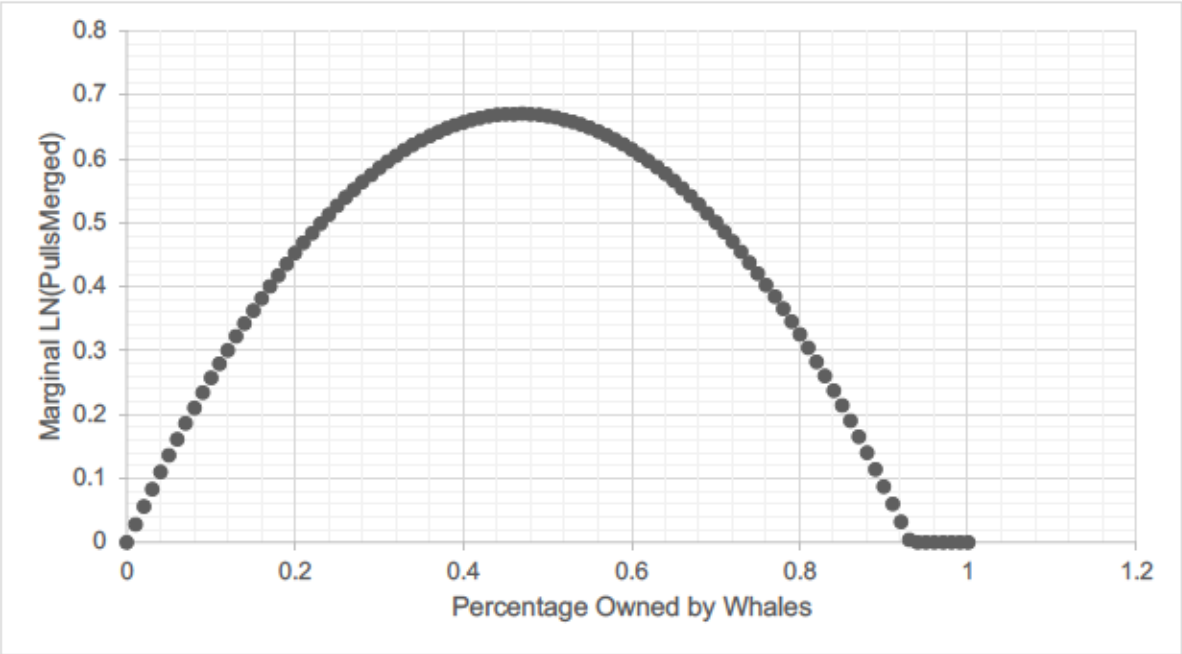
to explore these basic relationships prior to more intensive processes of testing them within traditional firm contexts, where national influences may be a strong factor.

6.6. Conclusion

Altogether, this study provides data that support important theoretical propositions related to internal governance mechanisms and innovation. The empirical findings notably suggest that ownership concentration has an inverse-U relationship with innovation, that institutional ownership from venture capital firms are positively related to innovation, that advisory board size behaves similar to boards of directors and that technical intensity of boards are stronger than size. This has important implications on theory, managerial practice and methodology, as discussed. There are several limitations of this research, including its use of utility tokens as an empirical environment, its limited proxies of mechanisms of governance and innovation and its lack of longitudinal data to further indicate causality. Several delimitation initiatives were done to counter these limitations. Altogether, the paper provides an excellent platform for future research as studies can build from this to ground development of a model exploring governance, innovation and financial performance, further develop more comprehensive model of innovation and governance, ground applied national studies on innovation and governance and explore differences and similarities between members of advisory boards and external members of boards of directors.

6.7. Figures

Figure 6.1: Impact of Percentage owned by Whales on Marginal LN(PullsMerged)



N=525

Chapter 7: Conclusion

The primary goal of this study was to examine the conceptual relationships between internal organizational governance mechanisms and innovation outcomes, by using utility tokens as an empirical laboratory. Given that these tokens are not bound to national countries which may influence governance and have a consistent measure of innovation outcomes, such was a seemingly natural setting to add to the inconclusive literature. Secondary goals were to contribute meaningfully with the context, especially on literature of governance of high-tech SMEs with particular emphasis of the impact of advisory characteristics on innovation outcomes, and within the growing literature surrounding utility token offerings, as a novel method of entrepreneurial finance.

Drawing on a rigorous review of theoretical basic and applied research, this study made a number of propositions on the conceptual relationship between governance and innovation for which it found support. First, it found support for ownership concentration to have an inverse-U relationship on innovation outcome, which suggests national forces moderate the relationship and can explain the relatively split literature. Second, it found support for institutional ownership having a positive and linear relationship on innovation outcome, which indicates that institutional investors help facilitate coordination of the team and keep it accountable. Fourth, it found that technical intensity of the board explained more variance than the size itself, and had a positive linear relationship on innovation outcomes. Lastly, it found support for a U-shape and negative linear relationship between advisory board size and innovation outcomes, which follows one stream of literature finding similar results as boards of directors.

The results of this study are limited in three major ways. First, as this study used utility tokens as its empirical context, the relationships may not be the same for traditional firms and caution should be taken in interpreting the findings. Second, this research defined innovation only on outcome and not as process, hence, there remains a gap for examining the conceptual relationship with empirical data from innovation processes. Further, the research focussed on two mechanisms of internal governance, namely ownership structure and board structure. Other mechanisms of internal governance exist, such as executive compensation and incentives which were not included in this study. Third, the research was not structured longitudinally and hence can not support causation. Delimitations included focussing on a population best exemplify the conceptual relationships, choosing the two major mechanisms of governance and a consistent measure of innovation as the variables and relying on a large N to make a concrete case for relationships which may exist in the data.

Accordingly, this study paves the way for future research, which can take several directions. First, it remains to be known if governance effects innovation and financial performance in the same way, that is, if it effects innovation positively, would it also effect financial performance. Second, using mixed methods research, identification of national institutions that effect governance and operationalizing these could prove fruitful to testing the propositions in this study with traditional firms, and attempting to control for national influences. Third, further examination into the advisory board would be useful. Advisory boards are prominent features of many high-tech start-up firms. Examining their characteristics, both in the UTO context for a conceptual relationship with innovation and among firms in specific countries for an applied context, should be necessary.

Methodologically, this study paves the way for using UTOs as an empirical laboratory to test relationships where national jurisdictions would otherwise limit so doing.

By examining governance and innovation within the empirical context of utility tokens, this research produced results that advance theoretical, managerial and methodological practice on governance and innovation.

Appendix 1: A: List of Abbreviations

ICO: Initial Coin Offering: A way for cryptocurrencies to raise funds as they develop their new token, which could act as currency, app or service. Public ICOs are similar to crowdfunding, where tokens are sold in exchange for a right to use one token. Every ICO project may seek funding to launch.

Token: A cryptographic entity with a value, amount and conditions specified. Tokens can be used, like software, to solve problems. For example, if it is a coffeeshop, one token may be a cup of coffee.

Utility token: A token which uses blockchain protocols to solve a problem, like how software uses code to solve problems.

Security token: A token which derives value from an external, tradable asset.

UTO: Utility Token Offering: A campaign for the launch of a utility token, which hope to fundraise enough funds and sell enough tokens to develop their technology.

STO: Security Token Offering: A crowdfunded campaign for the launch of a security token.

Whale: A token owner who owns 1% or more of a token's total supply.

MVP: Minimally viable product.

Bonus: A volume incentive given to those who purchase many tokens.

Hardcap: A maximum, or ceiling, on the amount possibly raised by a ICO campaign.

Softcap: The minimum, or floor, on the amount needed for a campaign to fundraise and be deemed successful.

Address: An address to a distributed ledger, such as how an IP address is associated with an internet connection or how a computer has a MAC address.

Advisor: An external member who is not formally apart of a token's team, that can advise one or more tokens on their operations.

GitHub: An open source platform used to develop open source code.

Repository: A central storage location of code, that may contain multiple source codes used by the program.

Commit: An individual change or extension to a file.

Fork: A replicated version of a repository, made separate for testing purposes.

Pull Request Open: An open request for merger of one or more commits to be pulled into a repository.

Pull Request Closed, rejected: An evaluated pull request with the moderator denying the pull request, such as if the moderator does not see value of the change or feature to be introduced, or finds faults in the code.

Pull Request Merged: An evaluated pull request with the moderator accepting the request and pulling into the requested repository.

References

Abramowicz, M. (2016). Cryptocurrency-based law. *Ariz. L. Rev., 58*, 359.

Adams, R. B., Hermalin, B. E., and Weisbach, M. S. (2010). The role of boards of directors in corporate governance: A conceptual framework and survey. *Journal of economic literature, 48*(1), 58-107.

Adhami, S., Giudici, G., and Martinazzi, S. (2018). Why do businesses go crypto? An empirical analysis of initial coin offerings. *Journal of Economics and Business, 100*, 64-75.

Adhami, S., Giudici, G., and Martinazzi, S. (2018). Why do businesses go crypto? An empirical analysis of initial coin offerings. *Journal of Economics and Business, 100*, 64-75.

Aghion, P., Bacchetta, P., Ranciere, R., and Rogoff, K. (2009). Exchange rate volatility and productivity growth: The role of financial development. *Journal of monetary economics, 56*(4), 494-513.

Aghion, P., Van Reenen, J., and Zingales, L. (2009). Innovation and Institutional Investment.

Ahlstrom, D. (2010). Innovation and growth: How business contributes to society. *Academy of management perspectives, 24*(3), 11-24.

Amsden, R., and Schweizer, D. (2018, April). Are Blockchain Crowdsales the New'Gold Rush'? Success Determinants of Initial Coin Offerings. In *2nd Emerging Trends in Entrepreneurial Finance Conference.*

An, J., Duan, T., Hou, W., and Xu, X. (2019). Initial coin offerings and entrepreneurial finance: the role of founders' characteristics. *The Journal of Alternative Investments, 21*(4), 26-40.

Anand, A., Milne, F., and Purda, L. D. (2006). Voluntary adoption of corporate governance mechanisms. *Available at SSRN 921450.*

Ankenbrand, T., and Bieri, D. (2018). Assessment of cryptocurrencies as an asset class by their characteristics. *Investment Management and Financial Innovations, 15*(3), 169.

Asensio-López, D., Cabeza-García, L., and González-Álvarez, N. (2019). Corporate governance and innovation: A theoretical review. *European Journal of Management and Business Economics.*

Baker, G. P., Jensen, M. C., and Murphy, K. J. (1988). Compensation and incentives: Practice vs. theory. *The journal of Finance, 43*(3), 593-616.

Balsmeier, B., Buchwald, A., and Stiebale, J. (2014). Outside directors on the board and innovative firm performance. *Research Policy, 43*(10), 1800-1815.

Bantel, K. A., and Jackson, S. E. (1989). Top management and innovations in banking: Does the composition of the top team make a difference?. *Strategic management journal, 10*(S1), 107-124.

Battaggion, M. R., and Tajoli, L. (2000). Ownership structure, innovation process and competitive performance: the case of Italy. *Università commerciale Luigi Bocconi*.

Baysinger, B. D., Kosnik, R. D., and Turk, T. A. (1991). Effects of board and ownership structure on corporate RandD strategy. *Academy of Management journal, 34*(1), 205-214.

Baysinger, B., and Hoskisson, R. E. (1989). Diversification strategy and RandD intensity in multiproduct firms. *Academy of Management journal, 32*(2), 310-332.

Belloc, F. (2012). Corporate governance and innovation: A survey. *Journal of Economic Surveys, 26*(5), 835-864.

Benedetti, H., and Kostovetsky, L. (2018). Digital tulips? Returns to investors in initial coin offerings: Returns to Investors in Initial Coin Offerings. *Available at SSRN 3182169.*

Block, J. H. (2012). RandD investments in family and founder firms: An agency perspective. *Journal of Business Venturing, 27*(2), 248-265.

Boreiko, D., and Risteski, D. (2020). Serial and large investors in initial coin offerings. *Small Business Economics,* 1-19.

Boreiko, D., and Vidusso, G. (2019). New blockchain intermediaries: do ICO rating websites do their job well?. *The Journal of Alternative Investments, 21*(4), 67-79.

Bourveau, T., De George, E. T., Ellahie, A., and Macciocchi, D. (2018). Initial coin offerings: Early evidence on the role of disclosure in the unregulated crypto market. *Available at SSRN 3193392.*

Bozec, Y., and Di Vito, J. (2019). Founder-controlled firms and RandD investments: New evidence from Canada. *Family Business Review, 32*(1), 76-96.

Bourveau, T., De George, E. T., Ellahie, A., and Macciocchi, D. (2018). *Initial coin offerings: Early evidence on the role of disclosure in the unregulated crypto market.* Available at SSRN 3193392.

Brenig, C., and Müller, G. (2015). Economic analysis of cryptocurrency backed money laundering. *AISNet*.

Brunninge, O., Nordqvist, M., and Wiklund, J. (2007). Corporate governance and strategic change in SMEs: The effects of ownership, board composition and top management teams. *Small Business Economics, 29*(3), 295-308.

Bushee, B. J. (2001). Do institutional investors prefer near-term earnings over long-run value?. *Contemporary Accounting Research, 18*(2), 207-246.

Bruton, G. D., Filatotchev, I., Chahine, S., and Wright, M. (2010). Governance, ownership structure, and performance of IPO firms: The impact of different types of private equity investors and institutional environments. Strategic management journal, 31(5), 491-509.

Carney, M. (2005). Corporate governance and competitive advantage in family–controlled firms. *Entrepreneurship theory and practice, 29(*3), 249-265.

Carpenter, J. N. (2000). Does option compensation increase managerial risk appetite?. *The journal of Finance,* 55(5), 2311-2331.

Carson, R. (2008). On Rent-Seeking Cost Under Democracy and Under Dictatorship (No. 07-01). *Carleton University, Department of Economics.*

Catalini, C., and Gans, J. S. (2019). *Some simple economics of the blockchain* (No. w22952). National Bureau of Economic Research.

Chen, K. (2019). Information asymmetry in initial coin offerings (ICOs): Investigating the effects of multiple channel signals. *Electronic Commerce Research and Applications, 36*, 100858.

Chen, V. Z., Li, J., Shapiro, D. M., and Zhang, X. (2014). Ownership structure and innovation: An emerging market perspective. Asia Pacific Journal of Management, 31(1), 1-24.

Chen, Y. (2018). Blockchain tokens and the potential democratization of entrepreneurship and innovation. *Business Horizons, 61*(4), 567-575.

Chen, Y., and Bellavitis, C. (2020). Blockchain disruption and decentralized finance: The rise of decentralized business models. *Journal of Business Venturing Insights, 13*, e00151.

Chiang, H. T., and He, L. J. (2010). Board supervision capability and information transparency. *Corporate Governance: An International Review, 18*(1), 18-31.

Chow, I. H. S., and Liu, S. S. (2007). Business strategy, organizational culture, and performance outcomes in China's technology industry. *People and Strategy, 30*(2), 47.

Christensen, C., Craig, T., and Hart, S. (2001). The great disruption. *Foreign Affairs*, 80-95.

Clarysse, B., Knockaert, M., and Lockett, A. (2007). Outside board members in high tech start-ups. *Small Business Economics, 29*(3), 243-259.

Cosh, A., Fu, X., and Hughes, A. (2007). Management Characteristics, Managerial Ownership and Innovative Efficiency in High-technology Industry. *Oxford University.*

Crosser, N. (2018). Initial coin offerings as investment contracts: Are blockchain utility tokens securities. *University of Kansas Law Review, 67*, 379.

Crossland, C., and Hambrick, D. C. (2007). How national systems differ in their constraints on corporate executives: A study of CEO effects in three countries. *Strategic Management Journal, 28*(8), 767-789.

Czarnitzki, D., and Kraft, K. (2004). Firm leadership and innovative performance: Evidence from seven EU countries. *Small Business Economics, 22*(5), 325-332.

David, P., and Kochhar, R. (1996). Barriers to effective corporate governance by institutional investors: Implications for theory and practice. *European Management Journal, 14*(5), 457-466.

Davydiuk, T., Gupta, D., and Rosen, S. (2019). De-crypto-ing signals in initial coin offerings: Evidence of rational token retention. *Available at SSRN 3286835.*

De Massis, A., Kotlar, J., Chua, J. H., and Chrisman, J. J. (2014). Ability and willingness as sufficiency conditions for family-oriented particularistic behavior: implications for theory and empirical studies. *Journal of Small Business Management, 52*(2), 344-364.

De Villiers, C., Naiker, V., and Van Staden, C. J. (2011). The effect of board characteristics on firm environmental performance. *Journal of Management, 37*(6), 1636-1663.

Deng, X., Lee, Y. T., and Zhong, Z. (2018). Decrypting coin winners: Disclosure quality, governance mechanism and team networks. *Governance Mechanism and Team Networks (September 25, 2018).*

Denis, D. J., Denis, D. K., and Sarin, A. (1999). Agency theory and the influence of equity ownership structure on corporate diversification strategies. *Strategic Management Journal, 20*(11), 1071-1076.

Denison, D. R., and Mishra, A. K. (1995). Toward a theory of organizational culture and effectiveness. *Organization science, 6*(2), 204-223.

Di Vito, J., and Laurin, C. (2010). Corporate ownership, RandD investment and performance of Canadian Firms. *Journal of Global Business Management, 6*(1), 1.

Di Vito, J., Laurin, C., and Bozec, Y. (2010). RandD activity in Canada: Does corporate ownership structure matter?. *Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration, 27*(2), 107-121.

Djankov, S., La-Porta, R., Lopez-de-Silanes, F., and Shleifer, A. (2006). The law and the Economics of Self-dealing, working paper, World Bank.

Donaldson, L., and Davis, J. H. (1991). Stewardship theory or agency theory: CEO governance and shareholder returns. *Australian Journal of management, 16*(1), 49-64.

Driver, C., and Guedes, M. J. C. (2012). Research and development, cash flow, agency and governance: UK large companies. *Research Policy, 41*(9), 1565-1577.

Dyck, A., and Zingales, L. (2004). Private benefits of control: An international comparison. *The journal of finance, 59(*2), 537-600.

Dyck, A., Volchkova, N., and Zingales, L. (2008). The corporate governance role of the media: Evidence from Russia. *The Journal of Finance, 63*(3), 1093-1135.

EY. October 19, 2018. *Initial Coin Offerings: The Class of 2017: One Year Later.* Retrieved from: https://www.ey.com/Publication/vwLUAssets/ey-study-ico-research/$FILE/ey-study-ico-research.pdf

Fama, E. F., and Jensen, M. C. (1983). Separation of ownership and control. *The journal of law and Economics, 26*(2), 301-325.

Finestone, Matthew. "Why Distribution of Ownership is Important to Digital Currency Investors." CoinSquare.com. Jan 7, 2018. https://news.coinsquare.com/investing/digital-currency-distribution

Fisch, C. (2019). Initial coin offerings (ICOs) to finance new ventures. Journal of Business Venturing, 34(1), 1-22.

Fisch, C., and Momtaz, P. P. (2020). Institutional investors and post-ICO performance: an empirical analysis of investor returns in Initial Coin Offerings (ICOs). *Journal of Corporate Finance*, 101679.

Fogel, K., Morck, R., and Yeung, B. (2008). Big business stability and economic growth: Is what's good for General Motors good for America?. *Journal of Financial Economics*, *89*(1), 83-108.

Forbes, D. P., and Milliken, F. J. (1999). Cognition and corporate governance: Understanding boards of directors as strategic decision-making groups. *Academy of management review, 24*(3), 489-505.

Francis, J., and Smith, A. (1995). Agency costs and innovation some empirical evidence. *Journal of Accounting and Economics, 19*(2-3), 383-409.

Gang, W., Zezhong, X., Travlos, N., and Hong, Z. (2007). Background of Independent Directors and Corporate Performance [J]. Economic Research Journal, 3.

Gans, J. (2016). The other disruption. *Harvard Business Review, 94(*3), 78-84.

Garratt, R., and van Oordt, M. (2019). Entrepreneurial Incentives and the Role of Initial Coin Offerings, Bank of Canada. Staff Working Paper.

Genus, A., and Coles, A. M. (2006). Firm strategies for risk management in innovation. *International Journal of Innovation Management, 10*(02), 113-126.

Giudici, G. (2016). Equity crowdfunding of an entrepreneurial activity. In *University evolution, entrepreneurial activity and regional competitiveness* (pp. 415-425). Springer, Cham.

Giudici, G., and Adhami, S. (2019). The impact of governance signals on ICO fundraising success. *Journal of Industrial and Business Economics*, 46(2), 283-312.

Gonzales-Bustos, J. P., and Hernández-Lara, A. B. (2016). Corporate governance and innovation: A systematic literature review. *Corporate Ownership and Control, 13*(2), 33-45.

Goodstein, J., and Boeker, W. (1991). Turbulence at the top: A new perspective on governance structure changes and strategic change. *Academy of management Journal, 34*(2), 306-330.

Goodstein, J., Gautam, K., and Boeker, W. (1994). The effects of board size and diversity on strategic change. *Strategic management journal, 15*(3), 241-250.

Gordon, R. J. (2018). *Why has economic growth slowed when innovation appears to be accelerating? (*No. w24554). National Bureau of Economic Research.

Gugler, K., Mueller, D. C., and Yurtoglu, B. B. (2008). Insider ownership, ownership concentration and investment performance: An international comparison. *Journal of Corporate Finance*, 14(5), 688-705.

Hardy, R. A., and Norgaard, J. R. (2016). Reputation in the Internet black market: an empirical and theoretical analysis of the Deep Web. *Journal of Institutional Economics, 12*(3), 515-539.

Haynes, K. T., and Hillman, A. (2010). The effect of board capital and CEO power on strategic change. *Strategic Management Journal, 31*(11), 1145-1163.

Haynes, K. T., and Hillman, A. (2010). The effect of board capital and CEO power on strategic change. *Strategic Management Journal, 31*(11), 1145-1163.

Hill, C. W., and Snell, S. A. (1988). External control, corporate strategy, and firm performance in research-intensive industries. *Strategic management journal, 9*(6), 577-590.

Holström, B., and Tirole, J. (1989). Theory of the Firm, w: *Handbook of Industrial Organization*, red. RL Schmalensee, R. Willig.

Hornuf, L., and Schwienbacher, A. (2018). Market mechanisms and funding dynamics in equity crowdfunding. *Journal of Corporate Finance, 50*, 556-574.

Hoskisson, R. E., Hitt, M. A., Johnson, R. A., and Grossman, W. (2002). Conflicting voices: The effects of institutional ownership heterogeneity and internal governance on corporate innovation strategies. *Academy of Management journal, 45(*4), 697-716.

Hosono, K., Tomiyama, M., and Miyagawa, T. (2004). Corporate governance and research and development: evidence from Japan. *Economics of Innovation and New Technology, 13*(2), 141-164.

Howell, S. T., Niessner, M., and Yermack, D. (2018). *Initial Coin Offerings: Financing Growth with Cryptocurrency Token Sales* (No. w24774). National Bureau of Economic Research.

Howell, S. T., Niessner, M., and Yermack, D. (2018). Initial coin offerings: Financing growth with cryptocurrency token sales. *The Review of Financial Studies.*

Hsieh, Y. Y., Vergne, J. P. J., and Wang, S. (2017). The internal and external governance of blockchain-basedorganizations: Evidence from cryptocurrencies. In *Bitcoin and Beyond (Open Access)* (pp. 48-68). Routledge.

Hsu, C. W., Lien, Y. C., and Chen, H. (2015). RandD internationalization and innovation performance. International Business Review, 24(2), 187-195.

Ingley, C. B., & McCaffrey, K. (2007). Effective governance for start-up companies: regarding the board as a strategic resource. *International Journal of Business Governance and Ethics, 3*(3), 308-329.

Jackling, B., and Johl, S. (2009). Board structure and firm performance: Evidence from India's top companies. *Corporate Governance: An International Review, 17*(4), 492-509.

Jensen, M. C., and Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics, 3*(4), 305-360.

Johnson, L. D., and Pazderka, B. (1993). Firm value and investment in RandD. *Managerial and Decision Economics*, *14*(1), 15-24.

Johnson, W. C., and Yi, S. (2019). Governance in the absence of regulation: a study of initial coin offerings. *Available at SSRN 3337096.*

Kaal, W. A. (2018). Initial coin offerings: the top 25 jurisdictions and their comparative regulatory responses (as of May 2018). *Stan. J. Blockchain L. and Pol'y,* 1, 41.

Kaal, W. A., and Dell'Erba, M. (2017). Blockchain innovation in private investment funds-A comparative analysis of the United States and Europe. *U of St. Thomas (Minnesota) Legal Studies Research Paper,* (17-20).

Kim, J. B., Li, Y., and Zhang, L. (2011). CFOs versus CEOs: Equity incentives and crashes. *Journal of financial economics, 101*(3), 713-730.

Kleinknecht, A., Van Montfort, K., and Brouwer, E. (2002). The non-trivial choice between innovation indicators. *Economics of Innovation and new technology, 11*(2), 109-121.

Khanna, T., and Palepu, K. (2000). Emerging market business groups, foreign intermediaries, and corporate governance. In *Concentrated corporate ownership* (pp. 265-294). University of Chicago Press.

Kostopoulos, K., Papalexandris, A., Papachroni, M., and Ioannou, G. (2011). Absorptive capacity, innovation, and financial performance. *Journal of Business Research, 64(*12), 1335-1343.

Kostovetsky, L., and Benedetti, H. (2018). Digital tulips? Returns to investors in initial coin offerings. *SSRN Electronic Journal*. http://doi. org/10.2139/ssrn, 3182169.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., and Vishny, R. (2000). Investor protection and corporate governance. *Journal of financial economics, 58*(1-2), 3-27.

Lacetera, N. (2001). Corporate governance and the governance of innovation: The case of pharmaceutical industry. *Journal of management and Governance, 5(*1), 29-59.

Latham, S. F., and Braun, M. (2009). Managerial risk, innovation, and organizational decline. *Journal of Management, 35*(2), 258-281.

Lee, P. M. (2005). A comparison of ownership structures and innovations of US and Japanese firms. *Managerial and Decision Economics, 26*(1), 39-50.

Lee, P. M., and O'neill, H. M. (2003). Ownership structures and RandD investments of US and Japanese firms: Agency and stewardship perspectives. *Academy of Management Journal, 46*(2), 212-225.

Lerner, J., and Wulf, J. (2007). Innovation and incentives: Evidence from corporate RandD. *The Review of Economics and Statistics*, 89(4), 634-644.

Lewellen, K. (2006). Financing decisions when managers are risk averse. *Journal of Financial Economics, 82*(3), 551-589.

Lhuillery, S. (2011). The impact of corporate governance practices on RandD efforts: a look at shareholders' rights, cross-listing, and control pyramid. *Industrial and Corporate Change, 20*(5), 1475-1513.

Li, T., Shin, D., and Wang, B. (2019). Cryptocurrency pump-and-dump schemes. *Available at SSRN 3267041*.

Lyandres, E., Palazzo, B., and Rabetti, D. (2019). Do tokens behave like securities? An anatomy of initial coin offerings. *SSRN Electronic Journal*.

Makowski, L., and Ostroy, J. M. (2001). *Perfect Competition and the Creativity of the Market.* Journal of Economic Literature, 39(2), 479-535.

Manso, G. (2011). Motivating innovation. *The Journal of Finance*, *66*(5), 1823-1860.

McConnell, J. J., and Servaes, H. (1990). Additional evidence on equity ownership and corporate value. *Journal of Financial economics*, 27(2), 595-612.

Mendelson, M. (2019). From initial coin offerings to security tokens: A US Federal Securities law analysis. *Stanford Technology Law Review, 22*, 52.

Momtaz, P. P. (2020). Initial coin offerings. *Plos one, 15*(5), e0233018.

Morck, R. K., Stangeland, D. A., and Yeung, B. (1998). *Inherited wealth, corporate control and economic growth: The Canadian disease* (No. w6814). National Bureau of Economic Research.

Morck, R., and Steier, L. (2005). The global history of corporate governance: An introduction. In *A history of corporate governance around the world: Family business groups to professional managers* (pp. 1-64). University of Chicago Press.

Morck, R., and Yeung, B. (2001). *The economic determinants of innovation* (Vol. 25). Industry Canada.

Morck, R., and Yeung, B. (2009). Never waste a good crisis: An historical perspective on comparative corporate governance.

Morck, R., Wolfenzon, D., and Yeung, B. (2005). Corporate governance, economic entrenchment, and growth. *Journal of economic literature, 43*(3), 655-720.

Munari, F., Oriani, R., and Sobrero, M. (2010). The effects of owner identity and external governance systems on RandD investments: A study of Western European firms. *Research Policy, 39*(8), 1093-1104.

North, D. C. (1987). Institutions, transaction costs and economic growth. *Economic inquiry*, 25(3), 419-428.

Osry, M. (2020). Advisory boards. Deloitte. Retrieved September 8, 2020 at https://www2.deloitte.com/ca/en/pages/deloitte-private/articles/advisory-boards.html

Petra, S. T., and Dorata, N. T. (2008). Corporate governance and chief executive officer compensation. *Corporate Governance: The international journal of business in society*.

Pfeffer, J., and Salancik, G. R. (2003). *The external control of organizations: A resource dependence perspective*. Stanford University Press.

Pietrewicz, L. (2018). Emerging trends in entrepreneurial finance: The rise of ICOs. *Studia i Materiały, 27*(1/2), 65-78.

Posner, R. A. (2004). The law and economics of contract interpretation. Tex L. Rev., 83, 1581.

PriceWaterhouseCoopers. January, 2020. *6th ICO/STO Report.* Retrieved from: https://www.pwc.com/ee/et/publications/pub/Strategyand_ICO_STO_Study_Version_Spring_2020.pdf

Rigobon, R., & Rodrik, D. (2005). Rule of law, democracy, openness, and income: Estimating the interrelationships1. *Economics of transition, 13*(3), 533-564.

Romer, P. M. (1986). Increasing returns and long-run growth. Journal of political economy, 94(5), 1002-1037.

Ruigrok, W., Peck, S. I., and Keller, H. (2006). Board characteristics and involvement in strategic decision making: Evidence from Swiss companies. *Journal of management Studies, 43*(5), 1201-1226.

Ruigrok, W., Peck, S. I., and Keller, H. (2006). Board characteristics and involvement in strategic decision making: Evidence from Swiss companies. *Journal of management Studies, 43*(5), 1201-1226.

Sapra, H., Subramanian, A., and Subramanian, K. V. (2014). Corporate governance and innovation: Theory and evidence. *Journal of Financial and Quantitative Analysis, 49*(4), 957-1003.

Scherer, F. M. (1982). Inter-industry technology flows and productivity growth. *The review of economics and statistics*, 627-634.

Schumpeter, J. A. (1939). *Business cycles* (Vol. 1, pp. 161-174). New York: McGraw-Hill.

SEC (U.S. Securities and Exchange Commission). Sept. 18, 2019. *SEC Charges ICO Incubator and Founder for Unregistered Offering and Unregistered Broker Activity*. Retrieved from: https://www.sec.gov/news/press-release/2019-181

SEC. (2017.). Statement on Crypotcurrencies. https://www.sec.gov/news/public-statement/statement-clayton-2017-12-11

Shapiro, D., Tang, Y., Wang, M., and Zhang, W. (2015). The effects of corporate governance and ownership on the innovation performance of Chinese SMEs. *Journal of Chinese Economic and Business Studies, 13*(4), 311-335.

Shleifer, A., and Vishny, R. W. (1997). A survey of corporate governance. *The journal of finance*, 52(2), 737-783.

Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations.*

Strömsten, T., & Waluszewski, A. (2012). Governance and resource interaction in networks. The role of venture capital in a biotech start-up. *Journal of Business Research, 65*(2), 232-244.

Su, W., and Lee, C. Y. (2013). Effects of corporate governance on risk taking in Taiwanese family firms during institutional reform. *Asia Pacific Journal of Management, 30*(3), 809-828.

Su, Y., Xu, D., and Phan, P. H. (2008). Principal–principal conflict in the governance of the Chinese public corporation. *Management and organization review, 4*(1), 17-38.

Tang, J., and Zhao, W. W. (2016). A visual-rich bibliometric analysis of entrepreneurship research in strategy venue (1991-2015). In *Academy of Management Proceedings* (Vol. 2016, No. 1, p. 17134). Briarcliff Manor, NY 10510: Academy of Management.

Tomizawa, A., Zhao, L., Bassellier, G., and Ahlstrom, D. (2020). Economic growth, innovation, institutions, and the Great Enrichment. *Asia Pacific Journal of Management, 37*(1), 7-31.

Tribo, J. A., Berrone, P., and Surroca, J. (2007). Do the type and number of blockholders influence RandD investments? New evidence from Spain. *Corporate Governance: An International Review*, 15(5), 828-842.

Turk, T. A. (1992). Takeover resistance, information leakage, and target firm value. *Journal of Management, 18*(3), 503-522.

Tylecote, A., and Visintin, F. (2007). A new taxonomy of national systems of corporate governance. *Capitalisms Compared* (Comparative Social Research, Volume 24) Emerald Group Publishing Limited. P. 71-122.

Tylecote, A., and Visintin, F. (2007). Corporate governance, finance and the technological advantage of nations. Routledge.

Vafeas, N. (1999). Board meeting frequency and firm performance. *Journal of financial economics, 5*3(1), 113-142.

Van den Berg, H. A. (2007). Measurement models in the intellectual capital theory. In *Strategies for information technology and intellectual capital: Challenges and opportunities* (pp. 49-65). Igi Global.

Van den Berg, H. A. (2013). Three shapes of organisational knowledge. *Journal of Knowledge Management.*

Vismara, S., Benaroio, D., and Carne, F. (2017). Gender in entrepreneurial finance: Matching investors and entrepreneurs in equity crowdfunding. In *Gender and entrepreneurial activity*. Edward Elgar Publishing.

Wagemans, A., and Witschge, T. (2019). Examining innovation as process: Action research in journalism studies. *Convergence, 25*(2), 209-224.

Wang, S., Ouyang, L., Yuan, Y., Ni, X., Han, X., and Wang, F. Y. (2019). Blockchain-enabled smart contracts: architecture, applications, and future trends. *IEEE Transactions on Systems, Man, and Cybernetics: Systems, 49*(11), 2266-2277.

Weerawardena, J., and Mavondo, F. T. (2011). Capabilities, innovation and competitive advantage. *Industrial Marketing Management*, *40*(8), 1220-1223.

Wells, J. D., Valacich, J. S., and Hess, T. J. (2011). What signal are you sending? How website quality influences perceptions of product quality and purchase intentions. *MIS quarterly*, 373-396.

Williamson, O. E. (1979). Transaction-cost economics: the governance of contractual relations. *The journal of Law and Economics, 22*(2), 233-261.

Wincent, J., Anokhin, S., and Örtqvist, D. (2010). Does network board capital matter? A study of innovative performance in strategic SME networks. *Journal of Business Research, 63*(3), 265-275.

Xiao, S., and Zhao, S. (2012). Financial development, government ownership of banks and firm innovation. *Journal of International Money and Finance, 31*(4), 880-906.

Yermack, D. (1996). Higher market valuation of companies with a small board of directors. *Journal of financial economics, 40*(2), 185-211.

Yoo, T., and Sung, T. (2015). How outside directors facilitate corporate RandD investment? Evidence from large Korean firms. *Journal of Business Research, 68*(6), 1251-1260.

Young, M. N., Peng, M. W., Ahlstrom, D., Bruton, G. D., and Jiang, Y. (2008). Corporate governance in emerging economies: A review of the principal–principal perspective. *Journal of management studies, 45*(1), 196-220.

Yuan, Y., and Wang, F. Y. (2016, November). Towards blockchain-based intelligent transportation systems. In *2016 IEEE 19th International Conference on Intelligent Transportation Systems* (ITSC) (pp. 2663-2668). IEEE.

Zetzsche, D. A., Buckley, R. P., Barberis, J. N., and Arner, D. W. (2017). Regulating a revolution: From regulatory sandboxes to smart regulation. *Fordham J. Corp. and Fin. L., 23*, 31.

Zhao, M. (2006). Conducting R&D in countries with weak intellectual property rights protection. Management science, 52(8), 1185-1199.

Zhou, K. Z., Gao, G. Y., and Zhao, H. (2017). State ownership and firm innovation in China: An integrated view of institutional and efficiency logics. *Administrative Science Quarterly, 62*(2), 375-404.

Zona, F., Zattoni, A., and Minichilli, A. (2013). A contingency model of boards of directors and firm innovation: The moderating role of firm size. *British Journal of Management, 24*(3), 299-315.

Zwiebel, J. (1995). Corporate conservatism and relative compensation. *Journal of Political economy, 103*(1), 1-25.