

**LAPPEENRANTA UNIVERSITY OF TECHNOLOGY**

**School of Business and Management**

**Master's Degree Programme in Strategy, Innovation and Sustainability (MSIS)**

Abdullai, Abdul-Rauf Larry

**DANCE WITH SOME AND DINE WITH OTHERS: ECOSYSTEM STRATEGY,  
MULTIPLE ECOSYSTEMS AND LEADERSHIP ROLES**

1<sup>st</sup> Supervisor: Professor Paavo Ritala, LUT

2<sup>nd</sup> Supervisors: Pontus Huotori (D.Sc), LUT

## ABSTRACT

**Author's name:** Abdul-Rauf Larry Abdullai  
**Title of thesis:** **Dance with Some and Dine with Others: Ecosystem Strategy, Multiple Ecosystems and Leadership Roles**  
**School:** LUT School of Business and Management  
**Master's Program:** Strategy, Innovation and Sustainability  
**Year:** 2018  
**Master's Thesis:** Lappeenranta University of Technology 150 pages (without ref list), Figures, 19 Tables 22

**Examiners:** Professor Paavo Ritala  
Pontus Huotori (D.Sc)  
**Keywords:** Ecosystems, strategies, leadership roles, orchestration, complexity.

This is an exploratory research aimed at furthering the understanding on the activities central players in business undertake to manage the complexities associated with their ecosystems. Admittedly, there exist extensive works on ecosystem leadership and strategies, nonetheless, quite a handful focus on how focal firms manage the relational and technological ecosystem complexities. Hence, the complexity attributes of ecosystems necessitated the interest to investigate the phenomenon which is considered timely and novel.

The research employed qualitative approach based on multiple case study on six S&P 500 companies. The overarching aim of the study was to identify, *what roles do focal firms in business play and what strategies do they employ in their specific roles to manage the complexities surrounding their ecosystems*. For better understanding of this phenomenon, the theoretical approach combined theories on ecosystems with the view of treating ecosystems as a complex adaptive systems (CAS). For the empirical process, seven thematic themes were developed to understanding the roles and strategies of focal firms and other peripheral actors in the ecosystem. In addition, evaluation matrix was crafted to highlight the robustness, productivity, niche creation, ecosystem size as well as the relational and technological complexities of the case firms' ecosystems. Finally, a comparison techniques was utilized to identify differences and similarities of the focal firms' ecosystem orchestration which revealed a relationship between ecosystem orchestration and ecosystem complexity.

The results highlighted several strategies employed by the focal firms indicating that ecosystem strategies are not discrete. Furthermore, the results showed that focal firms typically employed multiple roles in managing their involvement in multiple ecosystems. Complementors were also featured in this complex web of interdependency and interconnectedness. Overall, the results indicate that the more complex (both relational and technological) an ecosystem is, the more difficult it is to orchestrate and so focal firms aside leading the ecosystem, also adopt other roles such as complementing and participating in different ecosystems. The reverse is also true.

## **ACKNOWLEDGEMENTS**

This genesis of this thesis initially was as a result of my interest in researching about topics related to open innovation and multi-actor collaborations. However, I had the opportunity to work during summer to assist my supervisor in gathering data for his project. Upon completion of the summer job and with further deliberations and consultations, I was offered the opportunity to work with this rich data in furthering the understanding of the ecosystem concept. Thus, I extend my sincere gratitude to my supervisors Professor Paavo Ritala and Pontus Huotori (D.Sc) for the motivation, mentorship, immense knowledge and continuous support throughout my master thesis. Their relentless guidance and contributions helped me in learning so much which shaped the outcome of this thesis.

I would like to express my utmost gratitude to the Almighty God, my parents, wife and other family members for the unconditional support, motivation and sacrifices, without which I would not have been in Finland in pursuit of high education. The list of people I owe appreciation cannot be complete without mentioning Mohammadamin Esmaili, Agnes Asemokha, Shola Oyedeji, Abubakar Adekori, and the Banire family for their unwavering support.

Finally, I am grateful to LUT, all MSIS professors and non-teaching staffs of the university, colleagues and all my friends who supported me throughout my studies in diverse ways. I say a big thank you to all of you.

## **LIST OF ABBREVIATIONS**

AT&T	American Telecom and Telegraph Corporation
BE	Business Ecosystem
BRM	Better Risk Mitigation
CAS	Complex Adaptive System
CC	Commercial Capital
CEO	Chief Executive Officer
DBE	Digital Business Ecosystems
GE	General Electric
IFM	Improved Forecasting Method
IO	Industrial Organization
IE	Innovation Ecosystem
IOP	Input Oriented Perspective
IoT	Internet of things
ITC	Information Technology and Communication
OOP	Output Oriented Perspective
PLC	Product-Level Complementarity
RBV	Resource Based View
R&D	Research and Development
SC	Social Capital
SMEs	Small and Medium-sized Enterprise
STD	Smart Tradeoff Decisions
STEM	Science, Technology, Engineering and Mathematics
TC	Technological Capital
UMich	University of Michigan

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>5</b>
1.1	RESEARCH BACKGROUND.....	5
1.2	RESEARCH OBJECTIVE AND RESEARCH GAP.....	6
1.3	RESEARCH QUESTIONS .....	8
1.4	THEORETICAL APPROACH.....	9
1.5	DEFINITIONS AND DELIMITATIONS .....	10
1.6	STRUCTURE OF THE STUDY .....	12
<b>2</b>	<b>CONCEPTUAL BACKGROUND.....</b>	<b>14</b>
2.1	THE ECOSYSTEM ANALOGY.....	16
2.2	ECOSYSTEMS AS COMPLEX ADAPTIVE SYSTEMS .....	25
2.3	ECOSYSTEM STRATEGY .....	28
2.4	MANAGING THE ECOSYSTEM COMPLEXITY .....	34
<b>3</b>	<b>ECOSYSTEM STRUCTURE AND VALUE CREATION .....</b>	<b>39</b>
3.1	LEADERSHIP ROLES.....	39
3.2	COMPLEMENTARY AND PERIPHERAL ROLES .....	40
3.2.1	<i>How complementors participate in ecosystems</i> .....	43
3.3	ASSESSING THE ECOSYSTEM'S HEALTH.....	43
<b>4</b>	<b>RESEARCH METHODOLOGY.....</b>	<b>45</b>
4.1	RESEARCH DESIGN .....	46
4.2	RESEARCH APPROACH AND STRATEGY.....	49
4.3	CASE SAMPLE SELECTION.....	50
4.4	DATA COLLECTION AND ORGANIZATION METHOD.....	50
4.5	DATA ANALYSIS AND PROCESSING.....	51
4.6	VALIDITY AND RELIABILITY .....	53
<b>5</b>	<b>RESULTS AND ANALYSIS .....</b>	<b>55</b>
5.1	CASE COMPANIES' DESCRIPTION AND ECOSYSTEM STRUCTURE .....	57
5.2	COMPANY DESCRIPTION.....	60
5.3	ECOSYSTEM STRATEGIES AND LEADERSHIP ROLES .....	70

5.4	CENTRAL PLAYERS' ROLE IN ECOSYSTEM ORCHESTRATION.....	109
5.5	THE ROLE OF COMPLEMENTORS IN ECOSYSTEM HEALTH.....	111
5.6	CROSS-CASE ANALYSIS .....	113
5.6.1	<i>Evaluating the ecosystems of the case firms.....</i>	<i>114</i>
5.6.2	<i>Characteristics of the various ecosystem archetypes .....</i>	<i>115</i>
<b>6</b>	<b>Discussions .....</b>	<b>123</b>
6.1	STRATEGIES AS SUCCESS FACTORS FOR ECOSYSTEMS .....	123
<b>7</b>	<b>Conclusion.....</b>	<b>125</b>
7.1	THEORETICAL IMPLICATION.....	125
7.2	MANAGERIAL IMPLICATION.....	131
7.3	LIMITATION AND FUTURE RESEARCH .....	134
	<b>REFERENCES .....</b>	<b>136</b>

## LIST OF TABLES

Table 1. Summary of ecosystem analogies discussed above and their micro and macro implications (adapted from Pilinkienė & Mačiulis, 2014) .....	22
Table 2. Research design adopted.....	47
Table 3. Relevant situation for a research strategy (Yin, 2009) .....	49
Table 4. Sample of the database (for Amazon) developed from seven thematic themes ....	53
Table 5. Coded concepts .....	56
Table 6. Case companies' business operations outlook.....	57
Table 7. Evaluation metrics for ecosystem assessment .....	59
Table 8. Summarized Amazon ecosystem archetypes and leadership roles .....	60
Table 9. Summarized GE ecosystem archetypes and leadership roles .....	62
Table 10. Summarized data of AT&T's ecosystem archetypes.....	64
Table 11. Summarized data of Verizon's ecosystem archetypes.....	66
Table 12. Summarized data of Oracle's ecosystem archetypes.....	67
Table 13. Summarized data of Microsoft's ecosystem archetypes.....	69
Table 14. Summary of Amazon's leadership role in its top four ecosystem archetypes .....	74
Table 15. Summary of GE's leadership role in its top four ecosystem archetypes .....	78
Table 16. Summary of AT&T's leadership role in its top four ecosystem archetypes.....	82
Table 17. Summary of Verizon's leadership role in its top four ecosystem archetypes.....	86
Table 18. Summary of Oracle's leadership role in its top four ecosystem archetypes.....	91
Table 19. Summary of Microsoft's leadership role in its top four ecosystem archetypes...	96
Table 20. Glimpses of the six case firms' leadership activities.....	98
Table 21. Top six complementors in multiple engagement models with different keystones .....	113
Table 22. Evaluation of the case firms' ecosystems .....	114
Table 23. Features and patterns of the case companies' ecosystem .....	120

## **LIST OF FIGURES**

Figure 1. Overview of the research questions.....	9
Figure 2. Ecosystem Theoretical framework.....	10
Figure 3. Structure of the study .....	13
Figure 4. Collaboration in the manufacturing ecosystem (Fayoumi, 2016).....	15
Figure 5. Traditional business operations (Adapted from Moore, 1996).....	17
Figure 6. Cycle of ecosystem-based paradigm development (adapted from Moore 1996).....	18
Figure 7. Features of ecosystem (Adapted from Peltoniemi 2006).....	19
Figure 8. Five components of ecosystem complexity.....	25
Figure 9. Ecosystem strategies (Johnson, 2004).....	33
Figure 10. Abridged research method (Adapted from: Saunders et al., 2009).....	46
Figure 11. A model used to build data for the case analysis .....	52
Figure 12. Amazon’s top four ecosystem archetypes and leadership roles .....	61
Figure 13. GE’s top four ecosystem archetypes and leadership roles .....	63
Figure 14. AT&T’s top four ecosystem archetypes and leadership roles.....	65
Figure 15. Verizon’s top four ecosystem archetypes and leadership roles.....	67
Figure 16. Oracle’s top four ecosystem archetypes and leadership roles.....	68
Figure 17. Microsoft’s top four ecosystem archetypes and leadership roles.....	70
Figure 18. Case firms' multiple ecosystems and engagement models.....	110
Figure 19. Relationship between the level of orchestration and ecosystem complexities.....	121
Figure 20. Ecosystem strategies and leadership roles.....	122

# 1 INTRODUCTION

## 1.1 Research Background

The ‘ecosystem’ concept which was borrowed from ecology to mimic how living organisms interact with abiotic factors (Tansley, 1935), has witnessed a growing interest in among practitioners and scholars (Adner, 2017; Jacobides et al., 2018). Moore first introduced the ecosystem metaphor to the business arena (see Moore, 1996 p.26) and has since become prevalent in the discussions of business strategies with different flavours and definitions (see. Moore, 1993 p.3, 1996; Iansiti & Levien, 2004; Adner & Kapoor, 2010; Ritala et al., 2013; Autio & Thomas, 2014; Gawer & Cusumano, 2014; Jacobides, et al., 2015, 2018). I find Adner’s ecosystem definition most appropriate for this study because it aligns with the phenomenon under investigation. He defines ecosystem as: “the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize” (Adner, 2017).

Prior to this, organizations pride themselves with own internal capabilities (Iansiti & Levien, 2004) and innovations mainly directed towards either the protection of single iconic expertise, or the production of a product (e.g. mobile phone, computer, television set, manufacturing of a car etc.). However, the idea of ecosystems has increasingly heightened awareness and the need for new business models to create and capture value (Adner & Kapoor, 2010; Adner 2017).

Globalization, technology, stiff competition, inter-firm dependency, increased connectivity and the internet of things among other mega trends has made problems more complex along with rapid change of consumer taste and preferences and increasing demand for integrated and complex solution (Williamson and Meyer, 2012; Aarikka-Stenroos & Ritala, 2017). These and a host of other changing mega trends have spurred the emergence of the ecosystem concept in many disciplines from strategy, technology, innovation management to manufacturing, financial services and business-to-business marketing research (Kelly, 2015; Aarikka-Stenroos & Ritala, 2017). It is therefore no longer enough for a single company to have the solution to these complex and interconnected demands. Many business organizations strive to be technology leaders in the industry in which they operate by adopting first to market strategy to capture the value from their innovation. The

success and dominance of multi-national companies such as Oracle, Amazon, Microsoft, General Electrics, Verizon Communications and At&T has often been linked to any a number of reasons such as the passion, vision and strategies employed by the founders of these companies (Iansiti & Levien, 2004). However, the performance of these companies emanates from factors greater than just visions and strategies of these giants to include external factors in the focal firm's environment (Adner & Kapoor, 2010; Iansiti & Levien, 2004). Peripheral actors such as distributors, customers, suppliers, venture capitalists, outsourcing companies, independent service vendors, value added resellers, institutions and myriads of other complementors in the focal firm's external environment, influence and are influenced by the offerings of the focal firm (Iansiti & Levien, 2004).

Although the ecosystem concept is emerging (Pilinkienė & Mačiulis, 2014), attempts by scholars to have a thorough insight into the ecosystem complexity is lacking despite its importance. Hence, the overarching aim of this study is to highlight the actions central players undertake to manage their roles and performance in their ecosystems. Attempts have been made by researchers to explore relationship intimacy in an ecosystem in molding firms' strategies and trade-offs (van Angeren et al, 2011) as well as highlight the activities hub firms undertake to influence and attract peripheral firms to support their ecosystem (Gawer & Cusumano, 2002). Thus, the focus of these studies is mainly on the strategic linkages within the ecosystem (Adner & Kapoor, 2010). This research gap has heightened the need and interest to investigate the ecosystem orchestration of six multinational high technology firms with unique ecosystems. The researcher moves a step further beyond existing literature by looking at the set of activities or actions ecosystem leaders undertake and their leadership roles in managing the complexities in their ecosystems. The study will contribute to existing academic literature as well as provide insight for management and industry.

## **1.2 Research Objective and Research Gap**

The ecosystem concept has gain momentum and attracted researchers' interest in the past few decades. Researchers have contributed on this emerging concept in different perspectives. Many works have suggested different ecosystem flavours such as business

ecosystem (Iansiti & Levien, 2004; Moore, 1993), innovation ecosystem (Adner, 2006; Wessner, 2007; Yawson, 2009), digital business ecosystem (Nachira, 2002), industrial ecosystem (Frosch & Gallopoulos, 1989; Korhonen 2001), start-up an entrepreneurial ecosystems (Isenberg, 2010, Berger & Kuckertz, 2016; Acs et al., 2017). Organizations in the 21<sup>st</sup> century require the ability to deliver complex solutions to customers. However, it is difficult for a firm to possess all the resources to solve the complex and interconnected demands of customers (Lusch et al., 2010), hence, they externally pool specialized expertise and knowledge to ‘co-create’ with the help of information technology and communication (ITC) (Williamson and Meyer, 2012).

Co-creation refers to the process whereby two or more firms integrate their resources to create value which will otherwise be impossible to achieve. Players within an ecosystem come together to share their knowledge, technology, and other resources to create and share value among the actors (Frow et al., 2016). Nonetheless, the actions of central players in this co-creation process as well as their roles in ecosystem orchestration has not been thoroughly explored by previous researchers. Orchestration refers to the purposeful actions or set of activities undertaken by an orchestrator (an actor such as a central player) to initiate, influence, manage and coordinate interactions among ecosystems members (Nambisan & Sawhney, 2011; Davidson et al., 2015). Such orchestration activities include ensuring ecosystem stability, building and managing inter-firm innovation networks, knowledge mobility, coordination of interactions, mobilization, strategic partner selection, ecosystem design as well as motivation and fostering collaborations (see, e.g., Dhanaraj & Parkhe, 2006; Ritala, Armila & Blomqvist, 2009; Nambisan & Sawhney, 2011; Roijakkers et al., 2013; Dawson et al., 2014; Hurmelinna-Laukkanen et al., 2014; Accenture strategy, 2018). Thus, “orchestration” and “mutuality” appears to be the defining attributes of ecosystems. Mutuality emphasizes the participation of ecosystem members out of mutual benefit (Davidson et al., 2015). Thus, highlighting the set of strategies and orchestration activities central players employ in managing ecosystem complexities will contribute to further understanding this emerging concept.

Businesses are drifting away from traditional industrial silos (Aarikka-Stenroos & Ritala, 2017) and coalescing around ecosystems of few technology powerhouses (Iansiti &

Lakhani, 2017), creating myriads of opportunities and sometimes posing new challenges especially to incumbent firms (Kelly, 2015). It is not surprising that we see “hub firms” such as Amazon, General Electric, AT&T, Verizon Communications, Oracle and Microsoft occupy central positions. These central players create value in their ecosystem, but at the same time capture disproportionately the value being created. Thus, the very technologies that promised to even up or coordinate the business environment now seemed threatening to making some firms enjoy monopoly (Iansiti & Lakhani, 2017). In spite of this threat, the success of companies in this complex web rests on how integrated and interconnected they are with other firms (Kanter, 2011). As a result, the theory will also address ecosystem complexity.

### **1.3 Research Questions**

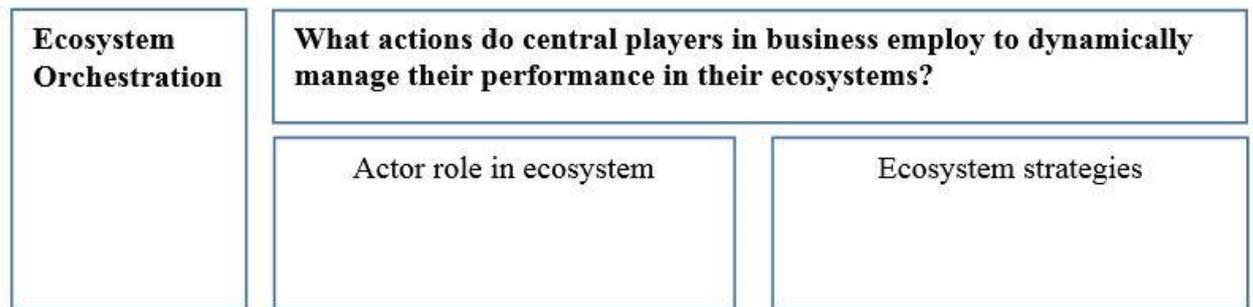
The argument held by economists over the years has been that the sole existence of business is to make money for shareholders (Kanter, 2011). However, not only can a firm’s value be measured through short-term profits but also how it orchestrates and sustain those conditions that makes it excel over time. Thus establishing an enduring ecosystem. The notion that a central player in business can succeed in orchestrating the ecosystem of large group of actors appears daunting and impossible a task, especially when the goal of orchestrating such a large ecosystem is to strengthen the central player’s own competitive advantage (Kanter, 2011; Williamson & Meyer, 2012). However, companies such as Amazon, American Telecommunication and Telegraph (AT&T), General Electric (GE), Microsoft, Oracle, Verizon communication and a host of other multinational companies have successfully built a formidable ecosystem around their businesses, which serves as a catalyst to their growth and value. This study therefore hopes to provide insight on how central players in business employ strategies to manage the complexities in their ecosystems. To achieve this the following two questions are investigated:

i. What role do focal firms play in their ecosystems?

ii. What ecosystem strategies do these focal firms employ by adopting specific roles?

The first question aims to understand the roles focal firms in business play in their ecosystem. To do this, the strategic goals, incentives or drivers, which influence ecosystem orchestration of the case firms, are examined. To answer the second question, the researcher carefully examines the actions, activities and strategies adopted by these focal

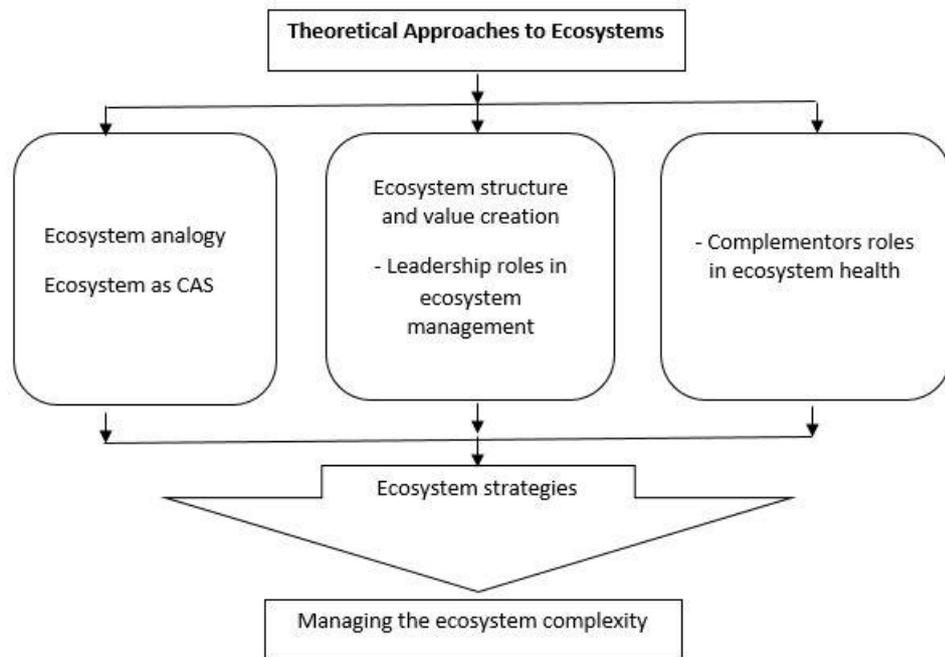
firm in managing the complexities of their ecosystem. Thus, a critical evaluation of the outcome of these two questions provides interpretations and understanding on the strategies central players in business employ in managing their ecosystems and why. Consequently, the researcher builds hypothesis based on the theoretical findings and empirical evidence.



**Figure 1. Overview of the research questions**

## **1.4 Theoretical Approach**

This study will explore existing literature on ecosystems in general and strategically zero in to ecosystem management. Complexity theory is also addressed in this section because of its overarching importance in ecosystem orchestration. Due to the complex nature of an ecosystem, communication quality and trust become the bedrock in today’s social and business relationships and hence, the study partially discuss these concepts as well. That said, the focus of the literature is on ecosystem strategies with the aim of deepening the understanding on the actions central players in business undertake to manage ecosystem complexity. Admittedly, there has been extensive research on this emerging concept. Nonetheless, existing research lacks an in-depth understanding on ecosystem complexity and the strategies employed to manage it, hence, this research aims to highlight the strategies and roles that focal firms play in managing the complexities in their ecosystems. Furthermore, the literature will also focus on the role of complementors in ecosystems to highlight the relevance of other players in the ecosystem as well as providing the basis for measuring the strength and health of an ecosystem. In this chapter, the various theories reviewed serves as a foundation to the study and also enables the reader appreciate the results and conclusions following the empirical analysis. Presented below is the theoretical framework showing various theories and concepts explored in this study.



**Figure 2. Ecosystem Theoretical framework**

## 1.5 Definitions and Delimitations

The limited research on the actions of central players in managing their ecosystems complexity triggered the choice of the theories reviewed in this study. Unlike business networks, ecosystems are characterized by wider “connectivity, interdependence, and co-evolution of actors, technologies and institutions” (Aarikka-Stenroos & Ritala, 2017), thus making it a multifaceted concept and a complex system. Together, the theories reviewed further deepen understanding on the actions focal firms in business undertake to manage the complexity in their ecosystems.

The six case companies in this study namely Amazon, GE, AT&T, Verizon Communications, Oracle, and Microsoft can broadly be categorized under the high-technology (high-tech) industry. The high-tech sector contributes essentially in world economy. According to Wolf and Terrell (2016), a study funded by the Workforce Information Council, the high-tech industry employed about 17 million workers in 2014 representing nearly 12 percent of total employment. They define high-tech as industries with high number of workers in “Science, Technology, Engineering, and Mathematics (STEM)” occupations.

However, the type of data as well as the case selection criteria did not permit the researcher to select all six companies with similar products and services. In addition, the categorization of the high-tech sector is very broad and also the fact that there was no other data available for me to carry out with this study. Nevertheless, the diverse nature of the selected case companies does not invalidate the results, because the overarching goal of the researcher is to deepen understanding and have an overall perspective on the actions these aforementioned case companies take to manage their ecosystem complexity by adopting specific roles irrespective of their industry or category within the high-tech industry. More so, the literature review has been tailored to be relevant to the empirical section of this study. Below are definitions of major concepts and terminologies used in this study:

**Ecosystem:** The term ‘ecosystem’ was borrowed from ecology in 1935, to mimic how living organisms interact with abiotic factors such water, air and other minerals occupying a given habitat (Tansley, 1935). According to Pilinkienė & Mačiulis (2014), “biologically, every living organism is defined by its genes, relationships to its prey and predators”. Similarly, innovative businesses do not operate in isolation and must pull different resources be it partnership, financial and human capital, suppliers and even customers (Moore 1993). Ecosystem is defined as “the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize” (Adner, 2017). Just as the ecological ecosystem has no boundaries, a firm’s ecosystem influences and is influenced by both its immediate and external surroundings. The efficient functioning of an ecosystem depends on the health of each partner that contributes to creating value in the ecosystem (Iansiti & Levien 2004). Thus, the entire ecosystem suffers if a member of the ecosystem is weak irrespective of the strength of other members since they all depend on each other to function effectively. Although Oh et al., (2016) argues that ecological ecosystems differ from innovation ecosystems in its scope of operation with the former being local and the latter, global. However, according to Ritala and Almpantopoulou’s (2017) review, Willis (1997, p. 269) argue that, the scope of ecological ecosystem “may range from anthill to the entire biosphere of the globe”. Similarly, argues that, “there is no global market for goods and service, rather there are now a set of globally connected local businesses” Bersin (2013). Thus, ecosystems might have global platforms but localized operations.

**Inter-firm collaborations:** For businesses to be successful, they must rapidly and effectively evolve. However, they cannot do so in a vacuum but must necessarily attract a host of resources, attracting partners, suppliers, capital as well as customers to create collaborative networks (Moore 1993). According to P.-L. Chen et al (2016) inter-firm collaboration refers to the “contractual arrangement between the recipient and the donor firms that explicitly specifies their exchange, sharing or co-development of knowledge that is embedded in tangible goods, such as products and technologies, or intangible goods, such as brands, business practices, and services”. Thus, in ecosystems, firms share ideas and resources which is beneficial to the members of that ecosystem (Moore 1993). For instance, the Apple and Microsoft ecosystems are made up of host of suppliers, developers, system integrators, independent software vendors and partners.

**Complexity:** The term complexity refers to the behaviour of a model or system whose various parts interact among its multiple components such that it follows local rules without any compulsion (Mitleton-Kelly, 2003). Like ecology, the ecosystem concept encompasses many different actors which by way of self-organising, emergence, co-evolution and adaption, makes the concept of complexity relevant in this study. Thus, the complexity theory comprises various theories emanating from several fields of natural sciences such as chemistry, physics, biology mathematics and evolution. The ecosystem complexity is partly necessitated by the interconnectedness and interdependency as a result of open innovation (Chesbrough, 2003) which underscores the need for open resources and integration with partners, suppliers, complementors and customers (Teece 2007), making an ecosystem a complex web of actors. The central theme in ecosystem complexity is the interdependency nature of the members in an ecosystem. Thus, due to the complexity of an ecosystem, it is not prudent to study the parts of the ecosystem without first understanding the whole (Peltoniemi & Vuori 2004). The interdependence and mutually interacting characteristics of ecosystems such as that of Amazon, Microsoft, Oracle, GE, Verizon Communications and AT&T makes it relevant to discuss the concept of complexity in this study to appreciate how central players in business manage their ecosystem.

## **1.6 Structure of the Study**

This research is structured such that it begins with introduction which covers research gap, background to the study and a prelude to the research problem. Next is the theoretical

section where existing literature relevant to the research questions are reviewed to give a solid foundation to the empirical aspect of the study. Empirical part follows where methodology, empirical analysis of the data as well as interpretation of results is reported. Finally, the results are discussed and conclusions arrived at, highlighting their implications to the existing theory and to management. In addition, the limitations to the research are clearly stated and future research areas suggested. Figure 3 below depicts a simplified structure of the study adopted.

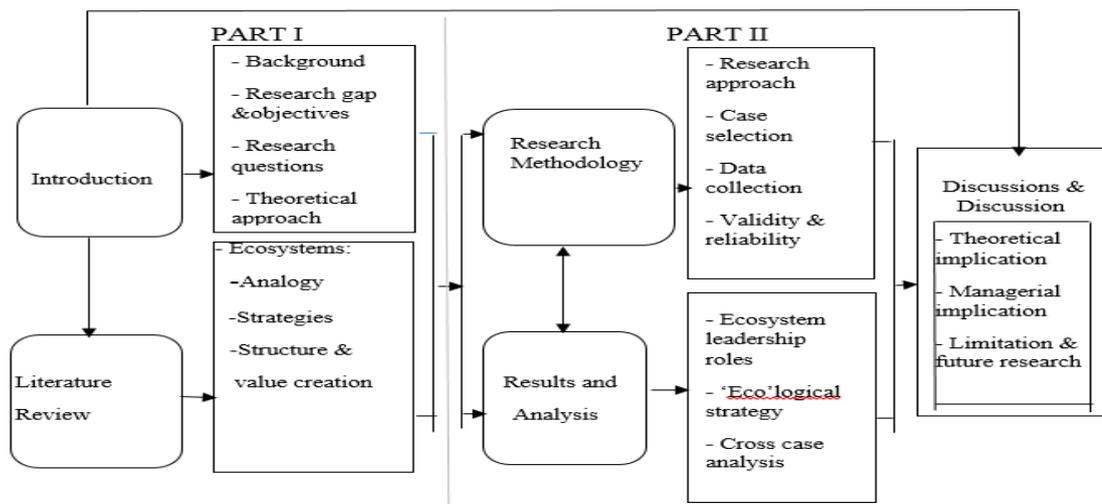


Figure 3. Structure of the study

## 2 CONCEPTUAL BACKGROUND

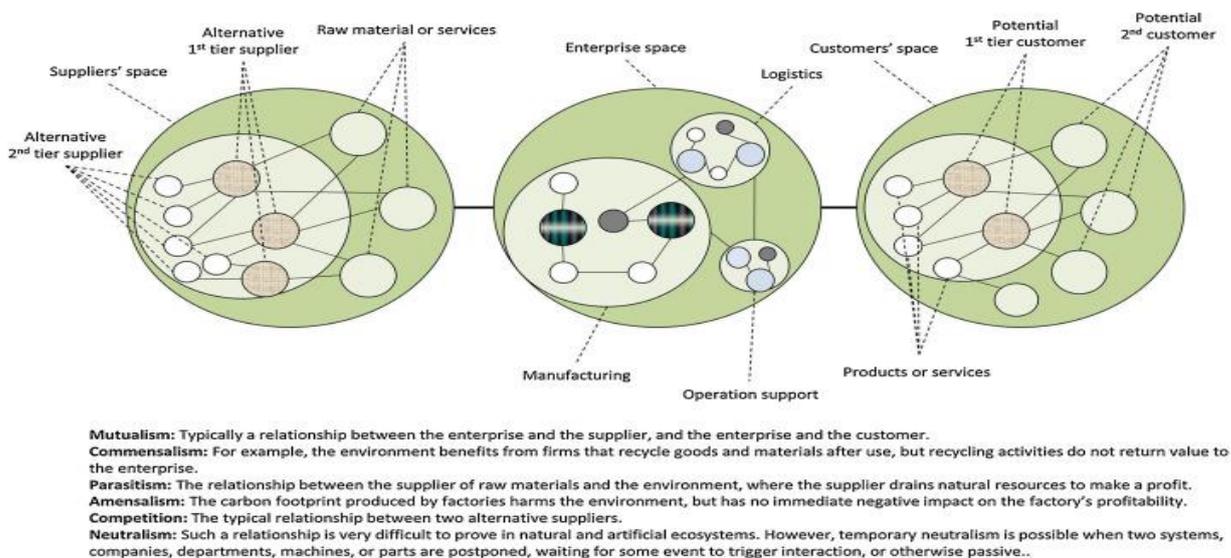
For the past decade, organizations have transitioned from individual and central planning towards a more open and market-oriented economic system. The idea of open innovation which suggests the “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough, 2003, 2011), also contributed to this shift. The concept of open innovation has enabled emerging firms to collaborate with established firms to acquire and share knowledge and technologies. For many businesses, open innovation makes innovation more profitable because time to launch new product or technology and the cost involved is reduced. In addition, it creates new streams of generating more revenue.

In this twenty first century, it is not possible for a firm to possess all the best of talents and resources; they must necessarily tap into host of other resources from other firms through collaborations. Drawing on existing literature, Chen et al (2016) discussed that, “inter-firm “collaboration is a contractual arrangement between the recipient and the donor firms that explicitly specifies their exchange, sharing or co-development of knowledge that is embedded in tangible goods, such as products and technologies, or intangible goods, such as brands, business practices, and services”. In essence, inter-firm collaboration involves but not limited to the transfer or exchange of strategic resources among the parties involve (Luo, 2002). Thus, it is essential for less endowed firms to collaborate with other firms to exchange resources and complement each other’s assets (Jorde & Teece, 1990).

Research have demonstrated that there are numerous benefits associated with inter-firm collaboration. Hence, firms collaborate for various personal as well as collective reasons. Often times, organizations engage in inter-firm collaboration due to but not limited to the following reasons: efficient decision making, speed to market, economies of scale, quick response to changes, knowledge transfer and sharing, cost and risk sharing etc. (Barratt, 2004; Camarinha-Matos et al., 2009; MacCarthy & Jayarathne, 2012). Furthermore, information sharing and knowledge transfer among firms equips members with a common knowledge. Consequently, this leads to better planning, efficient decision-making, and ultimately prudent risk management (Cannella, Ciancimino, and Framinan 2011). It should be noted, however, that although there are benefits that comes with inter-firm collaborations, there are equally potential risk and challenges (see Williamson & De

Meyer, 2012) which often affect small and medium enterprises (SME's) (Jorde & Teece, 1990).

Given the above understanding, it is not enough for innovative companies to solely rely on their technological breakthroughs. Following Teece (1990), a system of complementary components (developers, value added resellers, distributors, independent vendors, etc.) is necessary for integration to bring those breakthrough innovations to the customers (see Figure 4). Therefore, it is rare if not impossible for a company to solely develop robust technological innovations in isolation irrespective of the company's capabilities, size or access to strategic resources (Cantwell, 1989). In essence, many of the innovations are as a result of multilateral collaborations (Jorde & Teece, 1990).



**Figure 4. Collaboration in the manufacturing ecosystem (Fayoumi, 2016)**

The above Figure highlights the inter-firm collaboration and networked manufacturing. The manufacturing industry is one of the complex ecosystems due to its composition of different interdependent players (suppliers, support services, raw materials, distributors, and systems). The complexity is further compounded by the rapid changes and uncertainties (Fayoumi, 2016). Suppliers of complementary assets are important and contributes in bringing out successful innovations in ecosystems.

As mentioned earlier, researchers have written extensively on inter-firm collaborations, however, many of those are centered on the advantages, risks, as well as knowledge

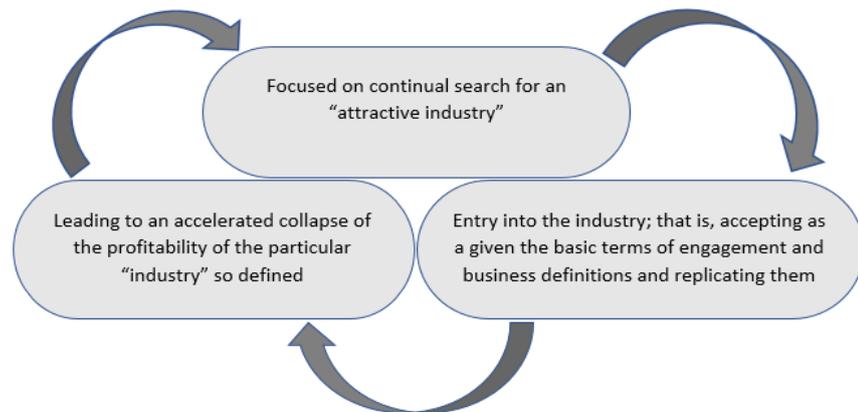
creation and information (Stank *et al.*, 1999; Barratt & Oliveira, 2001). Following the investigations by Lehoux et al (2013) on why and how companies collaborate and which strategies to adopt, they argue that, creating win–win inter-firm collaborations requires carefully building the relationship, efficiently coordinating operations, and diligently evaluating outcomes (Lehoux et al, 2013).

## **2.1 The Ecosystem Analogy**

Fast forwarding from the preceding concept, it is essential to appreciate that, in recent times, inter-firm collaboration goes beyond establishing relationship or sharing resources (Barratt, 2004), instead, using multiple collaborations as a spring board to create and capture value which is made possible through open innovation (Najda-Janoszka, 2018). Thus, a firm belonging to one industry may collaborate with multiple partners from different industries in order to create and capture value (Moore, 1993). Mega trends such as globalization, digitization, demographic change, technological convergence as well as scarcity of natural resources are paving new opportunities for firms who understand the rules of the game. These mega trends are further complicated by uncertainties, stiff competition and rapid shift in taste and preferences of customers. In this volatile world of uncertainty (Williamson & Meyer, 2012), the companies that succeed are those that establish or are part of a strong ecosystem. Thus, successful organizations are those that quickly and tactically evolve. They must pool a host of resources: partners, capital, suppliers, independent vendors, value added resellers, customers, and distributors to form cooperative networks (Moore, 1993).

Once upon a time, giant companies like Nokia in the mobile industry eventually lost leadership and profitability within the same business they were in comfortable leadership. Similarly, IBM which was once a leader in the personal computers, suffered similar catastrophe. Again, another pioneer in the web services in the 1990's, yahoo, commanded leadership until in the 2000's when it started to decline and finally lost control and competitiveness. Unfortunately, most managers in the past have channeled their strategies towards looking for opportunities in the white ocean and within the same old parameters of their industry. Consequently, this path simply contributes to the “overall rate of industry commoditization” and the eventual disappointment, weakening and sometimes collapse or

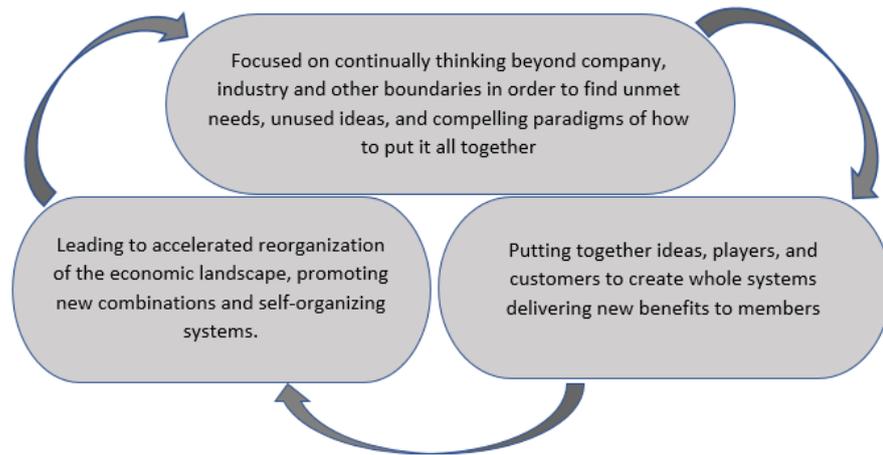
death of the organization (Moore, 1996, p.47) as Figure 5 below illustrates.



**Figure 5. Traditional business operations (Adapted from Moore, 1996)**

On the other hand, the likes of Apple, Microsoft, Amazon, Uber, Netflix and GE are able to succeed in this turbulent business environment. Thus, as digitalization and automation transform the economy, incumbent firms are losing battles to start-ups and upstarts (Yoffie & Kwak, 2002) such as Airbnb who have been in existence for only few decades. The question that keeps lingering in the minds of most top executives are; Is there a stable strategy or structure that will make firms hold on to leadership in this volatile business environment? What is it that the likes of Apple, Amazon, Uber, Microsoft, Airbnb and Netflix are doing right?

Unlike the traditional business as usual, the new cycle focuses on building whole ecosystems with the strength of innovation. Thus, the type of ecosystems orchestrated to attract more partners and absorb more and rich ideas into their circles. Thus, the primary aim of ecosystem members is to be at the centre of a rich proximity to innovative contributions, to employ abundant human creativities available to solve the world's prominent and complex problems, and to provide the foundation and environment for large-scale cooperation. Thereby, establishing new economic ties and network in a form of "community organizing" (Moore, 1996 p.49), as illustrated in Figure 6.



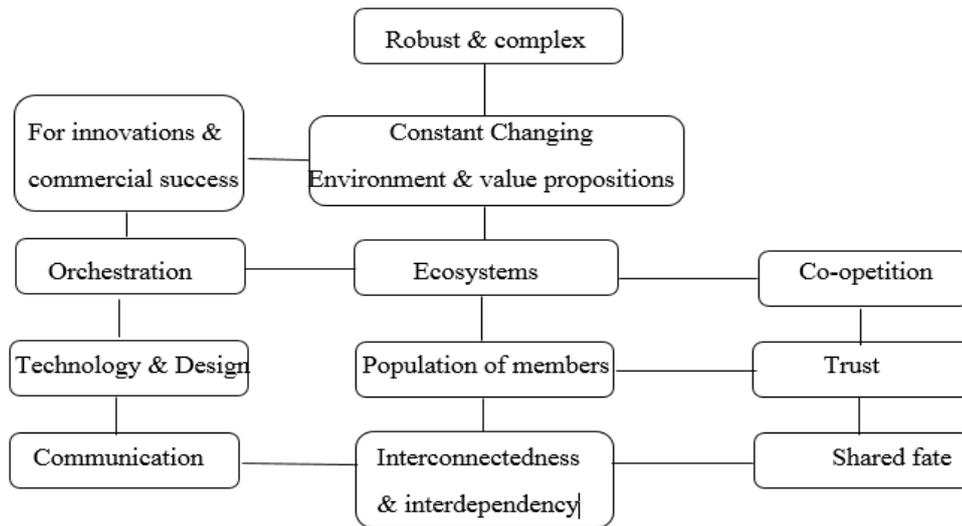
**Figure 6. Cycle of ecosystem-based paradigm development (adapted from Moore 1996)**

Ecosystem is an analogy from biology, and thus has been borrowed into business studies. More so, the ‘ecosystems’ analogy has been applied in a host of contexts outside its original biological application and thus provides an interesting metaphor which describes multiple interactions and connections among many firms (Autio & Thomas, 2014).

In essence, the health and success of an ecosystem requires the collaborative efforts from the interconnected members - suppliers, customers, value added resellers, competitors, distributors and other stakeholders - that belong to this community. This collaborative effort provides firms the opportunity to create value that will otherwise be impossible for a single firm to create alone (Adner 2006). Thus, the interdependency suggests that other members of the ecosystem influence the ability of a firm to create and capture value (Iansiti & Levien, 2004; Teece, 2007). Put differently, ecosystem success largely rests on members simultaneously competing and cooperating – “co-opetition” (Moore, 1993). Co-opetition concept which has attained prominence in research and among practitioners (Dagnino & Padula, 2002; Luo, 2004; Walley, 2007), is a strategy which incorporates both competition and cooperation simultaneously among organizations (Brandenburger & Nalebuff, 1996; Bengtsson & Kock, 1999, 2000), to enable competing firms create and use new technological knowledge in pursuit of innovations (Ritala et al., 2009). Co-opetition also enables the parties involved to develop management approaches to address the challenges that arises from environmental and technological turbulence (Gnyawali & Park, 2011). Firms in the high-tech industry often adopt this strategy due to the technological complexities as well as the high cost involved in research and development (R&D) (Garud,

1994; Gnyawali & Park, 2011).

Synthesizing the various ecosystems definitions in academic literature, Figure 7 below illustrates the features and characteristics of an ecosystem.



**Figure 7. Features of ecosystem (Adapted from Peltoniemi 2006)**

Given this background to ecosystems, it is essential to explore the ecosystems typologies to aid in understanding the strategies and roles adopted by central players to manage their involvement in these ecosystem archetypes. Just as ecological ecosystem has different species interacting and interdependent on each other, similarly, the business ecosystem is embedded with interdependent firm activities. However, the business ecosystems keep on changing with respect to the value propositions that the members in the ecosystem provide, co-creation practices as well as the resource availability to the members of the ecosystem (Frow et al 2016). As a borrowed analogy, **biological ecosystem** is that which consist of different organisms living in the same habitat (Peltoniemi, 2005). The University of Michigan (UMich, 2017) defines biological ecosystem as “an ecosystem which consists of the biological community that occurs in some locale, and the physical and chemical factors that make up its non-living or abiotic environment”.

From biological ecosystem, Moore (1993) coined the concept of “**Business Ecosystem**” (BE) where “companies coevolve capabilities around a new innovation: they work cooperatively and competitively to support new products, satisfy customer needs, and

eventually incorporate the next round of innovations” He suggests an organization be regarded as belonging to a business ecosystem which operates beyond the confines of an industry to function across a host of industries. Iansiti & Levien (2002, 2004) further extended the idea of business ecosystem to identify which components constitutes a business ecosystem and what strategies improves ecosystem health, stability and its effective functioning.

In this twenty first century, an organization which lacks innovative ideas will soon be kicked out of the market. Hence every business in this era have research and development team dedicated in bringing new ideas or modifying existing ones. Unfortunately, when these organizations decide to innovate, their focus is primarily on the innovation itself (product or service), as well as the packaging and branding (Adner & Euchner, 2014). Indeed, it is important to think about the actual innovation (product or service), however, great companies think differently when it comes to innovation. Great companies think about how to build “enduring institutions” (Kanter 2011). Thus, harnessing all the factors and actors that contribute to the realization of the value of the innovation) is essential. This conglomerate set of actors represent the **innovation ecosystem** (IE) (Adner & Euchner, 2014). Following Adner (2006), Innovation ecosystems is “the collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution.” Thus, successful innovation requires carrying out several activities in innovation networks (Pikkarainen et al, 2017). Advancement in information technology has made communication and coordination more cost effective thereby placing innovation ecosystems as a critical choice for most firms in their growth strategies. Thus, innovation ecosystem is characterised by capturing the complex synergies (Wessner, 2007) through leadership and strategy, governance, resources (knowlesge, technologies, finance and people), and the collective efforts of the members of the ecosystem (Durst & Poutanen, 2013). As Moore (1993) argued, businesses in the twenty first century cannot operate in a vacuum and must necessarily attract a host of resources. Thus, businesses co-specialize their capabilities and strengths around new innovations (Ritala et al., 2009).

Another ecosystem typology is “**Digital business ecosystem**” (DBE) which came to fore in 2002 by prefixing Moore’s “business ecosystem” with “digital” (Nachira, 2002; Stanley & Briscoe, 2010). The concept refers to the interactive collaborations of SMEs”

(Isherwood & Coetzee, 2011) to provide “an open source distributed environment, where software components, services, applications and also business models are regarded as ‘digital species’ that can interact with each other, reproduce and evolve according to laws of market selection” (Wang & Wilde, 2008). Collaboration digitally is thus essential in the development of SMEs since often these firms are geographically dispersed and might not be physically known to other participating companies. As Nachira et al, (2007) argued, the objective of ecosystem initiative is to make local economic actors more relevant and enable them to create and share value as well as interact on the global stage. In such situation, trust and reputation are the key elements warranting the acceptability or rejection of collaborating with members of the ecosystem (Isherwood & Coetzee, 2011).

From the above discussion on the various ecosystem analogies, table 1 below depicts a summary of the ecosystem typologies and their micro and macro ramification.

**Table 1. Summary of ecosystem analogies discussed above and their micro and macro implications (adapted from Pilinkienė & Mačiulis, 2014)**

Ecosystem analogies	Biological ecosystem	Innovation ecosystem	Business Ecosystem	Digital business ecosystem
Authors	Peltoniemi (2005); UMich, 2017	Adner, 2006; Wessner, 2007; Durst & Poutanen, 2013; Adner and Euchner, 2014	Moore, 1993,1996; Iansiti & Levien 2002, 2004.	Nachira, 2002; Nachira et al, 2007; Stanley & Briscoe, 2010; Isherwood & Coetzee, 2011
Environment	Local; Ecological community	From local to global; Interorganizational, political, economic and technological environment.	From local to global; Interconnected business environment.	From local to global; Digital environment.

Actors	Living and non-living organisms	Entrepreneur; Large and small enterprises; Educational institutions; Research institutes and laboratories; Venture capital firms; Financial markets; Government institutions	Large and small enterprises; Suppliers; Customers; Competitors; Owners; Investors; Government institutions; Other organizations	Research and education organizations; Innovation centers; Small and large enterprises with their associations; Local government and public administration.
Micro level impact	Preservation of the natural environment	Value and innovation creation; The level of firms' productivity; Influence on innovation performance.	Effect on business processes; Create cooperative networks.	Provides the digital support for the economic development of enterprises; Effect on business processes;

Macro level impact	Sustainable development; Effect on nature and the preservation of live	Enhance competitiveness; Effect on innovation index;	The level of productivity; Enhance competitiveness;	Enhance competitiveness;
Key determinants affecting ecosystem performance	Environmental conditions	Resources, governance, strategy and leadership, organizational culture, technology; Interaction between ecosystem actors.	Robustness, productivity, and niche creation; Interaction between ecosystem actors.	Services and technological solutions, business and knowledge; Interaction between ecosystem actors.

## 2.2 Ecosystems as complex adaptive systems

The theories on complexity emanates from different fields of studies from chemistry to physics and from computer simulation to biology and mathematics (Mitleton-Kelly, 2003). When ecosystems are discussed in academic literature and in practitioner journals, one distinct feature that runs through is the interdependency nature of the members in an ecosystem. This interdependency is as a result of coevolution necessitated by change. As defined by Merry (1999), coevolution is the interdependency which occurs “when the change in fitness of one system changes the fitness of another system”. This concept is explained in details as the thesis progresses.

The business ecosystem concept has a direct link to complexity science since the business ecosystem constitutes various organizations, and these organizations are made up of people all coming together to form a complex evolving system (CES) often referred to as complex adaptive system (CAS). A complex adaptive systems (CAS) refers to an interconnected and evolving agents (organizations) within a system (Mitleton-Kelly, 2007). Following Mitleton-Kelly (2003), she identified ten characteristics of complexity in relation to human systems (in this case ecosystems). For the relevance and appropriateness of this research, five of those principles Figure 8 will be discussed.

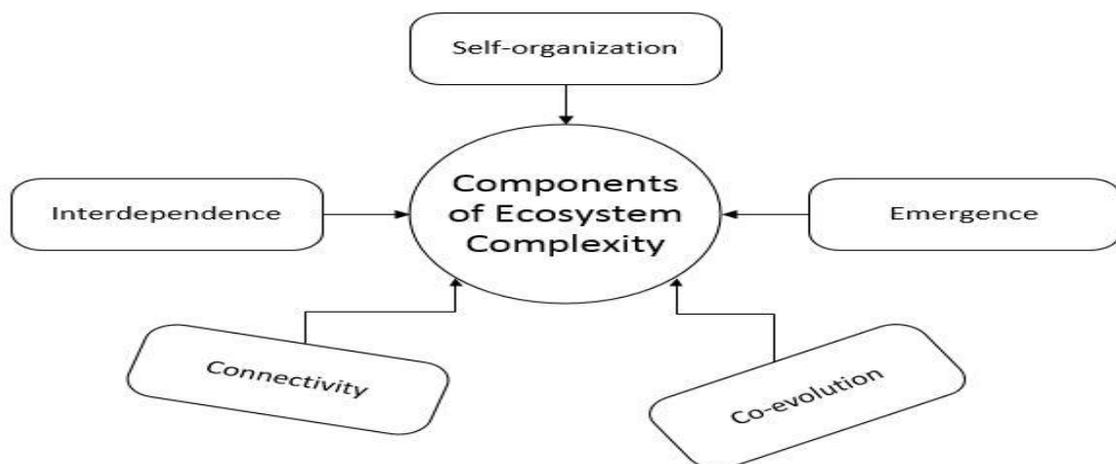


Figure 8. Five components of ecosystem complexity

## **Connectivity and Interdependence**

An ecosystem is regarded as CAS because of the connectivity, interdependency and inter-relationship among members within the ecosystem in which they interact and operate. These characteristics makes the actions and inactions of a member of such system influence the decisions of related members in that circle (Mitleton-Kelly, 2003). Thus, ecosystem members share their fate (Iansiti & Levien, 2004) where changes in one part of the ecosystem have a ripple effect throughout the entire ecosystem (Lewin, 1999). For instance, the roll out of a member firm's strategy to improve its relevance in the ecosystem may have serious ramifications on the vulnerability of other dependent members or on the health of the entire ecosystem. Put differently, failure of a firm (especially keystone) may have catastrophic consequence on other firms (Peltoniemi, 2006). Iansiti & Levien (2004) eloquently argue that, for a member of an ecosystem to carelessly implement a strategy without considering the overall consequences on other members in the ecosystem means it is ignoring the reality of connectivity and interdependency of ecosystems.

## **Co-evolution**

According to Rausher (2001), coevolution is the foundation of the Earth's wealth of biological diversity. Rausher explains coevolution as the interactions between two species causing reciprocal evolutionary adaptations where a change in one specie triggers a change in the other. The second specie develops a mechanism to counter-adapt the change, which then causes a reciprocal change in the first specie. Thus, coevolution refers to the evolutionary (mutual or competitive) changes, which occurs between species (or firms) because of their interactions with each other (Valen, 1973; Merry, 1999).

In relation to business ecosystems, the implementation of a company's strategies to strengthen its position or fitness has an immense impact on the possibilities of other companies in the ecosystem (Peltoniemi & Vuori, 2004), compelling them to make changes also. The idea of co-evolution stresses on the interactional and reciprocal evolutions (Futuyama 1979). Fitness in business settings suggests a firm's ability to gain competitive advantage (Peltoniemi 2006). For instance, a classic case of co-evolution is Microsoft's ecosystem, which consists of three broad

interconnected segments: hardware, software and service (Microsoft annual report, 2017). All three components play crucial role in the Microsoft ecosystem. A typical example is the launch of its Xbox, which gave rise to hardware developers, manufactures, the microprocessors, and independent software developers, develop software to match the Xbox. Soon demand and the use of the Xbox makes the software heavier for the microprocessors causing hardware developers to evolve and develop microprocessors that are more efficient. This co-evolution of actors in the Microsoft ecosystem has seen the original XBOX move from Xbox 360, Xbox 360 Pro, Xbox 360 Elite and now Xbox 360 S. This is coevolution process and technological transition is referred to as “emergence challenge in the new technology generation” (Adner & Kapoor, 2016).

### **Self-organisation and Emergence**

Self-organization refers to the situation whereby “pattern and regularity emerge without the intervention of a central controller” (Anderson, 1999). Thus, self-organization is an unregulated and uncontrolled process. Emergence on the other hand means, “the links between individual agent, actions and the long-term systemic outcome are unpredictable” (Smith and Stacey, 1997). In other words, patterns and properties emerge due to the interactions among members of an ecosystem, which make it difficult to predict.

The relevance of this concept to business ecosystems is that, self-organization means members of ecosystems having the liberty to organize freely to suit their needs and capabilities. Thus, the coming together of various firms, organizations, institutions without any formal structure or dictates (Peltoniemi & Vuori, 2004), to set new standards for the industry, share risk, create and transfer knowledge, overcome competition, enhance competitive advantage, creating new streams of revenue, entering new market, engaging in R&D or gaining economies of scale. Since members of ecosystems interact through knowledge creation and formation of innovative ideas, organisational learning takes place and this learning process becomes part of emergence property. Thus, emergent properties could be observed through the outcome or results of self-organization.

In summary, the above components of complexity are inter-related and does have direct implication on ecosystems. Self-organization of members, co-evolution of the ecosystem as it receives new members or members leave the ecosystem as well as the emergence of new ideas

and knowledge increases connectivity among the ecosystem members and the interdependency becomes tighter. In short, the logic behind ecosystems complexity implies that, managers and chief executive officers (CEO) employ appropriate -both technical and socio-cultural- strategies to orchestrate and manage the complexities associated with their ecosystems.

### **2.3 Ecosystem Strategy**

The strategies applied in individual companies might not work effectively if applied to an ecosystem. Most often, a firm's success in an ecosystem rest on other interdependent actors in the external environment (Iansiti & Levien, 2004). These actors could be the upstream suppliers, downstream customers as well as peripherals or complementary firms. We are in an era where competition is very stiff, and firms strive to create more value than its competitor by being the first to innovate in order to gain competitive advantage and capture value (Porter 1985; Brandenburger & Stuart, 1996; Adner & Kapoor, 2010). Due to the interdependency of firms in an ecosystem, a given innovation is often composed of many different components from other ecosystem members. Adner (2014) discuss that, members of the ecosystem are the partners such system integrators, independent resellers, value added resellers and other complementors who one depends on for success. Following Adner (2006), such situation “embeds the focal firm within an ecosystem of interdependent innovations”.

Ecosystem strategies refer to “the way in which a focal firm approaches the alignment of partners and secures its role in a competitive ecosystem” (Adner, 2017). To successfully create and capture value in ecosystem, the focal firm often plays crucial role by way of strategies. To be a focal firm does not depend on the size although there are traditional advantages that arises from bargaining power and size (Adner, 2017), instead, the ability to use smart power in influencing and shaping the ecosystem around you (Yoffie & Kwak, 2006). Ecosystem members enter into multilateral relationships and combine their individual strengths, integrate their resources and align their investments to create additional value and/or gain ecosystem advantage (Moore, 1993; Williamson & De Meyer, 2012). Often, the thought that central players in business are able to thrive by way of orchestrating the synergies of various ecosystem members who might be individually unknown to it, may appear to be a tall order especially when the overarching aim of the orchestration is to further empower the central player. However, “by taking a strategic

approach that actively promotes and guides the development of its business ecosystem, the focal firm enhances its own competitive advantage and ability to capture value” (Williamson & De Meyer, 2012).

Industrial organization (IO) theories postulates that, for a firm to prosper and survive, it must adapt to influences in its business environment. Put differently, the strategies a firm adopts to tap into complementary resources around the industry or environment in which it operates, in part, defines how successful it will be (Williamson & De Meyer, 2012). Following Porter (1981), a firm’s opportunity for profitability is enhanced by the industries with formidable structures. In an ecosystem setting, these structures and strategies are orchestrated by the focal firms. It is therefore essential for central players to invest in knowing in order to adopt appropriate strategies their ecosystems and formulate strategies to support it. Iansiti & Levien (2004) discussed that, for several decades now, Wal-Mart and Microsoft’s strategies serves as one of the ecosystem strategies that has stood the test of time. Like Wal-Mart, Microsoft created a platform which enables a vast number of companies to leverage and thereby boosting productivity, fostering innovations and advancing stability. Thus, both Microsoft and Wal-Mart focused on creating platforms and designing programs and technologies that allow other firms to leverage in creating and or adding value to customers. Thus, both Wal-Mart and Microsoft employed keystone strategies in diverse business ecosystems (Iansiti & Levien, 2004).

Another ecosystem strategy is to have the ability and capacity to combine and manage multiple partner relationships as this directly accounts for the outstanding performance of focal firms in ecosystem. Williamson & De Meyer (2012) argue that, the ability of a firm to “stimulate the development of a large and diverse ecosystem will ensure that it enjoys access to a greater pool of knowledge”. Central players often strive to influence the actions of their business partners and understand that their success largely depends on their ability to sustain overall health of their ecosystems (Iansiti & Levien, 2004). In this complex and ever-changing business environment, establishing a successful ecosystem goes beyond the mere willingness to embrace open innovation, instead, to include strategies to influence and motivate members of the ecosystem to learn from each other and align their investments (Williamson & De Meyer, 2012).

Panetta (2017) argues that, ecosystems enable firms to survive and respond to an ever-changing

digital world, given that central players consider the following eight dimensions when making strategic decisions regarding their participation in ecosystems.

### **Dimension 1: Ecosystem Strategy**

Given Adner's (2017) definition of ecosystem, deciding the role to play - keystone, dominator, niche player, or complementor - is a critical step in knowing what strategy to adopt.

### **Dimension 2: Degree of Openness**

The degree of openness within ecosystems is influenced by factors such as goals and directions, strategies and shared interest. Openness to the ecosystem determines the nature of co-opetition and how it is managed.

### **Dimension 3: Engagement of Diverse Participants**

As mentioned earlier that the defining characteristics of ecosystems is the interdependence of diverse players, recognizing the wide diversities and the roles each member plays, will define how firms develop their strategies and revise them accordingly.

### **Dimension 4: Types of Relationships/Collaborations**

Firms enter into partnerships with different intentions, aspirations and expectations. For example, Kone forged collaborations with other firms whose services and technologies are complementary to Kone's philosophy and ideals and overall supports Kone's go-to-market strategies (Panetta, 2017). Understanding the roles partnerships play in ecosystems has the potential of turning economic connections into competitive advantages. Thus, focal firms must establish trust and balance it with control when "creating a diversified engagement strategy".

### **Dimension 5: Form of Value Exchange**

The author explained that, aside monetary-based value exchange; ecosystems can effectively leverage information, service, brand, reputation, and other soft assets. In ecosystems, products and services are sometimes exchanged for useful information and other soft assets. To roll out a strategy, there is the need to understand what "value" could mean in ecosystems.

### **Dimension 6: Diversity of Industries**

When ecosystems expand, it often comes with it unexpected partnerships. Focal firms could find themselves collaborating with firms outside their primary industry. Thus, a strategy will have to consider all these wider spectra of partnerships.

### **Dimension 7: Complexity of Multiple Ecosystems**

Large and successful firms do not operate in a single ecosystem; they are most likely involved in multiple ecosystems. This in itself is a strategy to align an ecosystem with other ecosystems to make it strong. The wider and the more complex an ecosystem, the more likely value is created. Understanding how these multiple ecosystems interact and the potential overlaps and ramifications is key to adopt a strategy.

### **Dimension 8: Technologies**

As complex as ecosystems can be, central players should keep in mind that they are responsible for the technology that will enable the business ecosystem strategy now and in the future. Successful ecosystems leaders are those that leverage and strategically integrate information communication technology with business processes and manage the technological complexities.

In addition to the afore-mentioned strategies, Iansiti & Levien (2004) also identified three strategic modes that fits the world of business ecosystems: *keystone strategy*, *dominator strategy* and *niche strategy*.

### **Keystone strategies**

Keystone strategies are the strategies that seek to regulate and design the ecosystem, chiefly by creating platforms which serves as the source of ecosystem operations and innovations. Thus, a keystone strategies focus on the enhancement of the general health of the ecosystem and does that by both creating value and sharing the value created among ecosystem members which enhances ecosystem robustness. Through the creation of value, these strategies enhance the overall ecosystems' productivity by reducing the relational and technological complexities and facilitating innovations (Iansiti & Levien, 2004).

### **Dominator strategies**

Conversely, dominator strategies appear to rather make the ecosystem suffer. Thus, firms adopting dominator strategies more or less feed on the members of the ecosystem leaving them with little or no nutrients to survive on (Iansiti & Levien, 2004).

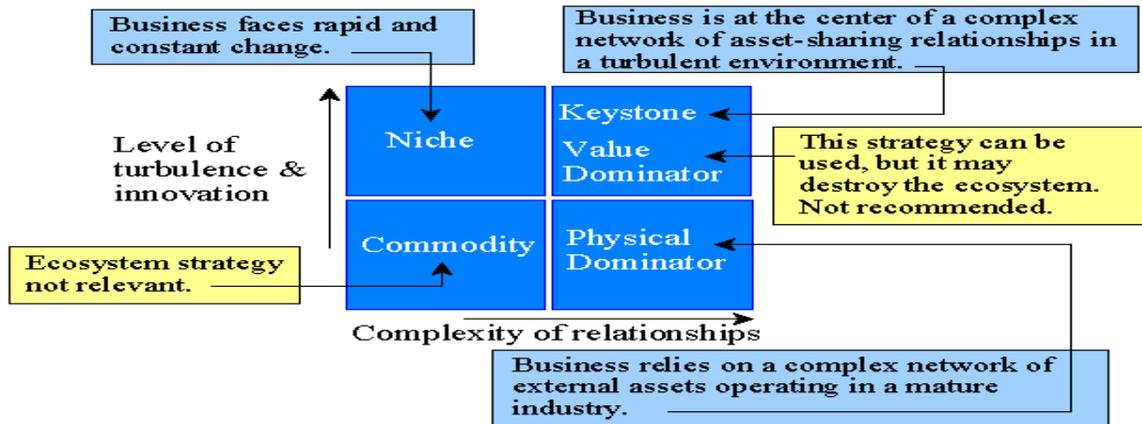
### **Niche strategy**

The majority of the members of the ecosystem often adopt the “niche strategy” where they stress on differentiation and focus on unique specializations and leveraging on other member’s key assets (Iansiti & Levien, 2004). As discussed by earlier researchers, unique specialties of individual firms contribute to innovations success in co-opetition endeavours (Cassiman & Veugelers, 1998; Hamel, 1991; Bengtsson & Kock, 2000; Oxley & Sampson, 2004).

Based on Iansiti & Levien’s (2004) ecosystem strategies, Johnson (2004) matches those strategies to ecosystem environment. Thus, which strategies best fit when the ecosystem is characterised with relationship complexity as well as instability. He argues that, if a firm belongs to an ecosystem where there is high degree of instability but with low or simple direct relationships, the best strategy to adopt is the niche strategy. This is because; adopting a niche strategy in a turbulent environment will ensure that, the firm always has a specialized value proposition to offer. Less complex relationships also suggest that niche strategy will lead to building trust and loyalty with the few partners (Johnson, 2004).

On the other hand, if an ecosystem is characterised with high degree of turbulence and relationship complexity, the best strategy to adopt is the keystone or value dominator strategy. However, adopting a keystone or dominator strategy will be effective if the firm possesses asset that is sort after by many partners (Johnson, 2004). Figure 9 below matches the ecosystem strategies to the ecosystem characteristics of turbulence and relationship complexity

## Strategies Matched to the Business Environment\*



\* Based on Iansiti & Levien's illustration and discussion, p. 74.

Figure 9. Ecosystem strategies (Johnson, 2004)

Furthermore, Williamson and De Meyer (2012), have also enumerated six strategies to unlocking and reaping the benefits of belonging to an ecosystem: i) pinpointing the added value, ii) structuring differentiated partner roles, iii) stimulating complementary partner investments, iv) reducing transaction costs, v) enabling flexibility and co-learning, and vi) engineering value-capture mechanisms.

Gawer & Cusumano (2007) also discussed that, there are four levers of platform on which firms can drive industry innovation and orchestrate or influence competition. They argue that, the sustainability of the ecosystem leadership position lies in these Four Levers: *firm scope*, *technology design and intellectual property*, *external relationships with complementors* and *lastly internal organization*.

**Firm scope:** This first level identifies the choice of activities to be performed by the focal firm in-house against those to be left out in the hands of outsiders. Thus, the need for central player to assess its strengths and expertise to determine which of its complements must be developed in-house.

**Technology design and intellectual property:** This second lever deals with the functionalities or performance to include in the ecosystem, whether the ecosystem should be a closed one (e.g. Apple ecosystem) or open to complementors and to what degree (e.g. Microsoft ecosystem)

**External relationships with complementors:** The third strategy through which the focal firm can drive industry innovation is its relationship with complementors. Thus, how the focal firm manages and support complementors to contribute value to the ecosystem.

**Internal organization:** Finally, the success of the focal firm's leadership role hinges on how and to what extent it uses its internal strategies to orchestrate and build trust among other members of the ecosystem which builds confidence and loyalty to the focal firm.

In line with this, Davidson et al. (2015) also suggest that, ecosystem members can unleash new opportunities by adopting the following strategies:

- (i) Identify and exploit possible value creation avenues and equip members of the ecosystem in creating value for the entire ecosystem.
- (ii) Be dynamic and tactical in adopting different roles and engagement models in their ecosystems.
- (iii) Recognize the importance of complementors and leverage the synergies from their engagement for value creation.
- (iv) Demonstrate their capabilities as central players throughout the ecosystem and ensure compatibility and integration of systems and resources.
- (v) Finally, for central players to continue to be relevant in their ecosystems, they must attract more partners and embrace new connectivity and engagement models.

## **2.4 Managing the ecosystem complexity**

Given the complexity and turbulence associated with ecosystems, its managing becomes fundamentally different from the traditional dyadic business relationships (Moore, 1996 p.52; Sargut & McGrath, 2011). The most profound difference is dealing with coevolving host of diverse and interdependent multiple relationships (Moore, 1996 p.52) especially in high-tech industry. However, at the same time, it serves as valuable resources to the participating firms (Håkansson, 1987) due to the immense benefits (both direct and indirect) such as knowledge sharing, access to technology, access to markets, branding, competencies, network and goodwill

(Håkansson & Snehota, 1995; Walter, et al., 2001). Since an ecosystem consists of complex interdependence relationships, it is therefore imperative to manage these relationships and the overall ecosystems effectively (Ritter, Wilkinson, & Johnston, 2004). Thus, the ability of a central player to manage its relationships successfully with other members of the ecosystem as well as the overall ecosystem complexity can be a competitive advantage (Dodgson, 1993; Day, 2000; Sivadas & Dwyer, 2000). Researchers have differed whether ecosystems can be managed or not. On the one hand, a school of thought argue that, central players (i.e. “hub firms”, “focal firms”, “orchestrators”, or “keystones”) are aware of their business environment and hence are in-charge of their resources and in control of their surrounding (Jarillo, 1988). On the other hand, there are those who hold that, central players do not possess the power to control their resources because of high degree of relational and technological complexities (Wilkinson & Young, 1994; Ford, 1997; Stacy, 1997; Håkansson & Ford, 2001).

The distinction between these schools of thoughts however has to do with the difference between deliberate and emergent ecosystems (Möller & Svahn, 2003) and are both relevant because ecosystems poses different relationship and network management challenges (Ritter et al., 2004). Iansiti and Levien (2004) also argues that, a firm’s industry of operation also affects ecosystem management. However, given the challenges and the business environment, the skills and competencies of the all the ecosystem members is essential in managing the relationships for the interest of the ecosystem as well as for themselves (Wilkinson & Young, 1994; T. Ritter et al., 2004).

Following the ongoing discussions, Sargut & McGrath (2011) identified two fundamental challenges that managing ecosystem complexity poses to business executives or focal firms: “unintended consequences” and “difficulty making sense of a situation”. The authors explained that, in a complex system (in this case ecosystems), unintended consequences do occur such that the smallest strategy implemented, or decision taken can have surprising effects. They enumerated three situations (not in any specific order) in which unintended consequence could occur:

The first is an interaction of series of events without any prior intensions or meanings. Example

cited was the simplification of Nintendo's innovative game console to keep price down, attract novice gamers and expand its market only to turn out that loyal customer rather interpreted the new console to be inferior. Although Nintendo succeeded in getting new gamers on board, with time Microsoft capitalised on the situation and released its Xbox series which became a hit pulling all the hard-core customers of Nintendo (Sargut & McGrath (2011)).

The second situation is what the authors refer to as "an aggregate of individual elements". They cited the 2008 credit crunch, which crippled the entire financial ecosystem as an example. The situation cannot be traced to any one particular occurrence. Rather myriads of distinct but interconnected events. Indeed, what seems obvious to analysts now regarding the recession was never projected before its occurrence (Sargut & McGrath (2011)).

A third situation, which often catches focal firms off-guard is taking an entrenched position in their traditional cultures and strategies and fail to evolve and adapt to changing situations. This occurs where "policies and procedures remain in place long after the reason for their creation becomes obsolete" (Sargut & McGrath (2011)). A painful example here is Nokia grossly sticking to their traditional technologies and strategies and failing to foresee and implement new technology of the touch screen although it has been on their board discussion long before Apple lunched their first touch screen phone.

According to Ritter et al., (2004), managing the multilateral relationships in ecosystems includes "initiating and responding, acting and reacting, leading and following, influencing and being influenced, planning and coping, strategizing and improvising, forcing and adapting". Thus, ecosystem management is not about controlling other firms, instead, managing and influencing the interactions and relationships with others. Managing is a two-way affair (Ritter et al., 2004) and hence "the extent to which a company will allow others to influence its nominally internal activities and will seek to involve itself within others is an important issue of managerial decision-making and control" (Ford & Saren, 1996, p. 48).

Ecosystem management can be enhanced through effective communication and interaction. A point well emphasized by Luoma-aho & Halonen (2010) is that, the importance of

communication is not only relevant in individual projects and organizations, instead, to ecosystems in general. Ecosystem members are sometimes geographically dispersed and the only way to share ideas and keep all stakeholders on the same page is through interactions and effective communication. Put differently, communication is the interface or linkage between the organization and the rest of the world (Cheney and Christensen, 2001; Cornelissen et al., 2006). Thus, communication is the bridge (Grunig, 2006) which connects hosts of actors present in ecosystems (Luoma-aho & Halonen, 2010). The health of the ecosystem is enhanced and the complexity well managed when “meanings are shared” through communication, and “trust established” (Luoma-aho & Halonen, 2010).

Managing an ecosystem requires the need for the orchestrator to demonstrate trust in the system and in the members of the ecosystem. According to Ellonen, Blomqvist & Puumalainen (2008), the success of innovations partly depends on trust: both on institutional level as well as on interpersonal relations. Jaatinen & Lavikka (2008) also discuss that, “trust and sharing are dynamic in nature”. In strategic management theory, a competitive global economy relies on trust to succeed (Hosmer, 1994). Following Ghoshal and Bartlett (1994), they argue that trust, when built, has the power to influence other members of the ecosystem. Thus, trust is stressed as an essential feature in the contemporary economy - ecosystems (Thorelli, 1986; Jarillo, 1988; Håkansson & Snehota, 1995; Huemer, 1998 p.15).

Managing an ecosystem is a herculean task (Sargut & McGrath, 2011) due to the degree of complexity (technological and relational). Managing the ecosystem complexity successfully, therefore, is to learn how to leave with it and mitigate the risk and challenges associated with ecosystem complexity. Sargut & McGrath (2011) discussed some steps that ecosystem members should take to manage this situation:

**Improved Forecasting Methods (IFM):** - Like ecology, the business ecosystems are highly unpredictable and therefore using traditional forecasting tool will not work for ecosystems. According to Chambers et al., (1971), three fundamental questions need to be considered in choosing the right forecasting techniques: “*What is the purpose of the forecast—how is it to be used? What are the dynamics and components of the system for which the forecast will be made?*”

*How important is the past in estimating the future?"* They proposed that central players must blend their experience and knowledge with the tools.

**Better Risk Mitigation (BRM):** - The ability for focal firms to minimize risk is essential for the management of the ecosystem complexity. The authors explained that, "in an unpredictable world, sometimes the best investments are those that minimize the importance of predictions". This can be achieved in part through decoupling or separating ecosystems. Thus, a keystone can be part of or align with other ecosystems as well to reduce the risk of losing it all should sometime drastic and systemic happen.

**Smart Tradeoff Decisions (STD):** - The ecosystem complexity requires that the focal firm ensures the ecosystem contains enough diversity of members but at the same time taking a "real-options approach". Real-options approach refers to "making relatively small investments that give you the right, but not the obligation, to make further investments later on".

From the ongoing discussions, it is evident that each of the actors in the ecosystem has a role to play in managing the ecosystem complexity to ensure the health of the entire ecosystem. Keystone firms will triumph through building a powerful and healthy platform, assets and values they share with the members and through managing their relationship with complementors. Concerning niche firms, their success largely depends on their ability to leverage strong and healthy platforms as well as managing their dependencies on other firms' key assets. Furthermore, niche firms need to understand the ecosystem they are joining since they are on the verge of losing should any of the following occur: associating with weak keystone firm; aligning with an unsustainable or obsolete platform; inability to understand the complexity of their environments; or been preyed upon by an aggressive dominator firm. Finally, dominators will have to ensure that they share the value that has been created by the ecosystem instead of milking it alone and consequently starving the rest of the members to death.

### **3 ECOSYSTEM STRUCTURE AND VALUE CREATION**

The ability of firms to co-create and be part of developing a strong ecosystem becomes a potential and powerful source of competitive advantage (Rohrbeck et al., 2009; Williamson & De Meyer, 2012). We are in an era of knowledge-intensive economic landscape (Pellikka & A.-Vehmas, 2016) where firms need to open their doors to external knowledge sources due to the difficulty if not impossible, to possess all the required knowledge and other assets (Chesborough, 2003, 2011).

Unlike the traditional business value-creation process, which is linear in nature, ecosystems partners involve a large number of partners sometimes from different industries which extends beyond the traditional value-chain (Moore, 1996 p.27; Iansiti & Levien, 2004). Thus, in business ecosystems, companies collaborate “as an interrelated system of interdependent companies rather than as individual companies” to jointly create value to customers (B. Clarysse et al., 2014) and for themselves. Since ecosystem is regarded as a nested system (B. Clarysse et al., 2014), it enables firms to create value which otherwise will be difficult for an organisation to create by itself (Adner, 2006). Thus ecosystem presents a firm better opportunity to solve customers’ complex demands, since it assembles different set of resources and innovative ideas to address customer needs faster (Carbone, 2009). However, given the degree of ecosystem complexities (Sargut & McGrath, 201) and the effect it has on strategy implementation (Bharadwaj et al., 2013), there is the need to understand the roles played by both central players as well as complementors in managing this complexity, thereby fully reaping the fruits of value creation in ecosystems.

#### **3.1 Leadership roles**

Ecosystems are characterized with uncertainty and complexity, high diversity of ideas and partners, cooperation and competition, and struggle for dominance. In such environment, there is the need for a lead firm to orchestrate the activities of the ecosystem members and secure valuable resources for the growth and stability of the ecosystem (Dhanaraj & Parkhe, 2006). In biological ecosystems, there are species which supplies nutrients to the majority of the ecosystem member (e.g. bee) and therefore functions as a hub specie. Like the biological hub species, Iansiti

and Levien identifies “keystones” as possessing such features in creating and sharing value to the entire ecosystem. They define keystone as a “species that governs most important ecosystem health, often without being a significant portion of the ecosystem itself” (Iansiti & Levien, 2004). These keystones perform different functions such as coordination, mobilization of resources, value creation, stabilizing the ecosystem and stimulating innovation. (see e.g. Dhanaraj & Parkhe, 2006; Nambisan & Sawhney, 2011; Roijakkers et al., 2013; Hurmelinna-Laukkanen et al., 2014; Pikkarainen et al., 2017).

Similarly, Iyer et al. (2006), also identified three essential leadership roles: hub, broker and bridge. The hub firm; (also referred to as keystone, orchestrator focal firm, central player or lead firm) has a large number of partner relationships within its ecosystem and with other ecosystems. The broker; this type of leader facilitates relationship between two members of the same ecosystem or from different ecosystems. The third leadership role is what the authors referred to as the bridge. A firm playing the bridge role serves as the main linkage to the entire ecosystem (Iyer et al., 2006). In essence, ecosystem leaders maintain the overall health of their ecosystems through such activities as generating essential nutrients which serves as the foundation critical to a host of ecosystem niches (Iansiti & Levien, 2004). The authors stressed that, it is essential that ecosystem leaders take actions which improves the health of both their ecosystems as well as especially that of other members of their ecosystem.

Successful ecosystem leaders have demonstrated in various ways how they lead their ecosystems for survival and growth. For instance, Iansiti and Levien (2004) discussed how Walmart and Microsoft achieved competitive advantage through their role as leaders in their respective industry. According to Iansiti and Levien (2004), keystones exert their influence on the ecosystem not by the virtue of their size, instead through their relationships with partners which make their role essential for the entire system.

### **3.2 Complementary and Peripheral Roles**

In the high-tech industry, keystones are increasingly fostering relationships with smaller firms (niche players or complementors) that complement their ecosystems. However, chunk of the existing research focus more on the keystone’s (hub, focal firm, orchestrator etc.) perspective

(see Selander et al., 2013; Iansiti & Levien, 2004) at the expense of complementors' perspective (van den Berk et al., 2010; Ghazawneh & Henfridsson, 2013). Meanwhile, a lot of innovation these days emerge from the combination of different existing knowledge (Carlson & Wilmot, 2006) co-created by both keystones and complementors (Estrin, 2009). According to Kude et al. (2012), there is the need to understand the motivations behind complementors' participating in ecosystems and how they successfully achieve that. Moreover, Yoffie and Kwak (2006) also argue that, understanding the goals, drivers and processes of complementors is fundamental to the management of ecosystems or partner relationships. Thus, although the keystone's product and service is essential and necessary, however, its value is mostly limited unless it is used jointly with a complementary product or service.

That said, there are myriads of reasons and motivations why firms especially complementors would want to be part or belong to an ecosystem. Among such is to have access to information or technology, which they alone could not afford to acquire. Thus, firms engage in partnerships to gain external resources and capabilities (Das & Teng, 2000; R. D. Ireland et al., 2002; Kude et al., 2012). Hence, keystones must not only concentrate developing new applications, instead, focus on providing resources to complementors in their quest to developing complementary products and services (El Sawy *et al.*, 2010). Thus, the focus of the central player must not remain on developing applications. However, in their development work, they must shift some of their attention in empowering complementors (Prügl & Schreier, 2006).

It is challenging to identify the external resources and capabilities of keystones that pulls complementors towards its ecosystem (Kude et al., 2012). Nonetheless, the literature on inter-firm collaborations has broadly classified capabilities and resources under three main headings: commercial, technological, and social capital (Ahuja, 2000) due to their relevance in ecosystems especially within the high technology sector (Hagedoorn, 1993).

**Technological Capital (TC):** Complementors or peripheral actors may partner with keystones to gain access to technological capital (Kude et al., 2012). Hagedoorn (1993) discussed that, the keystone's TC is determined by its immediate ability to provide integration of systems and its ability to develop system architectures. Thus, complementors are motivated to partner with

keystones due to the latter's ability to provide integrated systems as well as innovate system architectures.

**Commercial capital (CC):** The aim of any business venture is to be able to commercialize and keystones can help complementors achieve that. As opposed to keystones who are global players with wide access to markets and distribution channels, complementors are relatively handicapped in this regard and gaining access to the keystone's CC allows the complementor reach a wide audience of customers (Hagedoorn, 1993; Rao & Klein, 1994; Eisenhardt & Schoonhoven, 1996; Ahuja, 2000).

**Social Capital (SC)** Ahuja (2000) defines social capital as a firm's reputation (brand name or goodwill) in the market. The brand is one key differentiating factor for customers to recognize a company's product or service. According to Kude et al. (2012), among myriads of challenges SME's and start-ups encounter is their unknown brand in the market. As a result, potential customers are skeptical in trusting the reliability, quality and trustworthiness. Complementors are therefore motivated to partner with keystones due to the latter's high reputation. Khandeparkar (2014) discuss that, the association of a new product with a widely known brand attracts additional traffic to the product. Thus, by partnering keystones or participating in ecosystems, complementors become more recognized due to the already established brand of the keystone.

Following the ongoing discussions, it is worth mentioning that all the three drivers why complementors participate in an ecosystem are external resource-based view (RBV) and have been drawn from the input-oriented perspectives (IOP). However, recent contributions have analyzed the motivations from output-oriented perspective (OOP). In the works of Gao and Iyer (2006; 2008), they identified **product-level complementarity (PLC)** as another reason why complementors or participate in ecosystems. They refer to PLC as the relative relationship or proximity between two products. Put differently, two products or services are said to exhibit a degree of complementarity if each of the products needs the other to function or to enhance its functionality. Thus, a product is complementary to another because they can function together and are often jointly demanded. Hence, Kude et al. argue that, the "level of product complementarity interacts with the extent to which particular resources and capabilities of the

hub motivate the spoke to participate in a hub-and-spoke network”. Therefore, in ecosystems, not only is the interrelatedness and interdependency between firms but also between products and services.

### **3.2.1 How complementors participate in ecosystems**

Rickmann et al. (2014) identified steps and processes on how complementors participate in ecosystems. The first step is for complementors to be aware of the value propositions or offerings of the keystone. Next, they should evaluate the technical and soft skills of the keystone. Thus, whether the keystone is able to help them achieve their goals.

When satisfied with the first two steps, the complementor then forms partnership with the keystone. Here, it must be stated that not always does the complementor have to go to the keystone, it can be the reverse when keystones identify that the niche player has something great to offer which will complement its offerings. Once the partnership agreement is concluded, the complementor now have access to the keystone’s “resources” and begin to offer its specialized value proposition unto the market.

Finally, complementors begin to explore and exploit more opportunities to extend their tentacles either with the same keystone or multiple keystones in different ecosystems. Hence, in the interest of the keystone, it must continue to provide further opportunities to the complementors in order to keep them to its ecosystem, else the keystone risk been left alone after sometime.

### **3.3 Assessing the Ecosystem’s Health**

According to Iansiti and Levien (2004), three critical ecosystem measures of ecosystem health: productivity, robustness, and niche creation.

Productivity: A central player’s ability to consistently harness and convert the factors of production into low cost innovative products measure’s the productivity of its ecosystem. Hence, indicators to be used in measuring ecosystem productivity could be for instance a keystone’s ability to consistently develop new and variety of innovations, helping ecosystem members and customers be more cost effective etc.

Robustness: Secondly, robustness of an ecosystem is its ability to survive turbulence. Firms belonging to a robust ecosystem are often shielded from external disruptions. A central player's ability to provide a strong ecosystem which ensures survival both for itself and for other members of the ecosystem.

Niche creation: Finally, an ecosystem needs to be able to create a niche. As in a biological ecosystem, a business network needs to be able to support variety and have diversity to be capable of absorbing external shocks and stimulating innovation. The measure suggested to capture this is an "ecosystem's capacity to increase *meaningful* diversity through the creation of valuable new functions, or niches". To evaluate the ecosystem's ability to form niches, metrics such the ability to support variety of ecosystem members, ability to create and add value, the extent to which new technologies are provided through new products, services, processes or business opportunities.

## 4 RESEARCH METHODOLOGY

Under this section, the empirical approach employed in this study is explained. Thus, I explain the methods employed, research approach, design and overall technique adopted. Furthermore, this section also discusses the data collection process, analysis, the degree of credibility and acceptability of the findings as well as limitations to the study. Empirically, I support the research qualitatively with press releases based on multiple case study approach. In addition to answering the research questions, the study also aims to build theories to contribute to this emerging ecosystem concept.

Following Saunders, Lewis & Thornhill (2009), qualitative study strengthens theory generation, more so if the research is exploratory. In the context of organizational change, qualitative research can be utilized for several purposes including but not limited to theory generation, construct validation, provide description, theory testing, as well as the uncovering of new and emerging phenomena (Eisenhardt, 1989; Garcia & Gluesing, 2013). Hence, based on the nature of the data, I find it appropriate and rigorous to adopt qualitative approach since the research is exploratory. To buttress the decision to conduct the research qualitatively, Yin (2009) argue that, the nature of research question, the degree of control on behavioral activities as well as the extent of focus on existing events, is essential in determining the appropriate research methodology to adopt. For the purpose of this research, adopting an exploratory and qualitative approach therefore enables me to understand what activities central players in business actually undertake to orchestrate and manage their ecosystems. In additions, qualitative method has the ability to unearth tacit and hidden attributes that are beyond measurement (Marschan-Piekkari & Welch, 2004; Garcia & Gluesing, 2013).

Finally, all the six companies (Amazon, AT&T, GE, Microsoft, Oracle & Verizon Communications) investigated are large multinationals companies in the Standard and Poor's 500 (S&P 500). Given the global and interconnected nature of their operations and the reality that business environment is ever shifting, qualitative approaches provide the best, most rigorous and most nuanced methods to understand, illuminate and extrapolate this emerging phenomenon (Hoepfl, 1997; Garcia & Gluesing, 2013)

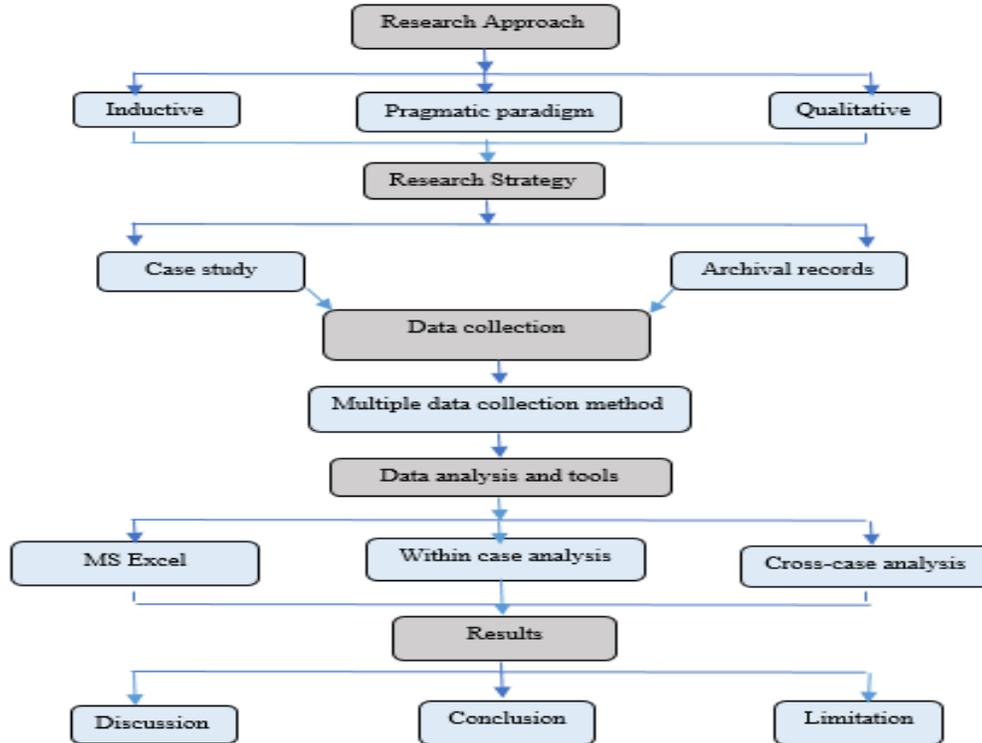


Figure 10. Abridged research method (Adapted from: Saunders et al., 2009)

#### 4.1 Research Design

This research is designed to ensure that the evidence gathered enables the researcher to answer the research questions explicitly and unambiguously. Thus, obtaining relevant information, which involves identifying the type of data needed in fulfilment of the research questions, specifying the type of evidence needed to answer the research question, be it to test a theory, build theory or to describe a phenomenon accurately. A point well explained by Saunders et al. (2009) is that, the research design is the plan (table 2) which guides the researcher to answer the research questions. Just as a plan is needed for the construction of a building, so is research design needed for a good research or project. This includes but not limited to properly outlining the objectives of the research, specifying the type and nature of data to be gathered, and the related ethical issues and challenges.

**Table 2. Research design adopted**

Preliminary Analysis	Research plan	Data sources	Data collection and organization	Outcome
↓	↓	↓	↓	↓
Identification of research gap	Scheduling (timing)	Secondary data	Manual collection of press releases	Results
Research scope	Desktop research	Company press releases and annual reports (from webpages & archives)	Checking for errors (i.e. duplicates & omissions) with python programme and excel	Empirical analysis -within case analysis -cross case analysis
Formulating research questions	Literature review		Excel coding & modeling	Discussion
			Manual identification of relevant info	Conclusion & further research

The researcher chose an exploratory method as it best fit this research due to the complexity of the phenomenon to be investigated and because it will afford the researcher gain better understanding and insight on the subject (Saunders et al., 2009). The nature of the data also necessitated the exploratory research design choice because it was difficult if not impossible to make sense of the data in the initial stage.

I utilized secondary data from company webpages as a source of my data. The data represents press releases of firms among the S&P 500 companies. In addition to the press releases, archived materials such as company annual reports were also utilized to further understand and appreciate

the phenomenon. This is in conformity with Eisenhardt (1989) who stresses that, typically, theory building involves the use of multiple data collection method although conducting inductive research allows flexibility to either use single or multiple data sources. As Yin (1994, p. 92) argues, the results and conclusion arrived at in case study research is potentially “much more convincing and accurate if it is based on several different sources of information following a corroborative mode.” As a result, exploratory case studies tend to use multiple data sources (Dubois & Gadde, 2002). The usage of multiple data collection methods allowed me to utilize triangulation to further substantiate the work and improve credibility of the results. This evaluation strategy ensures bias control, strengthens credibility (validity and reliability) and reveals essential propositions in research findings (Mathison, 1988; Golafshani, 2003).

Furthermore, this is a multiple-case study research. Multiple-case study enables the researcher to cross analyze, as well as investigate and compare a phenomenon in different ways (P Darke et al., 1998). According to (Yin, 1994, p.46), multiple-case studies may also be chosen for the purpose of predicting either contrasting or similar outcomes. Like multiple experiments in the laboratory, multiple-case study research also makes findings of the study robust and enables analytical or theoretical generalizability (Benbasat et al., 1987; Yin, 1994, p.31; P Darke et al., 1998). Thus, case-study research is appropriate for building theories and it provides an embedded design which permits the use of multiple levels of analysis within a single study (Yin, 1984; Eisenhardt, 1989). Archival materials such as annual reports from the case companies were also utilized to build up the results and gain more insights on the research questions. By adopting a multiple data collection method, triangulation was employed to corroborate the two sources of data utilized (Bryman, 2006). Thus, triangulation helps the research findings to be substantiated from multiple data sources (Eisenhardt, 1989). Thus, holistically, the essence of examining a phenomenon is captured when multiple case-study research is adopted, thereby enhancing the validity, reliability and accuracy of the findings (Noor, 2008)

Due to the differences in the areas of operations for all the six companies, I developed unique ‘themes’ for categorization and evaluation. This strategy was preferred as it has the tendency to reveal hidden meaning which can be inferred. Furthermore, the themes developed will also ensure coherence and consistency in what data is collected for all the companies and how they

are organized. Consequently, triangulation was utilized for clarity and credibility in analyzing the data. I further conducted a critical analysis of the details of the case firm activities which allowed me to gain understanding and make inferences on observed or emerged pattern of activity such as similarities and differences (Hughes et al., 2007).

## 4.2 Research Approach and Strategy

The choice of research strategy is influenced in part by the nature of research question(s) and objectives and the researcher’s philosophical underpinnings. Put differently, the theoretical approach employed guides the type of research approach and strategy to be adopted (Saunders et al., 2009). A point well explained by Saunders and his colleagues about understanding a research philosophy is that, the research philosophy one adopts consequently underpins the researcher’s choice of research strategy (Saunders et al., 2009).

According to the metaphor “research onion” proposed by Saunders et al (2009), a research approach can either be inductive, deductive or abductive. The choice of research approach depends on whether the researcher intends to build theories through the observation of empirical data (inductive) or testing theoretical propositions (deductive). On the hand, there is a middle ground (abductive approach), which combines both far ends approaches (Eisenhardt, 1989; Dubois & Gadde, 2002; Saunders et al., 2009). Although, there is no one best strategy to adopt in conducting research, factors such as: research questions, time, influences a strategy choice the researcher adopts (Yin, 2003; Saunders et al., 2009). Based on the research questions, the exploratory nature of the research and insights from Yin (2009) (table 3), I adopted an inductive research approach in this study.

**Table 3. Relevant situation for a research strategy (Yin, 2009)**

Research strategy	Form of research question	Requires control of behavioral events	Focuses on contemporary events?
Experiment	<i>How, why?</i>	Yes	Yes
Survey	<i>Who, what, where, how many, how much?</i>	No	Yes

Archival analysis	<i>Who, what, where, how many, how much?</i>	No	Yes/No
History	<i>How, why?</i>	No	No
Case study	<i>How, why?</i>	No	Yes

### 4.3 Case Sample Selection

To build theories in a case-study research, Eisenhardt (1989) suggests that, case(s) must be properly selected and carried out with a suitable population. As this would help minimize variations in data collection and allow the researcher define the extent to which the findings can be generalized. The firms selected in this study were all large global companies and among the top fifty S&P 500 companies who either are at the center of an ecosystem or belong to one. The data collected covers the period from 2005-2014 and was collected manually over a period of one year by a pool of research assistance (myself included).

To ensure fairness and rich content, the minimal qualification for selection was the number of counts of the term “ecosystem” in the companies’ press releases for the period (2005-2014). This means that the companies must have data available all throughout the above-mentioned period. Further, the companies must have mentioned the term “ecosystem” at least fifty times within the ten-year period under investigation. Thus, the case companies were not randomly selected, instead followed a self-selection process based on the minimum criteria set to allow me get enough data. Interestingly, all the six companies selected fall under the umbrella of high technology (high-tech) industry. However, due to the variations of high-tech industry and the constant changes in the industry, the criteria for case company self-selection was flexible and therefore included companies operating in different fields and specialization, but the unifying characteristics was the high-tech element.

### 4.4 Data Collection and Organization Method

The process of collecting qualitative data can be a lengthy, tedious and time-consuming. However, it yields very rich and dense data that must be modeled, codified and analyzed in ways that make sense and relevant to both the research questions and the phenomenon (Garcia &

Gluesing, 2013). Data collection involves the collection of information from various sources: archives, interviews, observations etc. (Eisenhardt, 1989; Saunders et al., 2009).

Within the context of ecosystems research, qualitative data will come in many forms – most common are through observations of a population of organizations' ecosystem or group of ecosystems, interviews with heads of organizations belonging to an ecosystem or different kinds of ecosystems, or through web pages and archives (e.g., press releases, annual reports etc.) of those organizations under consideration. This study utilized secondary data (web pages and archival data) of the companies under investigation. In all, 59 firms among the 101 S&P 500 companies together mentioned the term “ecosystem” in over 1000 press releases. However, only six companies (Amazon, AT&T, GE, Microsoft, Oracle and Verizon Communications) met the selection criteria as specified in preceding section.

#### **4.5 Data analysis and processing**

Following Eisenhardt (1989), data analysis is the foundation on which theories are built in case-study research. Given that data analysis is very important in a research process, it is therefore essential to ensure that the data collection process was done in an organized and careful manner to retain and unearth hidden meanings. This is also to ensure the validity, credibility and acceptability of the data generated. Thus, only the relevant and actual contents from the data (i.e., press releases and annual reports) were purposefully utilized to answer the research questions.

Next, Python Programming Language was utilized to ensure there were no possible errors such as duplication or omission of content given the huge number of press releases coupled with the fact that it was manually collected. Furthermore, misplacement errors where a press release mistakenly found in another release were corrected. Finally, after rectifying all the errors, the data sample consisted of 894 press releases from the six companies satisfying the selection criteria.

To proceed, it was daunting to make sense of the raw data so I developed seven thematic themes (i.e., company name and date of press release, ecosystem archetypes, salient details of the content, focal firm's role, complementors and their roles, the aim or strategic goal captured from

the content of the press release, outcome and challenges) and keywords related to the topic. The development of the themes was constructed to enable me gather relevant information from the raw data to help in answering the research questions and objectives, which was to understand *the leadership role and activities central players in business undertake to manage the complexities in their ecosystems*. For this reason, I had to read every single press release (894 press releases in total) and filter the essential information base on the seven thematic themes and keywords mentioned earlier. The data gathered from the press releases alongside materials from company archives (i.e. annual reports) were very informative and satisfied the research objective.

After developing the themes and keywords, MS-Excel was used to construct a data model that matched the case company's name with the keywords in order to make it easier to extract relevant information for the analysis as shown in Figure 11.

Select your company	Oracle	Select your Key words	ecosystem
Oracle	Date(mmddy or mmdyyyy)	Communications	Run
1	113005	bea systems ibm corporation iona technologies oracle sap ag siebel systems sybase xcalia and zend technologies today announced an effort to develop s	
2	021505	announced the creation of a dedicated linux test lab providing a rigorous test environment to further the quality stability and supportability of the operatin	
3	042005	to help customers automate business processes and reduce integration costs independent software vendors isvs and infrastructure technology providers	
4	060705	announced the first integrated release of the oracle r identity management suite since acquiring oblix in march 2005. the release delivers the industry's n	
5	091905	thanks to oracle technology and accelior consulting expertise ing lease belgium part of the ing group today enjoys all the benefits of a service-oriented ar	
6	011806	at an event today hosted by oracle ceo larry ellison in san francisco 's city hall oracle provided a progress report and outlined the next level of detail for (	
7	010706	this year 's oracle openworld will feature a wide range of dedicated activities tailored toward the specific needs of oracle 's partner <b>ecosystem</b> the expa	
8	0102306	oracle president charles phillips unveiled " oracle accelerate " an expanded small and medium business smb program today at oracle openworld leveragi	
9	0102306	demonstrating its commitment to delivering leading business applications oracle today announced the launch of independent software vendor isv solution	
10	0102306	in its ongoing effort to provide more enablement tools and help create demand for solutions provided by partners in oracle 's ever-growing <b>ecosystem</b> or	
11	0102506	the free standards group fsg and oracle today announced that oracle has joined the fsg as a platinum member fsg is a nonprofit organization dedicated to	
12	030306	in response to small and mid-size customers demand for a continuation of oracle 's jd edwards enterpriseone software on ibm 's platform oracle today ar	
13	030906	oracle china registered as beijing oracle software systems co. ltd. today announced plans to build a footprint into 26 tier-2 cities and recruit more partner	

**Figure 11. A model used to build data for the case analysis**

From the above data model, a database was developed (Table 4) based on the seven thematic themes from which the analysis began. The analysis was on two levels. Firstly, I analyzed the data on individual case bases (in-case analysis) and secondly, cross-case comparison by relating the cases with each other to find similarities, differences and patterns. I analyzed the data with special focus on ecosystem strategies, leadership roles and (technological and relational) complexities.

**Table 4. Sample of the database (for Amazon) developed from seven thematic themes**

Companies	Ecosystem types	Details	Focal firm's role	Other ecosystem actors and their roles	Strategic aim/goal	Outcome	Challenges/Cost
Amazon (12.04.2008)	<b>Innovation ecosystem:</b> "public data sets on aws is the latest of these efforts and we can't wait to see the discoveries and innovations that could stem from this ecosystem"	providing access to a centralized repository of public data sets that can be seamlessly integrated into aws cloud-based applications.	leading the ecosystem	u.s. census bureau, 3-d chemical structures provided by indiana university, bureau of economic analysis and ensembl: Providing data sets in order to grow the number of people with access to important and useful data and making it easy to compute on that data with cost-efficient services	hopes to fuel innovation and further accelerate the pace of new discoveries. working to lower the barriers to entry level the playing field and make it possible for our customers to be successful based on their ideas not on their resources	previously large data sets such as the human genome and u.s. census data required many hours to locate download and customize now anyone can access these large data sets from their amazon elastic compute cloud amazon ec2 instances and start computing on the data within minutes by growing the number of people with access to important and useful data and making it easy to compute on that data with cost-efficient services	how to store, analyze and annotate it and how to make both the raw genomic information and our annotations available to as many people as possible
Amazon (12.14.2011)	<b>Partner ecosystem:</b> "aws has a vibrant partner ecosystem in brazil that are building and selling innovative solutions and services on aws's pay-as-you-go infrastructure"	global cloud computing platform south american-based businesses and global companies with customers in south america can now leverage the aws suite of infrastructure web services to build their businesses and run their applications in	leading the ecosystem	Avanxo, Accenture, cit, concrete solutions, Deloitte dedalus prime, dextra infor, genexus globant, mpl lumis, oracle, summa and uptodate consulting: building and selling innovative solutions and services on aws's pay-as-you-go infrastructure	we are excited to help even more businesses innovate faster accelerate their pace of technology delivery and save money by either migrating their existing systems to the cloud or starting fresh with aws-powered environments."	changed the way that businesses think about technology infrastructure -- incur no up-front expenses or long-term commitments turn capital expense into variable operating expense scale seamlessly by adding or shedding resources as quickly as you wish free up scarce engineering resources from the undifferentiated heavy lifting of running your own infrastructure -- all without sacrificing operational performance reliability or security	

To conclude on this section, I adopted a collaborative assessment of the key findings in order to have a holistic view for answering the research questions. Finally, with the help of the setup of the data analysis, I was able to ascertain "What roles and actions central players in business undertake to manage their ecosystem complexities".

#### 4.6 Validity and Reliability

The validity of a research is of utmost importance irrespective of the type of research (qualitative or quantitative). To evaluate the validity, subjective intuitions developed as a result of the relationship between the researcher and the data must be avoided (Saunders et al., 2009). Reliability measures the extent to which the processes adopted for data collection and its subsequent analysis lead to consistent findings (Golafshani, 2003). Hence, research findings are said to be reliable and valid if they satisfy the measurement criteria and the candor of the results.

Given the importance of reliability and validity to both qualitative and quantitative research, however their treatment and applicability differs depending on whether the research is quantitative or qualitative. Whereas these two concepts are treated separately in quantitative studies, they are jointly treated and characterized by their credibility, transferability, or trustworthiness (Golafshani, 2003). Validity and reliability were my guiding principles in gathering the data and extracting information from the press releases and annual reports, which

strengthens the credibility of the results. Finally, triangulation technique, which makes the results more credible, was employed to validate the analysis (Saunders et al., 2009).

## **5 RESULTS AND ANALYSIS**

Under this section, findings are discussed and interpreted. This is done by giving a brief profile to each case company as summarized in Table 6. In the case descriptions, the broad strategies employed and the leadership roles adopted by the case companies are captured thereby answering the questions regarding ecosystem strategies and roles played by focal firms. To begin with, I first codified the case companies' ecosystem activities (Table 5) which focused on the total size of the ecosystem archetypes and the roles (i.e., leading, complementing or participating) of central players in the various ecosystems archetypes mentioned in their press releases as shown in Figures 12-17. Thereafter, I categorized the case firms' operations and activities into various captions such as strategies, robustness, productivity, niche creation, the degree of relationship complexity and the size of the ecosystems. Subsequently I did a case-by-case (in-case analysis) evaluation based on the categorization and on a generic level (see Table 7). Furthermore, I looked at the degree of complexity concerning the multiple and interconnected relationships of the focal firm with its complementors and among its fellow focal firms' ecosystems (relational complexity). Technological complexity of the focal firms' products or platforms was also taken into account. Finally, I related the case findings with each other (cross-case analysis). This is a big data research and therefore the cross-case analysis highlights the data management process, validity and depicts a condensed and visual representation of the outcome.

**Table 5. Coded concepts**

<b>Concepts</b>		<b>Description</b>	<b>Examples</b>
Ecosystem size		The relative extent or magnitude of the case companies' ecosystem. This is arrived at by tabulating the number of occurrences for each ecosystem archetypes identified. The total size is calculated by the sum of all the ecosystem archetypes mentioned in the case companies' press release. If the archetypes identified are more than four, I take four most frequent mention and then bundle the remaining archetypes as "others".	For instance, company 'X' mentions content ecosystems 20 times and partner ecosystems 9 times. The size of the ecosystem archetype "content ecosystem" is therefore 20 and the total ecosystem size for company 'X' is 29 (20+9).
Ecosystem archetypes		This refers to all the myriads of ecosystem archetypes as mentioned and identified in the case companies' in press releases.	Innovation ecosystem, business ecosystems, partner ecosystems, content ecosystems, technology ecosystem, mobile ecosystem etc.
Leadership roles:	Leading	A company is identified to be playing a leading role if it is a central player managing and orchestrating the direction of the ecosystem. This is either mentioned explicitly in the press the company's press release or inferred from the content of the pronouncement	Platform owner, central player in developing the ecosystem, market leader etc.
	Complementing	A company is categorized as complementing if it provides complementary services to an existing platform or ecosystem. This is sometimes mentioned explicitly in the company's pronouncements or inferred.	Offering complementary products and/or service, supporting and helping other ecosystems etc.

	Participating	I categorized companies as playing a participatory role when they are seen collaborating with other ecosystem members without taking active role in the management of the ecosystem.	Building alliances with other partners, belonging to other ecosystems without leading or complementing.
--	---------------	--	---

## 5.1 Case companies' description and ecosystem structure

This section combines a brief profile of the case companies and their ecosystems structure. Also, the summary of business operations outlook of the case firms and the evaluation criteria are also highlighted in tables 6 and 7 respectively.

**Table 6. Case companies' business operations outlook**

Company	Amazon	GE	AT&T	Verizon	Oracle	Microsoft
Incorporation	1994	1892	1885	2000	2005	1993
Industry	Online retailer	Industrials	Telecommunication services	Telecommuni- cation services	Software & technology solutions	Software & technology solutions
Size/Mkt cap (2017)	566,023.48	151,475.96	238,700.85	215,926.66	195,881.04	659,085.70
Revenue(\$m) 2017	177,866	122,274	160,546	126,034	37,736	89,950

Competitors	eBay, Netflix, Alibaba, BestBuy, Wal Mart	Emerson Electric Co., United Technologies Corporations, 3M, Siemens AG	Verizon communication, T:Mobile US Inc., Sprint Corporations, China Mobile, Telefonica	AT&T, T:Mobile US Inc., Sprint Corporations,	Microsoft, Amazon,, IBM, Intel, Hewlett-Packard Enterprise, SAP, Salesforce	Oracle, Apple, IBM, Google, SAP
S&P 500 Rank (2017)	35	9	11	16	82	34
Competitive advantage	low price, wide variety of products, convenience, cost edge over brick and mortar retailers	Strong R&D, differentiation capabilities, market development and market penetration techniques, diversification	Dominant player in DSL market, Extensive network, Technology innovator, Strong internal resources and Intellectual properties	Dominant player in DSL market, Technology innovator, low cost, Strong infrastructure, extensive network, intellectual properties.	Economies of scale, High switching cost, Better ways of managing information, Strong technology, Strong software and internet provider,	Economies of scale, Network effect, Brand strength and brand identity, Intellectual properties, Legacy products and services, flexible pricing, Desktop operating systems

Table 7 was crafted with insights from Iansiti and Levien (2004) to enable me collect relevant information in relation to the theories used and to have a concise and common base to assess the case companies. In other words, this evaluation affords me to have a critical interpretation in order to generalize the outcome.

**Table 7. Evaluation metrics for ecosystem assessment**

Measurement	Evaluation criteria
Robustness	Ability to survive (both for itself and complementors) turbulence and disruption (stable structure), integration of internal capabilities with complementor-relationship and diversity of ecosystems.
Productivity	Ability and effectiveness of benefiting ecosystem members (new and variety of innovations, helping ecosystem members and customers be more efficient and reducing cost.
Niche creation	Ability to support variety of ecosystem members, ability to create and add value, the extent to which new technologies are provided through new products, services, processes or business opportunities.
Relationship complexity	The degree of relationship (number of partners and the complexity of relationships. Is the relationship only with complementors or with other keystones in different ecosystems.
Firm role	What role(s) are adopted (keystone, dominator, complementor, periphery/ participatory or multiple roles)
Ecosystem types	The degree of ecosystem involvement and whether the keystone operates an open, closed or multiple ecosystems
Ecosystem size	The relative extent or magnitude of the case companies' ecosystem. This includes the sum of all the ecosystem archetypes identified in each case company's press release.

## 5.2 Company description

**Amazon.com, Inc.** was incorporated in 1994 in the state of Washington and reincorporated in 1996 in the state of Delaware. The company’s principal corporate offices are located in Seattle, Washington. Its initial public offering was completed in May 1997 and their stock listed on the NASDAQ Global Select Market under the symbol “AMZN.” Amazon.com opened its virtual doors on the World Wide Web in July 1995 and the company’s vision is to be Earth’s most customer-centric company. The company is guided by four principles: customer obsession rather than competitor focus, passion for invention, commitment to operational excellence, and long-term thinking. Their ecosystem is made up consumers, sellers, developers, enterprises, and content creators. In addition, the company provides advertising services and co-branded credit card agreements. The operations of the company are organized into three broad segments: North America, International, and Amazon Web Services (“AWS”) (Amazon 2017 annual report).

These segments reflect the way the Company evaluates its business performance and manages its operations. *“Amazon is a platform owner and serves its customers through their retail websites and focuses on selection, price, and convenience. The platform is designed to enable hundreds of millions of unique products to be sold by Amazon itself and by third parties across dozens of product categories. In addition, customers access the platform directly and through Amazon mobile websites and apps. The company is also into manufacturing and selling of electronic devices, including Kindle e-readers, Fire tablets, Fire TVs, and Echo. Furthermore, Amazon is also engaged in developing and producing media content”* (Amazon 2017 annual report).

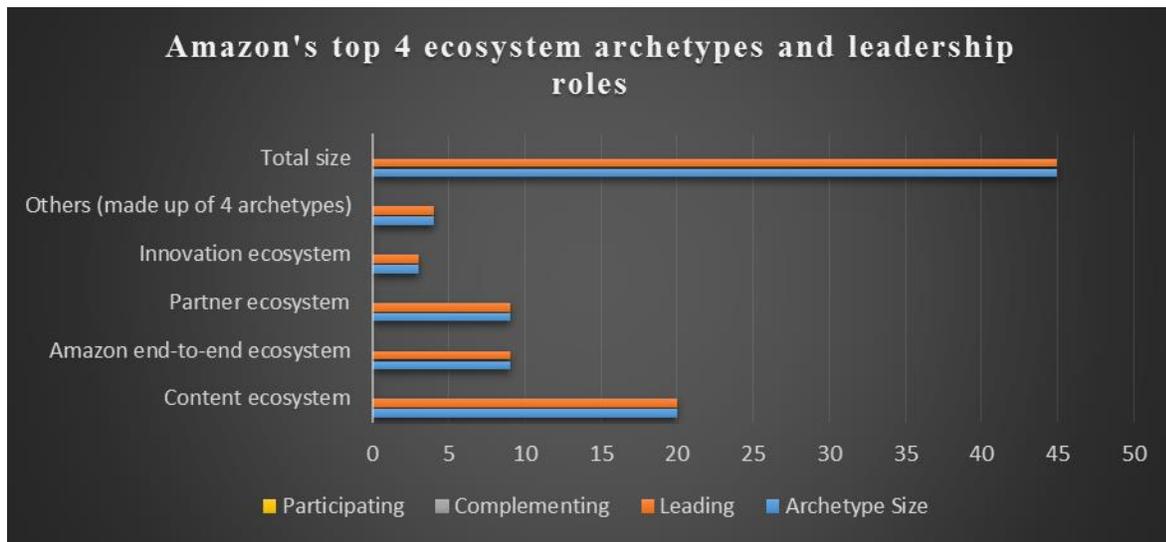
Furthermore, it can be seen from the data as shown in Table 8 that, Amazon participates in eight different ecosystem archetypes as identified from their press releases.

**Table 8. Summarized Amazon ecosystem archetypes and leadership roles**

Amazon ecosystem archetypes	Archetype Size	Leading	Complementing	Participating
Content ecosystem	20	20	0	0
Amazon end-to-end ecosystem	9	9	0	0
Partner ecosystem	9	9	0	0
Innovation ecosystem	3	3	0	0

Others (made up of 4 archetypes)	4	4	0	0
Total size	45	45	0	0

However, they are very active (mentioned frequently as well as either leading or complementing) in some while not very active (less pronouncements in the press release and sometimes only participating) in others. Figure 12 below shows Amazon’s top four (most frequently mentioned in their press release) ecosystem archetypes and the different roles they played in managing those ecosystems as explained in Table 5.



**Figure 12. Amazon’s top four ecosystem archetypes and leadership roles**

**General Electric (GE)** “is a global digital industrial company, transforming industry with software-defined machines and solutions that are connected, responsive and predictive. *With products and services ranging from aircraft engines, power generation and oil and gas production equipment to medical imaging, financing and industrial products, the company serves customers in over 180 countries and employ approximately 313,000 people worldwide*”. Since GE’s incorporation in 1892, the company has developed or acquired new technologies and services that have broadened and changed the scope of our activities considerably. Manufacturing operations are carried out at 191 manufacturing plants located in 38 states in the United States and Puerto Rico and at 348 manufacturing plants located in 43 other countries” (2017 annual report).

*“The company has two broad operating segments: Industrial and financial service. The industrial segment has components such as Power, Aviation, Lighting, Renewable energy, Healthcare, Oil and Gas and Transportation. Under the financial service segment, the main component is capital. GE’s business climate is characterized by changing technology that requires continuing research and development. With respect to manufacturing operations, the company believes that, in general, they are one of the leading firms in most of the major industries in which they participate”* (2017 Annual report). This statement was supported by the preliminary empirical analysis where it turned out that, at least they played leading role in 11 out of 13 of the ecosystems archetypes identified in their press releases as summarized in Table 9 below.

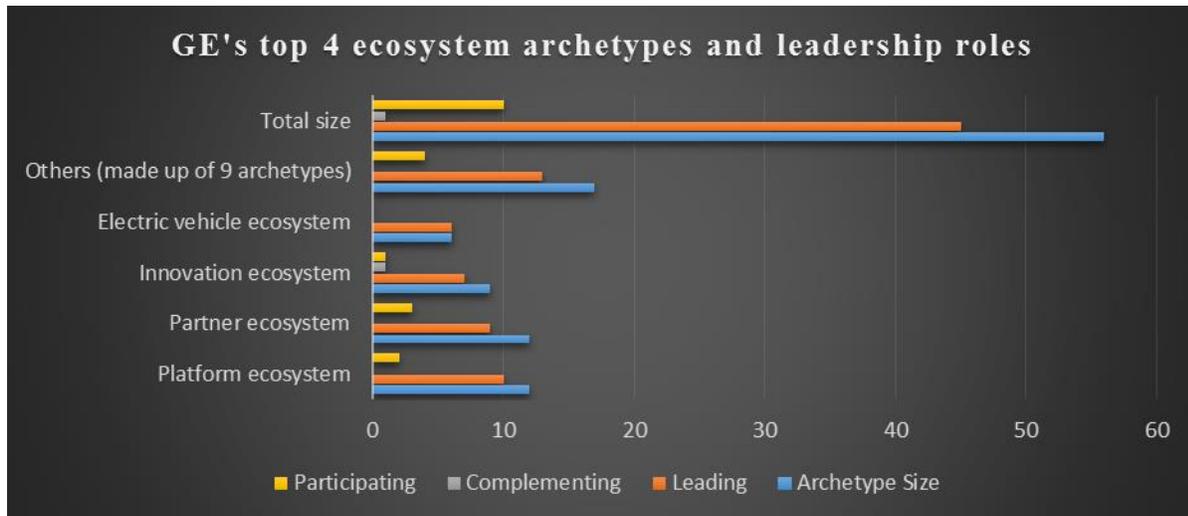
**Table 9. Summarized GE ecosystem archetypes and leadership roles**

General Electric ecosystem archetypes	Archetype Size	Leading	Complementing	Participating
Platform ecosystem	12	10	0	2
Partner ecosystem	12	9	0	3
Innovation ecosystem	9	7	1	1
Electric vehicle ecosystem	6	6	0	0
Others (made up of 9 archetypes)	17	13	0	4
Total size	56	45	1	10

*“As a diverse global company, the company’s business ecosystem is impacted by world economies, instability in certain regions, commodity prices, such as the price of oil, foreign currency volatility and policies regarding trade and imports. Other factors impacting GE’s business include: • product development cycles for many of their products are long and product quality and efficiency are critical to success • research and development expenditures are important to GE’s business • many of GE’s products are subject to a number of regulatory standards and • changing end markets, including shifts in energy sources and demand and the impact of technology changes”* (2017 Annual report).

The company’s data shows that, GE participates in thirteen different ecosystem archetypes as identified from their press releases and summarized in table 9 above. Among these archetypes, platform ecosystem as well as partner ecosystem had the highest count followed by

innovation ecosystem and electric heicle ecosystem. Figure 13 below shows GE’s top four (most frequently mentioned in their press release) ecosystem archetypes and the different roles they played in those.



**Figure 13. GE’s top four ecosystem archetypes and leadership roles**

**AT&T Inc. (NYSE: T)** “is a world leader in communications, media and entertainment, and technology and the company pride itself to be part of Fortune 10 companies. In 1984, the former AT&T divested its local telephone operations but retain its long distance, R&D and manufacturing arms. From this, Southwestern Bell, a regional telephone company, was born. Twelve years later, the Telecommunications Act of 1996 drove major changes in the competitive landscape. Southwestern Bell became SBC Communications to reflect its expanded U.S. presence through a series of acquisitions, including Pacific Telesis Group (1997) and Ameritech Corp. (1999). In 2005, SBC acquired AT&T Corp., creating the new AT&T, a leader in global communications. In 2007, AT&T led one of the most significant transformations in communications since the invention of the telephone: the birth of the mobile internet. The acquisition of BellSouth in 2006 further expanded the company’s regional footprint and gave AT&T full ownership of a national wireless company, Cingular Wireless, and rebranded to AT&T” (at&t.com).

From the company’s profile, the company operates under four separate business units namely

AT&T Communications, WarnerMedia, AT&T International and AT&T advertising and analytics:

- *“AT&T Communications provides mobile, broadband, video and other communications services to U.S.-based consumers and more than 3 million companies – from the smallest business to nearly all the Fortune 1000 – with highly secure, smart solutions. Revenues from these services totaled more than \$150 billion in 2017”.*
- *“WarnerMedia consists of HBO, Turner and Warner Bros. Together, these businesses had revenues of more than \$31 billion in 2017”.*
- *“AT&T International provides mobile services in Mexico to consumers and businesses, plus pay-tv service across 11 countries in South America and the Caribbean. It had revenues of more than \$8 billion in 2017”.*
- *“AT&T’s advertising & analytics business provides marketers with advanced advertising solutions using valuable customer insights from AT&T’s TV, mobile and broadband services, combined with extensive ad inventory from Turner’s cable networks and AT&T’s pay-tv services. A name for this company will be announced in the future”.*

From the wide array of business operations of at&t, it is no surprising that the company mentioned sixteen different ecosystem archetypes as captured in their press releases and summarized in Table 10.

**Table 10. Summarized data of AT&T’s ecosystem archetypes**

AT&T ecosystem archetypes	Archetype Size	Leading	Complementing	Participating
Innovation ecosystem	14	13	1	0
mobile ecosystem	11	11	0	0
Technology ecosystem	6	6	0	0
Platform ecosystem	6	5	1	0
Others (comprises of 12 archetypes)	27	16	10	1
Total size	64	51	12	1

As a telecommunication and technology company, innovation becomes a success factor as shown from table 10 that the company’s innovation ecosystem records the most mentioned ecosystem archetype in the press release. Also, as the company competes in the mobile phone industry, the

mobile phone ecosystem archetype which has a direct link with technology are also mentioned frequently and falls within the top four mentioned ecosystem archetype as shown in Figure 14.

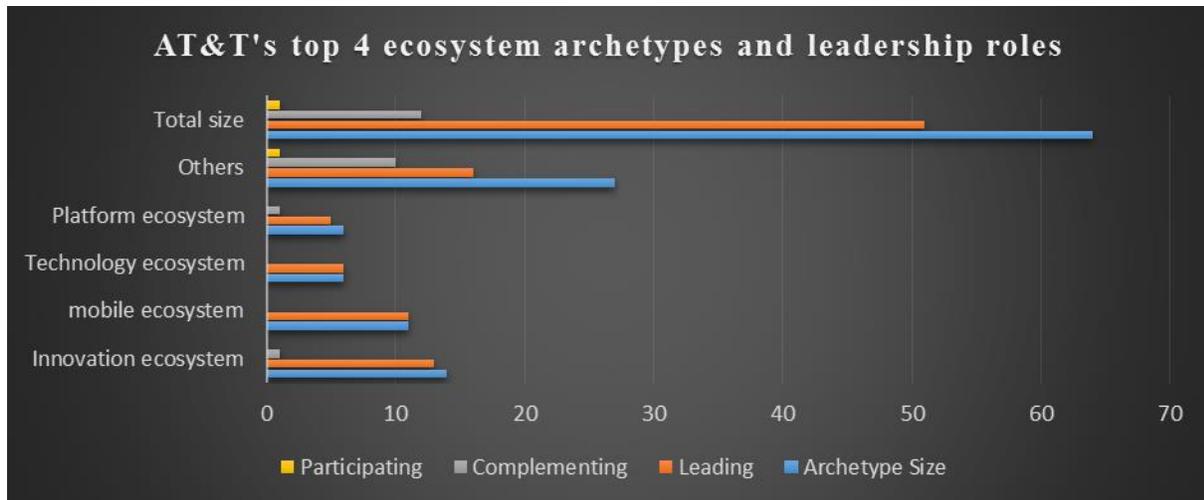


Figure 14. AT&T's top four ecosystem archetypes and leadership roles

**Verizon Communications Inc.**, “Verizon Communications was created on June 30, 2000 by Bell Atlantic Corp. and GTE Corp., in one of the largest mergers in U.S. business history. GTE and Bell Atlantic evolved and grew through decades of mergers, acquisitions and divestitures. Today, Verizon is a global technology company delivering the promise of the digital world to millions of customers every day. Verizon is a global leader delivering innovative communications and technology solutions that improve the way our customers live, work and play”. It has a *mission of “delivering the promise of the digital world by enhancing the ability of humans, businesses and society to do more new and do more good”* (Verizon.com).

The Company, through its subsidiaries, provides communications, information and entertainment products and services to businesses, customers and governmental agencies. Verizon currently offers wireless and 5G technologies. The company believes that with innovations that are supported by a strong technology, the future is no longer an abstract but a reality. The company transforms the way businesses, people and things interact with each other. Verizon also offers broadband and fiber network for communities and large and small business customers. Furthermore, the company also operates in the media and entertainment industry as well as in the internet of things. From driverless cars to smart cities, and from original content to mobile ads

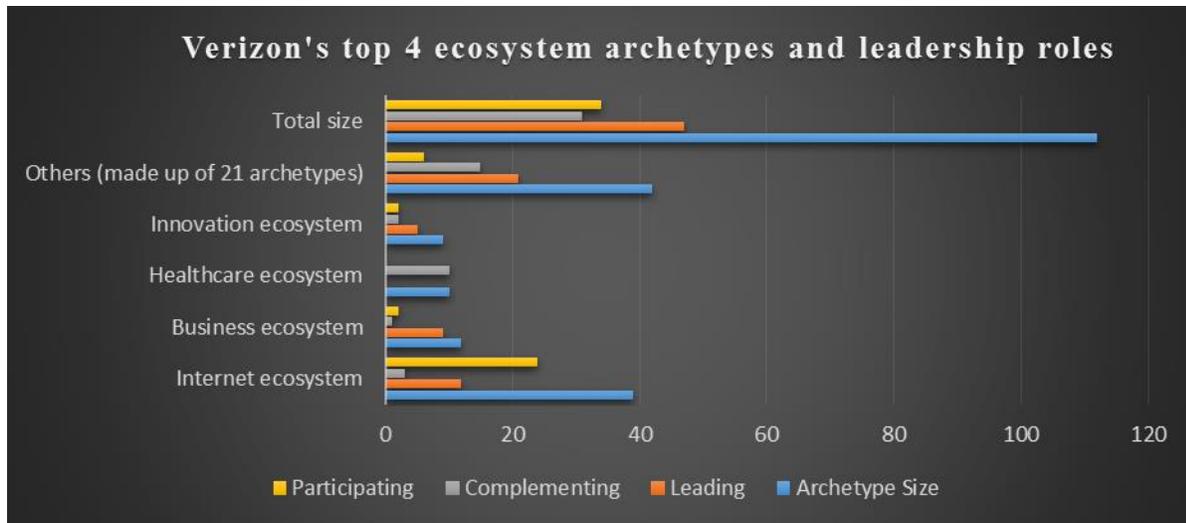
and video, Verizon is changing the way the world thinks and bringing the internet of things to communities, businesses and consumers. As the globe become more interconnected and interdependent than ever, security management is of great importance. The company is therefore helping people and businesses to secure their networks and combat cyber-attacks by proving security management services.

As the company operates in myriads of sectors from telecommunication to agriculture, it mirrors in its press releases as well. The data (see summary in Table 11) shows that Verizon operates in 25 different ecosystem archetypes as identified in their press releases. This variety of ecosystem archetypes makes the size of the ecosystem large as depicted in Figure 15. However, prominent among these various ecosystem archetypes are internet, business, healthcare and innovation ecosystems as shown in Table 11 and Figure 15.

**Table 11. Summarized data of Verizon’s ecosystem archetypes**

Verizon ecosystem archetypes	Archetype Size	Leading	Complementing	Participating
Internet ecosystem	39	12	3	24
Business ecosystem	12	9	1	2
Healthcare ecosystem	10	0	10	0
Innovation ecosystem	9	5	2	2
Others (comprises of 21 archetypes)	42	21	15	6
Total size	112	47	31	34

Verizon’s business markets include United States-based small and medium business customers, state and local government customers and educational institutions. In essence, the company transforms how people, businesses and things work together (Verizon.com). The figure below shows a graphical representation of how Verizon fared in all ecosystem archetypes identified in their press releases.



**Figure 15. Verizon’s top four ecosystem archetypes and leadership roles**

**Oracle Corporation (Oracle)**, “incorporated on October 9, 2005, provides products and services that address all aspects of corporate information technology (IT) environments, including application, platform and infrastructure. The Company's businesses include cloud and on-premise software, hardware and services to over 400,000 customers worldwide. Its hardware business consists of two segments, including hardware products and hardware support. Its services business includes activities, such as consulting services, enhanced support services and education services, among others” (2017 annual report). With this array of services provided to over 175 countries across the world, Oracle associates itself with about 27 different ecosystem archetypes per the pronouncements in their press releases. Serving this huge amount of clients worldwide means the company needs strong network. It turns out that among the various ecosystem archetypes identified, Oracle attaches much importance to partnerships as it is the most frequently mentioned among all the ecosystem archetypes identified as shown in Table 12.

**Table 12. Summarized data of Oracle’s ecosystem archetypes.**

Oracle ecosystem archetypes	Archetype Size	Leading	Complementing	Participating
Partner ecosystem	61	61	0	0
Oracle ecosystem	23	22	1	0
Java ecosystem	11	11	0	0
Healthcare ecosystem	5	0	5	0
Others (comprises of 23 archetypes)	34	19	9	6

Total size	134	113	15	6
------------	-----	-----	----	---

Oracle, a global provider of enterprise cloud computing, empowers businesses of all sizes on their journey of digital transformation with consulting, financing, support, and training services. The company provides leading-edge capabilities in three broad segments: software as a service, platform as a service, infrastructure as a service, and data as a service (2017 annual report).

“Oracle Cloud Platform enables developers, IT professionals, and business leaders to develop, extend, connect, and secure cloud applications, share data, and gain insights across applications and devices. Companies can innovate faster, increase productivity, lower costs, and benefit from enhanced security features with the most complete and open platform-as-a-service (PaaS) offerings. Oracle Cloud Platform offers the same capabilities in the cloud and on premises, for the greatest choice and most flexible access” (2017 annual report).

The Company competes with Microsoft Corporation (Microsoft), International Business Machines Corporation (IBM), Intel, Hewlett-Packard Enterprise, SAP SE, Amazon.com, Inc., salesforce.com, inc. and Workday, Inc. Figure 16 below shows the size of Oracle’s ecosystem archetypes as compiled from their data.

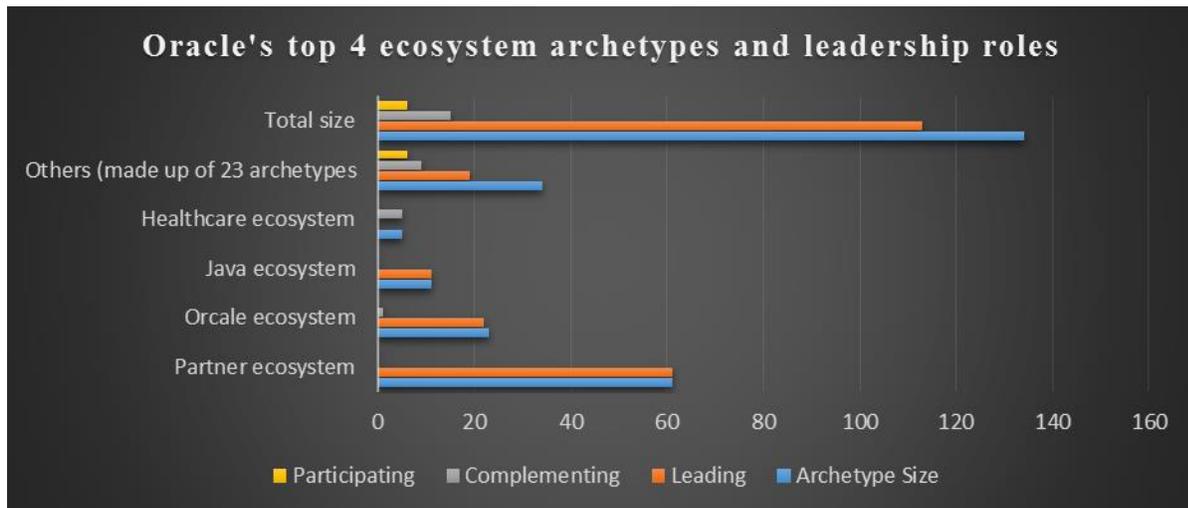


Figure 16. Oracle’s top four ecosystem archetypes and leadership roles

**Microsoft Corporation**, was founded in 1975 and present in over 190 countries worldwide. Microsoft is a technology firm with a mission of empowering people and organizations on earth

to achieve more through the strategy of building the best-in-class platforms and productivity services. The company works towards creating growth, opportunity and impact locally in every country worldwide (Microsoft 2017 annual report).

Microsoft main business operations is into developing, licensing, and supporting myriads of software products, services, and devices with the aim of providing new opportunities, greater convenience, as well as enhancing value in people’s lives. Their host of services provided help drive large business competitiveness, public-sector efficiency as well as the productivity of small businesses. The company is also into supporting new start-ups, improving both the educational and health sectors, and empowering human creativity. Microsoft’s energy is geared towards three thematic segments:

- Reinventing productivity and business processes.
- Building the intelligent cloud platform.
- Creating more personal computing.

These divisions of segments help the company to align its strategies and objectives across the development, sales, marketing, and services organizations. It also serves as a framework for the allocation of resources within businesses timeously (Microsoft 2017 annual report).

The business operation of the company is manifested in Microsoft’s press releases. Data from the company’s press releases (Table 13) captured as many as 46 different ecosystem archetypes. These archetypes ranges from IT, healthcare, media to finance etc. The data also shows that, Microsoft needs a wide range of partners to enable it carry out its mandated mission of empowering every individual and every organisation on the surface of the planet to achieve more. Partner ecosystem is the most mentioned of all the archetypes identified in the press release with 181 counts as shown in Table 13.

**Table 13. Summarized data of Microsoft’s ecosystem archetypes**

Microsoft ecosystem archetypes	Archetype Size	Leading	Complementing	Participating
Partner ecosystem	181	168	8	5
IT ecosystem	56	1	10	45
Microsoft ecosystem	31	31	0	0
Windows ecosystem	20	20	0	0

Others (comprises of 42 archetypes)	124	41	72	11
Total size	412	261	90	61

From the above Table and in Figure 17, it can be seen that partners form the backbone of Microsoft’s operations accounting for almost half of the total size of ecosystem archetypes. As these partners are scattered worldwide, Microsoft needs to create strong IT system as it turns out to be the next frequently mentioned ecosystem archetype. The Figure below gives a pictorial view of Microsoft’s ecosystem size on the bases of the archetypes identified in their press release and the leadership roles they played.

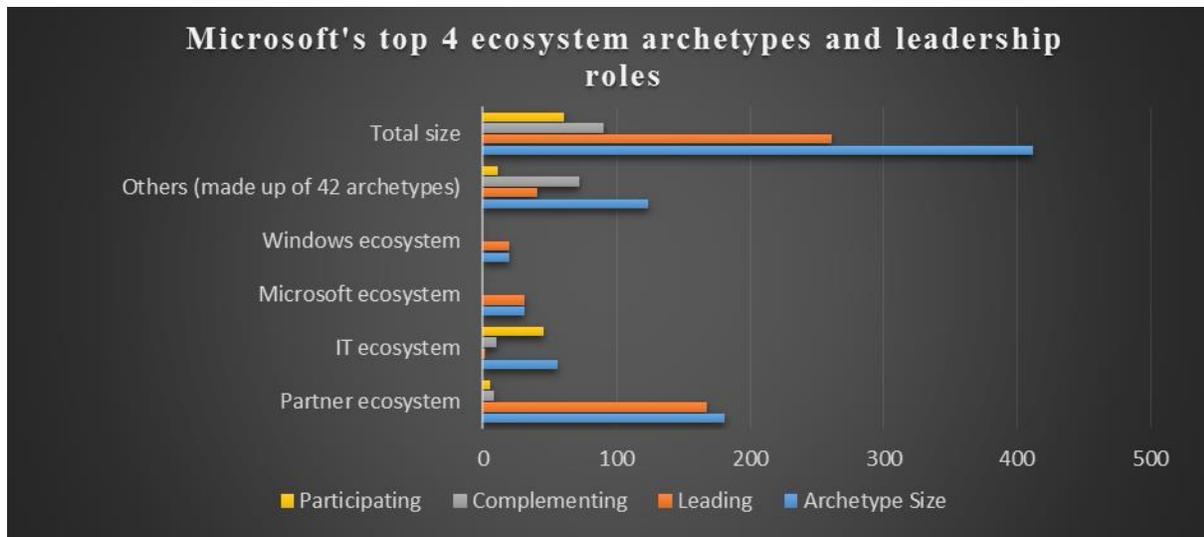


Figure 17. Microsoft’s top four ecosystem archetypes and leadership roles

### 5.3 Ecosystem Strategies and Leadership Roles

Under this section, the various strategies adopted by the case firms are discussed. This discussion is done taking into account the business operations outlook and evaluation metrics identified in Tables 6 and 7 respectively.

**Amazon** adopts a hybrid strategy: keystone and dominator strategies. The data showed that, Amazon is operation in eight different ecosystem archetypes and leading in all of them. The company is neither complementing nor merely participating in the ecosystems, instead, Amazon is actively taking a commanding lead in all the ecosystem archetypes identified thereby reaping

the most benefits from the ecosystem. The company employs mainly keystone strategies and some form of dominator strategies in its role as a focal firm. These strategies are buttressed by pronouncements in the press release as part of the company's strategic goal. For instance, among its strategies is *"to continue to build a commanding lead in the android tablet space by design a groundbreaking device that packs both hardware innovation and customer obsession into affordable prices"* (Amazon.com press release, 10.16.2013). Furthermore, strategic goal such as *"to push the boundaries of hardware, software and content for readers"* (Amazon.com press release, 09.03.2013), illustrates determination and dominance in the leadership role. In these two statements, other members are not given a chance to be at the forefront of the design and marketing of the products.

However, unlike a typical dominator who practically drains all the "nutrients" of the ecosystem to itself and leaving the rest of the ecosystem members with little or no nutrients to survive on, Amazon shares parts of the value it creates and therefore promotes innovation and business activities of the other members of the ecosystem. For instance, it was mentioned in the company's press release that, among the strategic goals of the company is to: *"to provide the application and environment for enterprises to innovate faster cut costs and standardize their use of aws across their whole IT landscape. with sap business suite running in production on aws enterprises can take advantage of the aws pay-as-you-go model to run their applications securely quickly and cost-effectively paying only for the resources used"* (Amazon.com press release, 11.15.2012). In addition, the company mentioned that among its strategic goals is *"to invest in innovations that empower customers, developers and others to unleash their creativity"* (Amazon.com press release, 06.18.2014). Similarly, the company mentioned in their press release that *"we are excited to help even more businesses innovate faster accelerate their pace of technology delivery and save money by either migrating their existing systems to the cloud or starting fresh with aws-powered environments"* (Amazon.com press release, 12.14.2011). Thus, Amazon as a keystone is committed to fuelling *"innovation and further accelerate the pace of new discoveries. working to lower the barriers to entry level the playing field and make it possible for our customers to be successful based on their ideas not on their resources"* (Amazon.com press release, 12.04.2008). Furthermore, the company does not only provide platforms and tools for other members to innovate, instead, it also takes active role in the

innovation itself and creating and contributing more value to the overall ecosystem. For example, the following strategic goals of the company buttresses this claim: *“offer customers with innovations supported by incredible reliability and amazon’s unmatched content ecosystem”* (Amazon.com press release, 09.17.2014). *“To innovate at an unbelievable speed bringing together both the combinations of hardware and customer obsession into an unbeatable price”* (Amazon.com press release, 11.12.2013).

Also, the company engages in several ecosystem archetypes. Chiefly among the ecosystem types found in Amazon’s press releases are *Content ecosystem, Amazon end-to-end ecosystem, Partner ecosystem and Innovation ecosystem*. As a retail company, having a wide variety of products is a key to success. It is not surprising that content ecosystem forms one of the top four ecosystem archetypes found in the company’s press release. The company strives to ensure that there is wide variety of products on its platform at affordable prices and convenience. This strategy is evident as mentioned in one of several strategic goals of the company is to *“continue to offer our customers the best hardware, the best prices, the best customer service, the best cross-platform interoperability and the best content ecosystem”* (Amazon.com press release, 08.30.2012). In another statement, it states that, *“kindle fire provides customers an incredibly large selection of digital content including thousands of exclusives instant access to the most popular apps and games”* (Amazon.com press release, 05.23.2013). However, the company does not just settle on producing variety of contents but also ensuring that, it is of the best quality relative to that of its competitors. For instance, Amazon mentioned that, it will *“continue to provide customers with new content top-rated world-class customer service”* (Amazon.com press release, 09.06.2012).

To achieve the number one spot in the highly competitive digital retail industry, Amazon cannot do it alone without the support of partners. Partners are the backbone of every successful business ecosystem. That is why Amazon regards its partners as crucial to its success. For instance, Amazon mentioned, *“our partners are critical to helping customers run their applications on aws and we will continue to invest in delivering the programs, tools and training to help our partners grow their cloud businesses, differentiate their offerings and drive success for our joint customers”* (Amazon.com press release, 11.12.2013). Therefore, the company strategically chooses partners in different parts of the world to help champion its course and ensure that

Amazon's content reach everywhere. For instance, among such strategic agreements is the Giunti-Amazon agreement. Amazon mentioned, "*The giunti-amazon agreement represents a milestone to advance the bookstore experience for our customers and promote reading in Italy in any possible format. Amazon and Giunti share the same core values customer obsession and a passion for reading with its 170 bookstores. Giunti is the ideal partner for amazon to help Italian readers discover the benefits of digital reading*" (Amazon.com press release, 05.09.2014).

In view of the importance of partners to Amazon's success, the keystone commits to the investment, training and developing these partners and regard them as assets. For instance, Amazon mentioned that, among its strategic goal is "*to more than double our investments in our apn partners with the most significant set of updates, enhancements and new benefits to the apn. Since its inception, we are very excited to work with our ecosystem to help our partners grow their businesses, differentiate their offerings and drive success for our joint customers*" (Amazon.com press release, 11.12.2014). Furthermore, because amazon is not a technology company, it needs strong technology to support its platform in order to achieve its mission statement "*we strive to offer our customers the lowest possible prices, the best available selection, and the utmost convenience*" (Amazon.com 2017 annual report). In view of this, Amazon strategically collaborates with two of the world's powerful software and technology companies, *Oracle and Microsoft* as shown in Figure 18. Although these two companies are competitors to each other, strategically, Amazon stands to benefit the best service from each of them as each compete to provide the best of services to Amazon in order to continue to be Amazon's partner and also gain competitive advantage. This smart move by Amazon is also to ensure that, the platform always has a backup should a technology support system of Microsoft fail for instance, Oracle is there to keep the platform up and running, thus mitigation and minimization of risk. In addition, these two technology giants are also keystones with lots of partners, by collaborating with them; Amazon stands the chance of extending their contents to external platforms thereby widening the availability and reach of its contents. For instance, in the case of Microsoft, Amazon mentioned that as part of its strategic goals is to "*make the best content selection along with all of the benefits of the kindle ecosystem available on windows 8 and other apps*" (Amazon.com press release, 10.25.2012).

**Table 14. Summary of Amazon’s leadership role in its top four ecosystem archetypes**

Case A	Content ecosystem	Amazon end-to-end ecosystem	Partner ecosystem	Innovation ecosystem
Role	Keystone & dominator	Dominator	Keystone	Keystone and Niche creation
Degree of orchestration	High	medium	High	High
Strategies	Availability, convenience and affordability	Quality, convenience and cost-efficiency	Collaboration and strategic partnerships	providing solid applications and supporting environment, investment in training and development of partners, designing breakthrough tech, pay-as-you-go pricing model, lowering barriers to entry

**General Electric** employs multiple strategies in its leadership role. The results of the data analysis show that, the company operates in 13 different ecosystem archetypes as gathered from their press releases. As discussed earlier in the literature review, each leadership role requires different strategies Panetta (2017). Consequently, in all the 13 different ecosystem archetypes identified, GE played the role of a keystone most of the times as onetime complementing and some other times only participating in the ecosystem without playing an active role. GE in its role as a keystone adopts strategies to strengthen and empower the ecosystem members, thus ensuring a healthy ecosystem. According to Iansiti and Levien (2004), keystone strategy on productivity seeks to “*enhance productivity by simplifying the complex task of connecting network participants to each other, and by making the creation of new products by third parties more efficient*” (Iansiti and Levien, 2004). This is evidenced in GE’s press release where GE mentioned that it “*aims to reduce the digital divide between new hospitals in emerging markets and those in mature markets providing every hospital with the same opportunity to improve the way healthcare is delivered*” (GE.com press release, 02.24.2009). In another pronouncement, the company states that, it is part of its strategies “*to develop a vibrant eco-system with many water players both foreign and local so as to build up a full range of R&D capabilities and transform innovative concepts into products and solutions that will address real world demands*” (GE.com press release, 09.21.2006). To achieve this, the company enters into partnership with

complementors and other key stakeholder such as HCL technologies, Aspetar Hospital in Qatar and the Qatar Foundation to improve healthcare delivery. This type of collaborations is necessary for GE to achieve the aim mentioned above.

GE mentions in its press release that “*improving the quality of healthcare through innovative collaboration*” (GE.com press release, 12.08.2011) is necessary. This indicates the importance of partnership and collaboration in the success of a keystone. GE has mentioned a couple of times in its press release that it aims to lead in developing new or improving existing technology but admits it cannot achieve that without collaborating with external partners. For instance, the data revealed that GE strives to lead the “*next manufacturing revolution through innovative hardware material and process advancements by collaborating with external innovators and partners*” (GE.com press release, 06.11.2013). Thus, “*collaboration feeds innovation*” (GE.com press release, 10.28.2014). Collaboration and partnership supports GE’s ecosystem productivity and robustness. Through partnership and collaborations, GE is able “*to bring its equipment to the customers so they don't have to wait for a trade show to see it*” (GE.com press release, 04.15.2013). Thus “*connecting productivity with care*”, (GE.com press release, 04.15.2013). Put together, GE’s keystone strategy is to “*deliver high performance control solutions that can be developed, deployed and maintained with GE's new collaborative cloud-based automation platform -- delivering true integration*” (GE.com press release, 07.17.2012). The hall mark of a keystone strategy is to “*develop a vibrant eco-system with many water players both foreign and local so as to build up a full range of R&D capabilities and transform innovative concepts into products and solutions that will address real world demands*” (GE.com press release, 09.21.2006).

Furthermore, as part of GE’s strategy, the company sometimes enters into partnership not to lead, instead to complement the other partner’s main product. This indicates that, as keystones, one could also develop complementary products for its own keystone product as well as for other ecosystem members’ main products. This is a surviving strategy so that in the event that the keystone’s product is obsolete or over taking by competition, there is always something to fall on while working towards innovating another sustaining product. For instance, in one of the company’s press releases, it stated that “*GE today signed a collaboration proposal cp to explore*

*the development of bioprocessing manufacturing capability and expertise at bio-xcell 's biotechnology park, malaysia 's premier biotechnology park and ecosystem for industrial and healthcare biotechnology”* (GE.com press release, 10.21.2013). Here, GE is considered to be complementing Malaysia’s biotechnology ecosystem. In addition, GE adopts strategies that promotes niche creation. For instance, in a press release GE entered into a partnership “*to build a full-fledged ge technology center and office in dhahran techno-valley aligned with the kingdom’s vision 2020 which aims to boost saudi entrepreneurship, manufacturing and exports to accelerate diversified and sustained economic growth”* (GE.com press release, 01.08.2013). This is to promote the economic growth of the Kingdom of Saudi as captured in the press release that “*The saudi ge innovation center will collaborate with partners customers key think tanks and academic institutions to promote the country 's innovation ecosystem”* (GE.com press release, 01.08.2013). Similarly, GE mentioned that, it is part of its strategies “*to help start-ups develop next-generation energy technology”* (GE.com press release, 01.27.2011).

GE competes in an industry where there are big players such as Siemens, 3M, United Technologies Corporations and Emerson. In such highly competitive industry, a keystone needs to deploy strategic moves in other to continue to be a leader in such turmoil ecosystem. From the data analysis, GE has adopted four main strategies to maintain its lead in the industry:

Differentiation- As part of GE’s strategies, the company attracts target customers to its specialized and unique technologies and products. The company differentiates its technologies from that of competitors. GE mentioned in the press release that it will “*invest sgd 130 million over the next 10 years to establish a world-scale ge water process technologies global r d centre in singapore comprising five centers of excellence”* (GE.com press release, 09.21.2006). In a similar pronouncement, GE commits to “*continue leveraging the vibrant ecosystem in Singapore to commercialize the innovations from the water r&d center including the use of singapore to test-bed and demonstrate new-generation water technologies”* (GE.com press release, 03.19.2009). Heavy investments in R&D enables the company to develop new and unique technologies and products with a cutting-edge functionality. This sets the company apart from its competitors and position it strongly in the industry.

Variety and diversity- Offering myriads of products and technologies (new product development) to different market segments. This strategy ensures that sales is maximized. Thus, the larger customer base the company has through operating in different market segments, the more sales it will make which will sustain the ecosystem financially. For example, the following excerpts from the company's press release supports this strategy: *"Today GE announced new offerings from its 2b software investment targeting the rapidly emerging market for integrated care solutions. These new offerings combine software services and a broad ecosystem of partners to help healthcare delivery organizations reduce both clinical and financial risk while positively impacting the quality of care. Additionally, today ge healthcare announced an expanded approach to population health by leveraging its relationship with Caradigm, a population health company formed by ge healthcare and Microsoft in 2012"* (GE.com press release, 02.24.2014). In another statement, GE intelligent platforms *"announced the premier integration program designed to enable customers to acquire complete integrated systems while reducing development expense and minimizing time-to-market. the first two members of the program are elma electronic inc. and nei, who bring substantial design development and integration skills and experience to the commercial/ microtca and telecommunications/advancedtca markets respectively"* (GE.com press release, 04.27.2010).

Market penetration- GE uses market penetration strategy to ensure that it increases its customer base in existing markets by improving the efficiency and innovating better technologies to customers. This can be inferred from the company's pronouncement that it is *"committed to bringing the most advanced processor technology and leading edge performance to its customers"* (GE.com press release, 03.02.2011).

Diversification- Another strategy identified in the analysis is that, GE seeks growth not only in one specialization or segment but rather, through different sectors. For example, the company invests in energy technologies, healthcare, aviation, electric lighting and transportation (electric cars). These are different sectors which each requires expertise and R&D investments; however, the company is committed to embarking on such strategy. This strategy of diversification also creates "enough food" for the ecosystem members and ensures niche creation and attraction of complementors. The following statements from the press release buttresses the strategies on

diversification: “GE today unveiled its new Saudi ge innovation center, the first milestone that is part of the us 1 billion investment commitment announced by the company last year aimed at fostering home-grown innovation. The 2,200 sq meter Saudi GE innovation center in Dhahran techno-valley will work closely with customers on addressing the kingdom’s priorities in creating more energy efficient and affordable healthcare solutions. The Saudi ge innovation center delivers on the strategic agreement signed by ge and king Fahd university of petroleum minerals kfupm in 2011, to build a full-fledged ge technology center and office in Dhahran techno-valley aligned with the kingdom’s vision 2020 which aims to boost Saudi entrepreneurship manufacturing and exports to accelerate diversified and sustained economic growth. The Saudi ge innovation center will collaborate with partners, customers key think tanks and academic institutions to promote the country’s innovation ecosystem” (GE.com press release, 01.08.2013).

**Table 15. Summary of GE’s leadership role in its top four ecosystem archetypes**

Case B	Platform ecosystem	Partner ecosystem	Innovation ecosystem	Electric vehicle ecosystem
Role	Keystone	Keystone and complementor	Keystone and complementor	Keystone and complementor
Degree of orchestration	High	High	High	Medium
Strategies	Differentiation	Market penetration and diversification	Differentiation & diversification	Differentiation & diversification

AT&T is considered overall as a keystone base on the results of the data. However, the results show that, the company engages in multiple ecosystem archetypes as gathered from their press release. In view of this, although the company is a keystone, the results of the analysis indicate that the company sometimes functions as a complementor in their collaborations and ecosystem activities. As a keystone, the data analysis reveals how AT&T rolls out strategies that benefits the overall health of the ecosystem. For instance, AT&T discussed in their press release that, they are committed to operate across the entire mobile ecosystem to meet the demands and needs of customers and the entire ecosystem members. This is captured in the company’s pronouncements where it states that, “our approach is to play across the mobile ecosystem by developing mobile web and app experiences optimized across diverse platforms and carriers. by doing so we are

*able to meet mobile consumer needs expand our reach – and integrate advertising that puts advertisers in the spotlight and provides value to the user”* (AT&T.com press release, 10.08.2009). This is clearly a keystone strategy to create and share value across the entire ecosystem.

As Iansiti and Levien (2004) mentioned, a keystone orchestrates and helps other members of the ecosystem to survive and grow, as the success of the keystone relies on these complementary partners and businesses. AT&T does exactly so as it mentioned in the press release that, they are *“commitment to helping business and organizations of all sizes embrace mobility as mobile applications are becoming mission critical to enterprises and to helping companies to improve customer satisfaction and employee productivity. With the acquisition of incompass wireless we’re strengthening our already strong foundation to enable business model transformation through mobile applications, machine-to-machine solutions and mobile services”* (AT&T.com press release, 11.02.2010). Since the telecommunications industry has one of the widest customer base in the world, it becomes highly impossible for a keystone to reach all of those customers without the help of partners. The onus therefore lies on the keystone to empower, motivate and orchestrate the activities of its partners to reach to those millions of customers. In view of this, AT&T mentioned that, it is their strategic goal *“to encourage developers to use their creativity and technical talent to help at&t’s customers do more with their devices”* (AT&T.com press release, 02.04.2010). Unlike a dominator firm, which mainly consumes the “wealth” of the ecosystem members leaving them with little or no nutrients to survive, the keystone creates value for the members and provides the tools, technology and environment for complementors to innovate and grow their business. AT&T therefore in its role as a keystone, enters into collaborations and partnerships not solely for its benefit but as a win-win for all members of the ecosystem as mentioned in the following press release: *“the agreement highlights how at t is fostering innovation and creating value for enterprise developers and solution providers”* (AT&T.com press release, 12.17.2013).

Although AT&T is a software and telecommunication firm, to maximize its wealth and minimize or mitigate the risk of losing it all should something go wrong (Sargut & McGrath, 2011), the company is seen participating in several industries and multiple ecosystems. However, in such

roles, it seeks to expand its tentacles and play a complementary role since it is not its main area of specialization. The company mentions emphatically in its press release that, “*at&t’s strategy is to extend its core communications capabilities to provide mhealth solutions across the entire healthcare ecosystem*” (AT&T.com press release, 10.13.2010). This is because “*at&t understands the importance of technology in improving healthcare efficiencies and increasing collaboration across the country*” (AT&T.com press release, 02.04.2010) although the healthcare industry is not AT&T’s main sector of operation.

Another interesting finding from the analysis is that, although Verizon Communications is one of AT&T’s biggest competitors, yet they collaborate to innovate and then go their separate ways to market the innovation as shown in Figure 18. In fact, not only does AT&T collaborate with Verizon but collaborates with most software and telecommunications “giants” to chart a better direction for the entire telecommunication ecosystem. In such situation, since most of the players are keystones, they each play a participatory role to forge their strengths, combine resources and ideas, technologies and know. Thus, knowledge creation and information sharing as well as influencing policies and charting a path for the industry becomes the center of such collaborations. This was also made evident in the press release as follows: “*at&t\* orange, telefonica, teliasonera, verizon, vodafone, alcatel-lucent, ericsson, nokia, siemens networks, samsung electronics co. ltd. and sony ericsson have defined the preferred way to ensure the smooth introduction and delivery of voice and sms services on long term evolution lte networks worldwide. The above telecommunications industry leaders have jointly developed a technical profile for lte voice and sms services also known as the one voice initiative. the profile defines an optimal set of existing 3gpp-specified functionalities that all industry stakeholders including network vendors service providers and handset manufacturers can use to offer compatible lte voice solutions*” (AT&T.com press release, 11.04.2009). It was also mentioned that the “*the objective of the initiative is to ensure the widest possible ecosystem for lte and to avoid fragmentation of technical solutions*” “*lte will with this initiative not only serve as a broadband access for increasing data traffic but also for continuing voice and sms services. Network operators will be able to more quickly develop their customized lte ecosystem in collaboration with both network equipment vendors and device manufacturers*” (AT&T.com press release, 11.04.2009). This indicates that, not only is the company interested in innovating new

technologies and building partnerships, but also interested in how its ecosystem absorbs information from the numerous collaborations and evolve through learning.

AT&T employs differentiation strategy as well and regards the success of its ecosystem as a collective effort of all the ecosystem members. This strategy is manifested in the following statement: *“working closely with our ecosystem of enterprise customers and solution providers. We have jointly identified core network capabilities that allow all of us to create differentiated services and solutions,” said Andy Geisse ceo at t business solutions. “We expect our work to result in a proliferation of innovative solutions that will help enterprise customers innovate grow and become more productive.* New jersey-based Ancero a provider of managed services and communications sees AT&T’s api approach as a true enabler for its transformation. *“automating processes using open apis helps us serve our customers faster and with a higher degree of accuracy which not only reduces cost and inefficiency but even more importantly also helps us increase customer satisfaction”* (AT&T.com press release, 09.18.2013).

Following the findings from the analysis, AT&T’s strategies can be categorized under the following four broad headings:

Ecosystem growth through innovations and global presence. The following statements supports assertion: *“At&t is focused on developing industry-specific applications for telepresence across a range of industries — including health care, high-tech, retail and government — to generate new revenue and growth possibilities for businesses while also helping them reduce costs and improve productivity”* (AT&T.com press release, 04.21.2008). Also *“to help electronic manufacturers quickly bring their products to market, creating new business models, offering new pricing structures for customers who purchase emerging devices and continually expanding our mobile network capabilities to support the long-term growth of these devices”* (AT&T.com press release, 01.26.2010).

Enhancement of customer experience through collaborations and network expansion. The following statements from the press release supports this claim: strategy is *“to expand at&t’s lineup of network ready 3g modules by providing consumer electronics and m2m device makers*

*cost efficient alternatives and that includes optimized module pricing with world class support to help them get to market as quickly as possible” (AT&T.com press release, 10.219.2010). It also mentioned that at&t’s strategy is “to reinforce at t’s industry leadership in the business space while conveying a concept central to its customer strategy – namely that its “network” is much more than a physical structure” (AT&T.com press release, 02.02.2011).*

Operational excellence through investment in R&D and human development, strategic partnerships and efficient platform. This strategy can be found in the company’s press release that, *“at&t have remained strategically important to our enterprise m2m customers due to our focus on providing the right combination of product sales expertise professional services hardware and applications to support a global m2m deployment. at t has made and will continue to make significant strategic investments with the world’s finest platform providers” (AT&T.com press release, 02.27.2012).*

Differentiation and diversification. Evidence from the press release shows that *“at&t’s approach is to play across the mobile ecosystem by developing mobile web and app experiences optimized across diverse platforms and carriers. By doing so we are able to meet mobile consumer needs expand our reach – and integrate advertising that puts advertisers in the spotlight and provides value to the user” (AT&T.com press release, 02.27.2012).*

**Table 16. Summary of AT&T’s leadership role in its top four ecosystem archetypes**

Case C	Innovation ecosystem	Mobile ecosystem	Technology ecosystem	Platform ecosystem
Role	Keystone & complementor	Keystone	Keystone	Keystone & complementor
Degree of orchestration	High	High	High	High
Strategies	Ecosystem growth through innovation , diversification and global presence,	Differentiation and strategic partnerships	Operational excellence through R&D investments, innovation and collaboration	Enhancement of customer experience through collaborations and network expansion

Like AT&T, **Verizon Communication** is also a telecommunication company operating in a highly competitive environment. The two biggest telecom companies: Verizon and AT&T compete and cooperate at the same time (see Figure 18). As a keystone, Verizon has a wide range of products and operates in numerous ecosystem archetypes. In fact, the data shows that, Verizon operates in 25 different ecosystem archetypes with myriads of products. This creates value for the ecosystem and ensures ecosystem productivity and robustness. As can be seen in their 2008 press release, this wide range of products earned them an enviable position. For instance, the following statement in the company's press release shows how Verizon strengthens its ecosystem and ensures growth for the entire ecosystem members: *"the strength of Verizon business voice and data portfolio and forward-looking strategy has earned it a leader ranking in a new report by analyst firm idc in its inaugural report. `` idc marketscape U.S. enterprise telecommunications 2008 vendor analysis doc 214572 October 2008 ". idc stated that Verizon business demonstrated the highest ranking in the capabilities criteria scoring highly in all product categories, `` due to its range of services features and clearly developed solutions ecosystem ". `` Verizon has a strong voice and data product portfolio and strategy and is seen as an innovative company when it comes to bringing new services to market " stated the report. For example, idc noted that Verizon business boasts `` one of the leading voip platforms with marketable points of differentiation, " such as the best burstable enterprise shared trunks capability built into the company's ip trunking offering"* (Verizon.com press release, 10.21.2008).

Not only does the company develop wide range of products in this highly competitive industry, Verizon adopts quality in relation to its products, connectivity and infrastructure as a competitive advantage to survive and continue to lead in the telecommunication industry. This quality strategy also earned them recognition by one of the giants (Intel) in computer industry. Verizon mentioned that *"it's no small task to provide the technology engine for one of the world 's leading silicon innovators, our account teams and technical and consultative experts work together to ensure that Intel 's business ecosystem operates reliably and securely so our valued customer can perform to its highest standards"*(Verizon.com press release, 03.05.2010). This hard work paid off when Intel recognized and awards Verizon in the following statement. *"Verizon business has made Intel Corporation's exclusive list of 2009 supplier continuous quality*

*improvement award winners. Verizon business is the only communications service provider among the 10 companies receiving Intel's highest honor reserved for its global suppliers. Verizon business received this year's award for its "extraordinary commitment to quality and exceptional performance" in delivering the advanced communications and it solutions that support Intel's business operations worldwide. Verizon business services enable 80,000 Intel employees in 61 countries to work together with its extended enterprise of customers, suppliers and partners across the globe. Verizon business also received a preferred quality supplier award from Intel for 2008 "Verizon network services consistently exceeded our requirements in 2009" said Chris sellers it service operations director Intel. "The management commitment from Verizon has extended Intel's pursuit of continuous quality improvement through their proactive industry-leading it communication solutions. We are happy to note Verizon as one of our top performing network providers and congratulate them for earning the supplier continuous quality improvement award" (Verizon.com press release, 03.05.2010).*

Furthermore, the company adopts differentiation and diversification strategies to set itself apart in this highly competitive industry. Differentiation ensures uniqueness of products and service while diversification involves the investment in wide range of products and operating in different markets as well as different ecosystem archetypes. Evidently, the data reveals that Verizon invests in different businesses to ensure robustness and sustainability of the ecosystem. For instance, the press releases indicate that Verizon is involved in myriad of business such as machine-to-machine technologies, cloud service, hosting service and a host of other businesses. All of these activities ensure that the keystone is creating enough "food" for the ecosystem members and thereby making the ecosystem healthier. As mentioned "*we are continuing to sharpen our focus on harnessing the power of our advanced technology platforms to deliver industry-specific solutions that unlock productivity and value for our clients, their customers and society*" (Verizon.com press release, 11.27.2012). This makes Verizon a selfless central player is in business not to only make profits for itself but share the success and value to other members of the ecosystem, which includes the society in which it operates. In fact, it was mentioned emphatically in the press release that "*Verizon is one such company having embraced the idea of shared value creation at the c-suite level Verizon announced in its 2011 annual report that it would pursue a "shared success" strategy to grow its business while addressing a range of*

*fundamental social needs*” (Verizon.com press release, 12.16.2013).

In addition, Verizon is seen sometimes complementing as it leads most of the times. The company does that through strategies such as collaborations and forming joint alliances with other key companies. This encourages complementors and builds trust in the keystone and its ecosystem. Verizon assures its complementors that *“as more enterprises embrace the cloud, we are committed to working with our technology providers to develop an ecosystem of cloud-based services that run on Verizon cloud and enhance overall business functions”* (Verizon.com press release, 11.07.2013). They do this by *“... simplifying its relationship with indirect sales channels and the companies that form its extensive technology ecosystem”* (Verizon.com press release, 02.27.2013). Among such numerous collaborations and strategic alliances, it was mentioned that *“to meet the growing demand for video meetings, Telefonica global solutions and Verizon enterprise solutions have joined forces so that Verizon immersive video exchange and Telefonica global telepresence exchange customers can collaborate via cisco telepresence”* (Verizon.com press release, 10.03.2012).

In a similar announcement, it was mentioned that *“verizon digital media services and the platform the leading white-label video publishing company and an independent subsidiary of Comcast today announced a strategic alliance to accelerate major media and pay-tv operators’ plans for multiscreen video delivery”* (Verizon.com press release, 07.31.2014). Elsewhere in the press release, it mentioned that *“health evolution partners and Verizon enterprise solutions have established a strategic relationship to encourage innovation and adoption of connected health information technologies that help drive patient care improvements and better manage costs under a new multiyear agreement announced Monday feb. 6, health evolution partners hep a health care buyout firm and Verizon connected healthcare solutions. The company’s health IT practice group will collaborate to identify and work with companies to spur the development and adoption of advanced it solutions and applications, in areas such as mobile health telemedicine and health data management to help transform health care delivery in the u.s.”* (Verizon.com press release, 02.06.2012). All the above statements indicate how *“Verizon is committed to building strategic relationships”* (Verizon.com press release, 02.06.2012) to help spur the adoption of its products and services as well as functioning as ecosystem leader.

However, the IT industry is characterized with rapid changes in innovations coupled with complex customer demands, hence Verizon mentions in the following statement that: *“planning and preparedness are the best defenses against emergency situations that can impact critical business operations...”* (Verizon.com press release, 09.13.2012). Thus, the company uses *“...risk management and critical business functions and processes identification...”* (Verizon.com press release, 09.13.2012) strategy to maneuver and survive in this complex industry. As Sargut & McGrath (2011) mentioned, to manage ecosystem complexity demands a central player to master the act of mitigating or minimizing risk in such turbulent and volatile environment.

Integration was also identified as a strategy that the company employs to sustain its leadership role. The following statement by the company attest to this strategic move: *“regarding recent strategic moves, verizon last month strengthened its ability to provide fully integrated solutions by creating verizon enterprise solutions, a sales and marketing organization to harness all of verizon 's solutions for business and government customers globally”* (Verizon.com press release, 01.24.2012). As a central player in business, Verizon ensures that its strategies are carved *“to stimulate technology innovation, augment service delivery and accelerate the market adoption of unified computing”* (Verizon.com press release, 02.25.2011), thereby enhancing the management of its ecosystem.

**Table 17. Summary of Verizon’s leadership role in its top four ecosystem archetypes**

Case D	Internet ecosystem	Business ecosystem	Innovation ecosystem	Partner ecosystem
Role	Complementor	Keystone & complementor	Keystone & complementor	Keystone
Degree of orchestration	medium	High	High	High

Strategies	Innovation, enhancing the power of advance technology, providing internet security service	Innovation, quality, providing interoperable technology, diversification, “shared success” and value creation strategy	New product development, differentiation through product and infrastructure quality,	collaborations and strategic partnerships, market penetration, risk management and critical business functions and processes identification
------------	--	--	--	---

**Oracle** operates in a software and technology industry where demand is so high. Few decades ago, software and technology companies used to develop only products and technologies for limited types of devices like supercomputers and personal computers. However, today there are myriads of devices such as GPS systems, video games, robots, smart watches, smart phones, driverless cars and all kinds of smart home appliances that operates on software and technology solutions. In view of that, there is demand to innovate and produce many varied software and technology solutions. To compounded matters is the increase use of wireless network technologies and the internet of things. All of these results in massive demand for software programs. Unsurprisingly, Oracle adopts a strategy of developing many different software. As a keystone, Oracle has succeeded in its leadership role fundamentally on three broad strategies: standardization, IT-to-business alignment (automation) and simplification.

Standardization strategy – As mentioned earlier, having many different software means a company needs to have huge budget for maintaining all this software. As a result, Oracle’s strategy is to help firms reduce cost and increase efficiency and productivity. Hence, Oracle provides standardized products to enhance security, productivity and reduce the risk of incompatibility. This also serves as a competitive advantage to differentiate the company’s product from that of competitors. The following statement shows Oracle’s commitment to standardization and helping customers be more efficient and increase revenue: *“in today’s environment it is critical that healthcare payers focus on increasing revenues and reducing costs while also delivering superior customer service to develop and maintain long-term relationships with customers and members. oracle revenue management and billing for health insurance helps*

*meet this challenge by enabling efficient streamlined processes for billing, payments and collections” (Oracle.com press release, 08.13.2009). Similarly, the following statement “the mobile workforce is a business reality and oracle fusion tap is an example of how oracle delivers mobile and cloud innovations that fundamentally improve productivity...” (Oracle.com press release, 10.02.2012) is an example of how Oracle is helping businesses improve their productivity. This helps businesses to reduce cost effectively as demonstrated in the following press release: "oracle communications services gatekeeper enables network operators to enhance the quality and monetization of their service delivery platforms sdp, cost-effectively scale their third-party developer and partner ecosystems, and rapidly expand their portfolios of revenue-generating communication and data services" (Oracle.com press release, 07.14.2008).*

IT-to-business alignment (Automation). Like any other ecosystem leader, a keystone cannot achieve its mission without the support of partners. As the success of software and technology solutions providers largely depend on technical expertise and marketing, Oracle works to align these two fields and make business transactions more efficient. Oracle demonstrates this strategy in the following press release: *“continuing its leadership and commitment to provide key innovations specifically created for social services agencies, oracle today released the new oracle social services suite that includes updated versions of Oracle’s Siebel crm public sector 8.2 and oracle policy automation 10, one of the first software suites created specifically for social services. the oracle social services suite provides agencies with a complete open and integrated platform for eligibility and case management in order to simplify eligibility determination, increase caseworker efficiency and improve program effectiveness” (Oracle.com press release, 03.31.2010). Oracle is able to archive its leadership success through collaboration with partners around the globe. Not only does this strategy deliver complete and reliable solution but also increases the company’s presence and strengthens its ecosystem. For instance, Oracle mentioned in the following statement categorically that increasing global presence is part of its strategic goal: “oracle’s goal is to establish presence in 15 more tier-2 cities across china in 2006. Our tier-2 city expansion plan is a concrete action taken by oracle to respond to the Chinese government’s effort to 'develop the western region revitalize the central region and empower the northeastern industrial base using it technology” (Oracle.com press release, 03.09.2006).*

To sustain this leadership role and be present in many countries means the company must continue to develop innovative products to meet the increasing demand for software and technology programs. This further creates value for to the ecosystem. Oracle recognizes these opportunities and so the company innovates new products to serve different market segments. The following statements show how important partnership is to the success of Oracle's ecosystem: *"oracle is committed to ensuring that partners get access to the right tools content and resources to help speed time to market. Our expanded line-up of partner-focused events at oracle openworld clearly illustrates the value we place on our partners and their ability to create unique solutions and service offerings for our joint customers"* (Oracle.com press release, 10.17.2006). Interestingly, the analysis of the data reveals that, out of the 27 different ecosystem archetypes identified in the company's press analysis with 134 counts, partner ecosystem alone appeared 61 times, more than half the total ecosystem pronouncements of the company. Indeed, the software and technology solutions industry is an industry with a host of partnership since it is difficult for a single firm to develop all the software and technologies for a modern day products, which requires different software to function.

To begin with, Oracle admits that it cannot be present everywhere in the world except through its partners and cloud strategy. As evidenced in the press: *"there are many corners of the market and globe oracle simply cannot reach. Our success relies on our partners' ability to sell and implement oracle cloud services in the broad market. For this very reason, we continue to invest more resources in helping partners maximize their cloud-based opportunities in turn extending the opportunities for our customers. Our goal is to create the industry's most compelling cloud offering and this agreement represents a significant addition for solution providers seeking to move up the 'stack' and offer saas solutions and applications that address key business needs. Oracle is committed to supporting and leveraging the channel in its cloud strategy"* (Oracle.com press release, 09.29.2014). In fact, it is revealing to know that partners accounts for over 80% of Oracles sales, as mentioned in the following pronouncements, *"globally more than 80 percent of our sales transactions are done by oracle partners. And we welcome this opportunity to share our strategy and direction with them, encourage networking and gain invaluable feedback to keep our collective businesses growing"* (Oracle.com press release, 09.22.2008). These partnerships include Oracle collaborating with competitors to innovate and together develop

solutions to their clients. As identified in the company's profile in the preceding section, IBM is one of the competitors to Oracle, yet the two companies form partnership to innovate and jointly meet the demand to their customers. In the following statement, Oracle entered into a partnership with IBM to *“strengthen its partnership with IBM to position their industry-leading smb reseller channel to promote oracle's JD Edwards applications. Specifically, oracle has increased investment with IBM to jointly deliver JD Edwards solutions to the smb market. the investment will support go-to-market activities for oracle 's jd edwards software products with oracle and ibm sales teams and value-added resellers vars”* the analysis revealed that Oracle is *“continuing its leadership and commitment to provide key innovations specifically created not only for businesses but also for social services agencies”* (Oracle.com press release, 03.03.2006). In addition, certain inter-firm collaborations are strategic to the success of Oracle's business. As stated in the following pronouncement, *“systime is a strategic partner for us and our efforts to co-develop integrations to oracle's agile plm will give JD edwards enterpriseone customers new tools with which to drive product innovation”* (Oracle.com press release, 05.06.2009). Therefore, *“working in close collaboration with dedicated partners like systime we continue to leverage oracle application integration architecture aia to extend the value of our customers' investments. We chose systime due to their industry strength and specialization in oracle's enterprise suite of applications the co-development of this integration will give jd edwards enterpriseone customers new tools to drive product innovation and can also make the full design-to-release process more effective and efficient”* (Oracle.com press release, 02.02.2010).

Simplification- Oracle response to the rising demands for software by ensuring that the solution provided are simple. This also makes it easier for complementors to build on the platform. By so doing, productivity and the overall robustness of the ecosystem is guaranteed. In the following statements, Oracle demonstrates how it uses simplicity as a strategy to function as a keystone: *“oracle resellers want differentiated solutions that can be sold at volume by combining a dramatically simpler user experience with pay-as-you-grow pricing the oracle database appliance plays well in this oracle reseller sweet spot”* (Oracle.com press release, 09.21.2011). Also, *“java embedded technologies are a key component of oracle 's complete 'device to datacenter platform simplifying implementation of machine to machine m2m solutions addressing the strong demand for java in the embedded market”* (Oracle.com press release, 09.25.2012).

Furthermore, Oracle forms partnership with not only keystones such as IBM, but with start-ups and small and medium enterprises. In all these, the company’s goal is to become the leading provider of applications in its field of operation. For instance, the company stated that their “*goal is simple to become the 1 provider of applications to small and medium businesses. The smb business unit will maintain a world-class partner/reseller ecosystem, drive the continued development of product and industry bundles and work to ensure smb customer success*” (Oracle.com press release, 10.23.2006).

**Table 18. Summary of Oracle’s leadership role in its top four ecosystem archetypes**

Case E	Partner ecosystem	Oracle ecosystem	Java ecosystem	Business ecosystem
Role	keystone	keystone	keystone	Keystone and complementor
Degree of orchestration	High	High	High	Medium
Strategies	Collaborating with other key competitors, start-up as well as small and medium enterprises.	Standardization and simplification, middleware	collaboration, innovation and standardization to decrease integration cost between components of different ecosystems	IT-to-business alignment, automation, partnerships, innovation, quality and cost efficiency

**Microsoft** also operates in the software and technology solutions sector and it is classified a keystone based on the data and the level of activities undertaken. Clearly, from the company’s vision and mission statements indicates a mark of a keystone with focus on empowering every business and every individual worldwide. Microsoft’s vision is “*to help individuals and businesses realize their full potential*” (Microsoft.com, 2017 annual report), which is also aligned with their mission “*to empower every person and every organization on the planet to achieve more*” (Microsoft.com, 2017 annual report). In view of this, the company undertakes strategies to achieve its stated vision and mission. To achieve this, Microsoft’s strategy is to “build best-in-class platforms and productivity services for an intelligent cloud and an intelligent edge infused with artificial intelligence (“AI”)” (Microsoft.com, 2017 annual report). Based on the company’s

data, the strategy mentioned in their annual report (2017) can be broken down further into the following strategies:

Product development- In the software and technology sector, the success of a firm lies on number of products and quality. The industry is characterized by intense competition and complex demand. As a result, Microsoft realizes the importance of having presence of products spread across the globe as already embedded in its vision and mission statements. This strategy is substantiated through the following statements: *“Microsoft and its partners are delivering mission-critical solutions focused on four areas new product development performance plant floor operations performance global value chain performance and sales and customer performance”* (Microsoft.com press release, 03.08.2005). As the company operates in several other countries across the globe, Microsoft invests in putting up R&D centers in strategic countries to help in its product development agenda. For instance, in 2008, Microsoft *“announced the launch of its first Microsoft embedded systems development centre mesdc in Aachen Germany. The mesdc is part of Microsoft’s effort to expand regional development centers in Denmark, France, Ireland, Serbia, the U.K. and other countries across Europe. The center will support global product development and drive smart connected service-oriented device development located within the European Microsoft innovation centre emic in Aachen. The mesdc is a significant part of the 75 million u.s. global r d investment that the windows embedded business is making in Europe this fiscal year”* (Microsoft.com press release, 02.26.2008). The purpose or benefit of such investments is to *“support global product R&D, drive development of new and innovative features of Microsoft’s embedded operating systems and accelerate collaboration between the u.s.-based Microsoft product groups and their counterparts in Europe. The mesdc will also support the needs of the active windows embedded customer and partner ecosystem in Europe by engaging with select members of this group to showcase high-visibility embedded systems projects that accelerate embedded development in the enterprise. the mesdc will form an integral part of helping us recruit outstanding embedded systems engineers across Europe to perform product r d and the mesdc located in the emic in Aachen provides a very conducive environment for these engineers to spearhead incubation projects and accelerate technology transfer and collaborative efforts within Microsoft”* (Microsoft.com press release, 02.26.2008).

Diversification- Microsoft also invests in different products and market segments. This creates more value to the keystone and to the overall ecosystem. As a result, more revenue streams are generated which further strengthens the ecosystem. If a company diversifies its resources, it also spreads and reduces the risk of losing it all should there be any market or economic downturn. Hence, Microsoft divides its operations into 5 broad segments namely: **Windows, online services, server software, entertainment and devices and finally Microsoft business** (Microsoft.com, 2017 annual report). In view of this, Microsoft for instance in 2011, *“announced the acquisition of California-based video discovery technology company videosurf inc., founded in 2006. Videosurf offers a back-end computer vision technology that “sees” frames inside videos to make discovering content fast, easy and accurate. Over time Microsoft will integrate this technology across its entertainment platform to augment the Xbox 360 ecosystem and evolve search and discovery of entertainment content on Xbox live”* (Microsoft.com press release, 11.22.2011). This strategic move is to strengthen the entertainment and devices segment of Microsoft. Another evidence is Microsoft’s partnership agreement with Nokia. This strategy allows Microsoft to diversify its resources and technologies and create completely new service offerings as stated by the company. This is evident in their 2011 press release that, *“Microsoft plans to form a broad strategic partnership that would use their complementary strengths and expertise to create a new global mobile ecosystem. Nokia and Microsoft intend to jointly create market-leading mobile products and services designed to offer consumers, operators and developers unrivalled choice and opportunity, as each company would focus on its core competencies. Additionally, nokia and Microsoft plan to work together to integrate key assets and create completely new service offerings while extending established products and services to new markets. Nokia and Microsoft would closely collaborate on joint marketing initiatives and a shared development roadmap to align on the future evolution of mobile products. Bing would power Nokia’s search services across nokia devices and services giving customers access to Bing’s next generation search capabilities. Microsoft adcenter would provide search-advertising services on Nokia’s line of devices and services. Nokia maps would be a core part of Microsoft’s mapping services for example maps would be integrated with Microsoft’s Bing search engine and adcenter advertising platform to form a unique local search and advertising experience. Microsoft development tools would be used to create applications to run on nokia windows*

*phones allowing developers to easily leverage the ecosystem's global reach*" (Oracle.com press release, 02.11.2011).

Differentiation- Engaging in new product development as well as diversification puts Microsoft on a comfortable pedestal to differentiate its products from that of competitors. This also enhances the fulfilment of the company's vision and mission of capturing global presence. As mentioned in the company's press release, "*Microsoft and its industry partners deliver differentiated business solutions that enable high-tech and electronics manufacturers to optimize their global value chains drive innovation build high-value connections with partners and suppliers and implement innovative solutions*" (Oracle.com press release, 10.25.2009). This strategy makes the company and its products more attractive to the ecosystem members and customers. This strategy has worked well for Microsoft and built brand loyalty for the technology giant. By differentiation, Microsoft is able to gain competitive advantage over its competitors. Partners are also able to differentiate their offerings based on the products and services rendered by the keystone. For instance, Microsoft mentioned in their press release that they are "*excited to work with SanDisk on this next-generation experience which will allow hardware manufacturers to better differentiate their products and provide an even richer software and services experience for customers*" (Oracle.com press release, 05.11.2007).

Partnerships and alliance- The data also shows that, for Microsoft to succeed as a keystone, it must have to do that through the collective efforts of its partners. Microsoft recognizes the significance of partnership in achieving its vision and mission. As such, out of over 50 different ecosystem archetypes identified in the company's press release with over 400 counts, partnership alone accounts for about half of the pronouncements. This indicates how relevant partnerships and collaborations are to the success of Microsoft. Through partnerships across the globe, Microsoft is able to penetrate the market as well as offer operational excellence due to the myriads of expertise, technologies, resources and synergy of the ecosystem members. As mentioned in the press, Microsoft "*stands resolute in our mission to improve our tools and platform partner with leading tools vendors and provide a wealth of resources to ensure that developers remain at the forefront of technology innovation*" (Oracle.com press release, 02.07.2005). As a keystone, the data revealed that Microsoft has used licensing extensively in its

partnership agreement. This form of partnership creates niche and help strengthen the technologies and operations of the partnering firm. In one of the company's pronouncements, the company discussed that *"Microsoft corp. and onkyo corp. have signed a broad patent cross-licensing agreement that will enable significant technological innovation in high-quality home, entertainment, and enhance the overall user experience. The agreement covers a broad range of consumer products and allows greater mutual access to each partner's respective patent portfolio. The intellectual property ip collaboration between Microsoft and Onkyo, which recently acquired japan-based pc manufacturer Sotec co. ltd., will contribute to the production of high-quality hardware and versatile reliable software technology. Consequently, this will further promote seamless integration and accelerate innovation in consumer audiovisual a/v electronics personal computing and home theater custom installation markets"* (Oracle.com press release, 03.20.2008). Microsoft's wide spectrum of partner ecosystem strengthens the company's brand visibility.

Microsoft therefore creates value for the ecosystem, which contributes to the overall health and growth of the ecosystem. Partnerships and licensing agreements allow firms to share information and technologies because it affords each partner the opportunity to tap into the resources of each other. In the following statement for instance, *"Microsoft corp. and pioneer corp. signed a patent cross-licensing agreement that furthers the development of each company's product lines and will expand technological innovation to enhance the overall customer experience. The agreement allows greater mutual access to each partner's respective patent portfolio. The agreement recently signed by representatives of both companies expands the relationship between Microsoft and pioneer to promote the incorporation of patented technologies in their respective products although the contents of the agreement including the specific financial terms are confidential the parties indicated that Microsoft is being compensated by pioneer"* (Oracle.com press release, 09.16.2008). Thus, *"agreements like this allow companies around the world to access our rich research and development and patent portfolio and create cutting-edge technologies that benefit their value proposition to customers"* (Oracle.com press release, 06.16.2008). As eloquently captured in the company's press release, Microsoft mentioned that this technology licensing strategy *"demonstrates Microsoft is implementing a policy of providing a broad range of industries with access to its technology with the aim of contributing to the advance and growth of*

other industries and their technology. This agreement with fast is an example of how Microsoft is committed to licensing its intellectual property portfolio to benefit customers and the IT ecosystem as a whole” (Oracle.com press release, 06.16.2008).

All of the above strategies demonstrates Microsoft’s goal of ecosystem leadership as shown in Table 14. Thus, Microsoft demonstrates its commitment to delivering innovative technologies geared towards helping businesses, partners, start-ups and customers. Evidence from the press release shows Microsoft’s “continuing efforts to provide companies startups and businesses around the world with access to cutting-edge technologies developed in Microsoft research labs this type of collaboration also adds value to a healthy it ecosystem and helps create local economic development opportunities” (Oracle.com press release, 06.16.2008).

**Table 19. Summary of Microsoft’s leadership role in its top four ecosystem archetypes**

Case F	Partner ecosystem	Microsoft ecosystem	Windows ecosystem	Business ecosystem
Role	keystone, complementor and participation	keystone and participation	keystone and complementor to its own product	keystone and complementor
Degree of orchestration	High	High	High	High
Strategies	Licensing, acquisition, patent and inter-firm collaborations with several actors both complementors and major keystones	Innovation, new product development, open ecosystem, third party system integrators and independent software developers build complements on keystone’s platform	innovations, variety of products, pricing model, security and convenience, developing complementary products for its own key product	innovation, investment in new product design, providing cutting-edge technology to companies, start-ups and businesses around the globe, collaborations, open ecosystem and engagement with third parties

From the above Table, Microsoft demonstrates high degree of orchestration in all of its four top most ecosystem archetypes. Its host of partnerships makes information flow very easy and accessible. The company played multiple roles although it is touted as a keystone, it doubled

played the role of complementor and participatory role in some cases. Table 20 below shows glimpses of case firms' leadership activities undertaken to champion the course of their ecosystems. The leadership activities presented in Table 15 gives a picture of what these central players are doing to ensure they stay relevant in their ecosystems as well as the industry in which they operate. I selected three activities each from the case companies at random. The idea for the random selection of activities is to appreciate whether at any given time a central player is engaged in activities and decisions to promote the general good of the ecosystem. Hence, I also capture motivations (strategic goals) behind the activities undertaken. Subsequently, I tried to separate the direct beneficiaries of the said activities from the general or overall good (if any) of the case companies' activities.

**Table 20. Glimpses of the six case firms' leadership activities**

Activities	Strategic goal	Direct beneficiaries	Overall benefit
Amazon			
<p>Providing access to a centralized repository of public data sets that can be seamlessly integrated into aws cloud-based applications (Amazon.com press release, 12.04.2008).</p>	<p>Hopes to fuel innovation and further accelerate the pace of new discoveries. working to lower the barriers to entry level the playing field and make it possible for our customers to be successful based on their ideas not on their resources</p>	<p>U.S. census bureau, Indiana university, bureau of economic analysis and ensemble (Amazon.com press release, 12.04.2008).</p>	<p>Growing the number of people with access to important and useful data and making it easy to compute on that data with cost-efficient services (Amazon.com press release, 12.04.2008).</p>
<p>Amazon coins is the latest offering in an array of services that make amazon the most complete end-to-end ecosystem for building monetizing and marketing their apps and games (Amazon.com press release, 05.13.2013).</p>	<p>To enable developers to reach millions more amazon customers worldwide in-app purchasing on kindle fire mac pc and web-based games (Amazon.com press release, 05.13.2013).</p>	<p>Developers- it's another opportunity to drive traffic, downloads and increased monetization (Amazon.com press release, 05.13.2013).</p>	<p>Amazon coins is an easy way for customers to purchase apps and in-app items on kindle fire. It's also an opportunity for customers to save money on their app and game purchases (Amazon.com press release, 05.13.2013).</p>

<p>Amazon is adding all seven Harry Potter books in English, French, Italian, German and Spanish to the Kindle Owners' Lending Library. The Harry Potter series is the all-time best-selling book series in history and Amazon has purchased an exclusive license from J.K. Rowling's Pottermore to make the addition of these titles possible. The Kindle Owners' Lending Library now features over 145,000 books to borrow for free including over 100 current and former New York Times best sellers. This is the kind of significant investment in the Kindle ecosystem (Amazon.com press release, 05.10.2012).</p>	<p>To eliminate the barriers that are associated with traditional library lending (Amazon.com press release, 05.10.2012).</p>	<p>Pottermore - Adding an innovative feature that's of great benefit to the Amazon content ecosystem for popular titles like Harry Potter - unlimited supply of each title - you never get put on a waiting list thereby getting access to a wider market and customers (Amazon.com press release, 05.10.2012).</p>	<p>Over a year borrowing the Harry Potter books plus a handful of additional titles can alone be worth more than the 79 cost of Prime or a Kindle, thus customers get to save cost. The Kindle Owners' Lending Library also has an innovative feature that's of great benefit for popular titles like Harry Potter - unlimited supply of each title - customers never get put on a (Amazon.com press release, 05.10.2012). waiting list</p>
---	---	---	---

Activities	Strategic goal	Direct beneficiaries	Overall benefit
General Electric			
<p>GE announced today a structured partnership to enable service offerings for all aspects of their healthcare IT lifecycle -- planning, deployment, customization and ongoing maintenance (GE.com press release, 02.24.2009).</p>	<p>Aims to reduce the digital divide between new hospitals in emerging markets and those in mature markets providing every hospital with the same opportunity to improve the way healthcare is delivered (GE.com press release, 02.24.2009).</p>	<p>HCL technologies, Aspetar Hospital in Qatar and the Qatar Foundation (GE.com press release, 02.24.2009).</p>	<p>This initiative will provide rapid deployment low-cost licensing and an expanded ecosystem (GE.com press release, 02.24.2009).</p>

<p>GE healthcare is bringing together some of the industry 's leading authorities to address one of the industry 's toughest challenges -- building viable and sustainable business models that will support post-stimulus health information exchange. GE healthcare 's global eHealth solutions business is presenting a full day of thought leadership interactive discussion and best practices regarding the development of sustainable business models for hios and hies (GE.com press release, 06.08.2010).</p>	<p>To address one of the industry's toughest challenges - building viable and sustainable business models that will support post-stimulus health information exchange (GE.com press release, 06.08.2010).</p>	<p>Massachusetts eHealth collaborative, eHealth initiative city of Washington dc, office of the national coordinator for healthcare IT, NY state office of health information technology transformation, Boston Consulting Group, healthbridge hie, clinical informatics research and development partners healthcare system Boston, Boston Medical Centre (GE.com press release, 06.08.2010).</p>	<p>Improve healthcare productivity, reduce waste and unnecessary costs, create new care access and improve care decisions (GE.com press release, 06.08.2010).</p>
<p>GE unveiled its new Saudi GE innovation centre, the first milestone that is part of the US 1 billion-investment commitment announced by the company last year aimed at fostering home-grown innovation. The 2,200 sq meter Saudi GE innovation centre in Dhahran techno-valley will work closely with customers on addressing the kingdom's priorities in creating more energy efficient and affordable healthcare solutions (GE.com press release, 01.08.2013).</p>	<p>To build a full-fledged ge technology center and office in Dhahran techno-valley aligned with the kingdom's vision 2020, which aims to boost Saudi entrepreneurship, manufacturing and exports to accelerate diversified and sustained economic growth (GE.com press release, 01.08.2013).</p>	<p>King Fahd University of Petroleum Minerals kfupm, partners, customers, key think tanks and academic institutions (GE.com press release, 01.08.2013).</p>	<p>The center highlights ge 's country partnerships and capabilities as well as examines key trends and issues in various sectors including energy, aviation and healthcare. It will also serve as an ideas incubator for ge and its partners to work together, share knowledge, collaborate and co-create -- thus building localized solutions (GE.com press release, 01.08.2013).</p>

Activities	Strategic goal	Direct beneficiaries	Overall benefit
AT&T			
<p>At&amp;t today announced global plans to deliver the industry's first fully managed cisco telepresence solution that allows companies to connect to their customers, suppliers and partners worldwide. The new offer — at&amp;t telepresence solution — is a highly scalable solution that creates unique 'in-person experiences with the simplicity of a phone call (AT&amp;T.com press release, 04.21.2008).</p>	<p>At&amp;t is focused on developing industry-specific applications for telepresence across a range of industries — including health care, high-tech, retail and government — to generate new revenue and growth possibilities for businesses while also helping them reduce costs and improve productivity (AT&amp;T.com press release, 04.21.2008).</p>	<p>Cisco (AT&amp;T.com press release, 04.21.2008).</p>	<p>Today's announcement is the first of what is expected to be many industry-leading innovations to be introduced by at&amp;t and cisco. At&amp;t and cisco have agreed to combine the innovative cisco telepresence solution with at&amp;t's internet protocol ip network and virtual private network vpn capabilities to create new ways for companies to collaborate and conduct global business across industries that will include health care high-tech retail and government. At&amp;t is playing a critical role in the delivery of intercompany cisco telepresence to the more than 750 cisco telepresence room footprint worldwide (AT&amp;T.com press release, 04.21.2008).</p>
<p>AT&amp;T and other major telecommunications industry leaders have jointly developed a technical profile for lte voice and sms services also known as the one voice initiative. The profile defines an optimal set of existing 3gpp-specified functionalities that all industry stakeholders including network vendors, service providers and handset manufacturers can use to offer compatible lte voice solutions (AT&amp;T.com press release, 11.04.2009).</p>	<p>The objective of the initiative is to ensure the widest possible ecosystem for lte and to avoid fragmentation of technical solutions (AT&amp;T.com press release, 11.04.2009).</p>	<p>Orange, Telefonica, Teliasonera, Verizon, Vodafone, Alcatel-lucent, Ericsson, Nokia, Siemens networks, Samsung electronics co. ltd. and Sony Ericsson (AT&amp;T.com press release, 11.04.2009).</p>	<p>This is the most applicable approach to meeting the consumers' expectations for service quality, reliability and availability when moving from existing circuit switched telephony services to ip-based lte services. This approach will also open the path to service convergence, as ims is able to simultaneously serve broadband, wireline and lte wireless networks (AT&amp;T.com press release, 11.04.2009).</p>

<p>At&amp;t* is significantly expanding industry alliances accelerating its platform strategy and fostering an “ecosystem” of innovation to meet business customer demand for highly secure mobility and cloud-based solutions (AT&amp;T.com press release, 09.18.2013).</p>	<p>Seize the opportunities afforded by the emergence of business mobility, security and cloud computing as highly popular industry-transformative technologies. At&amp;t’s strategy for enterprise customers includes deploying its core fiber lte and ip broadband networks to deliver key services such as Ethernet and virtual private networking, differentiating itself by scaling and deploying cloud security, and application interface platforms delivering fully integrated solutions to companies (AT&amp;T.com press release, 09.18.2013).</p>	<p>Industry analysts (AT&amp;T.com press release, 09.18.2013).</p>	<p>Expanded network reach and access across 15 markets in Latin America as a result of enhanced network connectivity with America móvil. AT&amp;T and américa móvil are building on existing capabilities and interconnections to deliver advanced enterprise solutions to multinational companies said it is on schedule to deliver fiber to approximately 250,000 additional business customer locations by year-end 2013. In total, the company plans to reach an additional 1 million business customer locations by the end of 2015. With this program, so far at&amp;t has deployed fiber to more than 5,000 additional multi-tenant office buildings reaching more than 170,000 business customer locations from late last year through august 2013. “there are only a few times when you get to participate in a technology disruption as big as the one we’re currently experiencing (AT&amp;T.com press release, 09.18.2013).</p>
--	--	--	---

Activities	Strategic goal	Direct beneficiaries	Overall benefit
Verizon Communications			
<p>Engineers and equipment makers are gathering in the Verizon technology lab in Waltham and in labs elsewhere in north America and in Asia and Europe to test a new system that enables incompatible services and networks to work together (Verizon.com press release, 10.20.2008).</p>	<p>To create a global ecosystem for testing standards for a variety of service configurations including those developed by the atis iptv interoperability forum iif (Verizon.com press release, 10.20.2008).</p>	<p>Engineers, equipment makers, the national communication system ncs and the unh-iol, British telecom and Vodafone, china mobile (Verizon.com press release, 10.20.2008).</p>	<p>IMS is more than a platform; it is a system that will enable the true convergence of services using some very interesting blends of network and internet functions. At the simplest level contact lists, voice messaging photo files, e-mails and other content or features that currently reside in one place will be universally available regardless of the equipment you are using or network to which you are connected (Verizon.com press release, 10.20.2008).</p>
<p>Financial services firms in Europe can now benefit from a dedicated trading-business infrastructure provided by Verizon that is specifically designed to help the firms share market data and execute timely trades. The Verizon financial services network previously available only to companies in the U.S. is a scalable secure low-latency solution that is designed to facilitate trading and information exchange in global capital markets, where trade-execution speeds are becoming ever more important (Verizon.com press release, 04.21.2010).</p>	<p>To help the firms share market data and execute timely trades (Verizon.com press release, 04.21.2010).</p>	<p>Financial services firms- the solution offers financial services firms such as brokers, hedge funds exchanges, asset managers and pre and post-trade services providers a fully managed highly available scalable interface to the financial ecosystem (Verizon.com press release, 04.21.2010).</p>	<p>Users can simply and seamlessly collaborate with customers and partners, consolidate their market access, distribute services and information, and execute pre-trade trade and post-trade transactions within a secure resilient environment (Verizon.com press release, 04.21.2010).</p>

Verizon is teaming up with non-profit organization stopbadware to help protect internet users from security threats like computer and mobile spyware viruses and other malware during the next three years the organizations will work together on issues ranging from educating small businesses about badware to developing approaches to help smartphone phone users protect their handsets (Verizon.com press release, 03.04.2011).	To help protect internet users from security threats like computer and mobile spyware viruses and other malware. Our commitment extends beyond securing our own network to helping ward off security threats for internet users (Verizon.com press release, 03.04.2011).	NGO- stopbadware, internet users and Verizon itself.	Verizon is aggressively broadening its focus on protecting computer and network-based malware and extending those protections into the mobile world. The company's relationship with stopbadware will bolster this initiative (Verizon.com press release, 03.04.2011).
---	--	--	--

Activities	Strategic goal	Direct beneficiaries	Overall benefit
Oracle			
Announced the creation of a dedicated linux test lab providing a rigorous test environment to further the quality stability and supportability of the operating system (Oracle.com press release, 02.15.2005).	To help oracle ensure that the operating system will be as finely tuned and as dependable as commercially available products (Oracle.com press release, 02.15.2005).	An increasing number of companies are turning to linux to run their mission-critical applications (Oracle.com press release, 02.15.2005).	Bringing linux testing `` in house " helps oracle ensure that the operating system will be as finely tuned and as dependable as commercially available products. As a result of these tests, oracle will be able to fix operating system issues as they are discovered and provide those fixes back to the linux community and operating system partners to ensure a stronger linux release. According to market research firm idc the overall linux ecosystem will grow 25.9 percent annually to reach 35.7 billion in 2008 (Oracle.com press release, 02.15.2005).

<p>Oracle the world's largest enterprise software company today launched oracle marketing ecosystem partnership for marketing agencies (Oracle.com press release, 11.06.2007).</p>	<p>We are enabling marketing agencies and marketing services organisations to take advantage of our established partner programme and a growing demand in the marketing industry for crm solutions that automate campaign execution and provide effective management tools for marketing resource (Oracle.com press release, 11.06.2007).</p>	<p>marketing agencies- marketing agencies joining the oracle partnernetwork opn will have access to opn benefits including sales support discounted educational services and access to more than 15 years of crm implementation expertise (Oracle.com press release, 11.06.2007).</p>	<p>The programme will allow marketing agencies in Europe middle east and Africa (emea) to join the oracle partnernetwork opn and work with oracle to jointly deliver crm marketing solutions (Oracle.com press release, 11.06.2007).</p>
<p>Oracle also plans to preserve and expand the partner ecosystem including system integrators, independent software vendors, value-added distributors, and value-added resellers to help ease the deployment of oracle fusion middleware (Oracle.com press release, 07.01.2008).</p>	<p>To accelerate innovation in our product offerings and help our customers strategically implement middleware to more easily build deploy and manage applications in a secure environment (Oracle.com press release, 07.01.2008).</p>	<p>Hp- hp will continue to leverage Oracle's consulting expertise in both oracle and bea products to help our joint customers accelerate soa adoption and drive increased business value (Oracle.com press release, 07.01.2008).</p>	<p>By combining leading products and technologies oracle has created an oracle fusion middleware road map that is consistent with Accenture's assessment of how a converged product set would best benefit our clients. The integration of the oracle fusion middleware stack and the bea product family combined with oracle's standards-based platform offers the potential of a compelling foundation for building solutions to fit the complex and varied collaborations between people software and machines in today 's hospital and healthcare environments (Oracle.com press release, 07.01.2008).</p>

Activities	Strategic goal	Direct beneficiaries	Overall benefit
Microsoft			
<p>Microsoft corp.'s automotive business unit is collaborating with Samsung electronics, scansoft, Siemens, sirf, Xilinx, and magneti marelli to develop a flexible low-cost telematics system to be integrated into every new fiat auto car based on a reference design defined by Microsoft and fiat auto (Microsoft.com press release, 02.24.2005).</p>	<p>To develop a flexible low-cost telematics system to be integrated into every new fiat auto car (Microsoft.com press release, 02.24.2005).</p>	<p>Samsung electronics, scansoft, Siemens, sirf, Xilinx and magneti marelli- the system will incorporate key aspects from each collaborator (Microsoft.com press release, 02.24.2005).</p>	<p>Together the companies are developing a robust system that will meet the needs of drivers and passengers for an enjoyable user-friendly and safer experience talking on the phone enjoying their personal music selection and looking for addresses. Motorists are doing all this while driving. The joint telematics solution being developed will provide drivers with easy access to applications for all these activities (Microsoft.com press release, 02.24.2005).</p>

<p>Microsoft corp. and research in motion rim nasdaq rimm tsx rim today announced a product collaboration and joint marketing agreement to extend enterprise instant messaging im and presence to blackberry® subscribers (Microsoft.com press release, 04.18.2005).</p>	<p>Extending these valuable communications tools from the desktop with Microsoft office communicator to mobile devices like blackberry is a core element of our vision for integrated communications, which aims to unify communications across pcs, phones, and mobile devices so people can communicate and collaborate more effectively and efficiently. We are excited about expanding our vibrant developer partner ecosystem to include providers of rich mobile solutions like blackberry to further extend and enhance the live communications experience (Microsoft.com press release, 04.18.2005).</p>	<p>Research in motion and blackberry- the combined Microsoft-rim solution is designed to extend rich live communications server features to employees using blackberry enabling mobile professionals to transmit instant messages and share presence-based information to maintain real-time connectivity with colleagues, partners and customers while they are away from the office (Microsoft.com press release, 04.18.2005).</p>	<p>Through this agreement Microsoft and rim plan to extend the benefits of live communications server to the many companies and government organizations using blackberry around the world (Microsoft.com press release, 04.18.2005).</p>
--	--	--	---

<p>Microsoft research teams have delivered hundreds of product innovations to Microsoft corp. customers since 1991. Today, at an event marking the research organization's 15th anniversary of turning ideas into reality, Microsoft chairman bill gates appeared on screen, as Microsoft research senior vice president, Rick Rashid and leaders from academia and industry gathered at the company's Redmond lab, to recognize these successes and preview new areas where Microsoft research continues to influence the future of computing. (Microsoft.com press release, 09.26.2006).</p>	<p>To recognize these successes and preview new areas where Microsoft research continues to influence the future of computing (Microsoft.com press release, 09.26.2006).</p>	<p>Start-ups- the research organization along with other parts of the company licenses technology to selected start-ups companies that in turn develop and market products. On this foundation to date, at least six start-ups have launched successful products through the ip ventures program (Microsoft.com press release, 09.26.2006).</p>	<p>Beyond its influence on a broad range of Microsoft product innovations, Microsoft research also enhances the overall it ecosystem by providing economic opportunities for other businesses through its ip ventures program. From the beginning Microsoft research has provided an open collaborative environment where the brightest minds in computer science can work together to tackle the hardest problems in computing and explore new ideas for reinventing the pc. With more than 700 researchers at five laboratories worldwide, Microsoft research contributes to Microsoft products as well as long-range technology advancements often in collaboration with the academic community. Microsoft researchers have made a significant global impact on the collective knowledge of the greater software community openly sharing their research findings and new discoveries by publishing more than 3,700 academic papers across 55 fields. Over the past 15 years, Microsoft research has evolved into a diverse organization of not only computer scientists but also psychologists, sociologists, anthropologists, and medical doctors working to develop innovative technology that will benefit people around the world (Microsoft.com press release, 09.26.2006).</p>
--	--	---	--

## 5.4 Central players' role in ecosystem orchestration

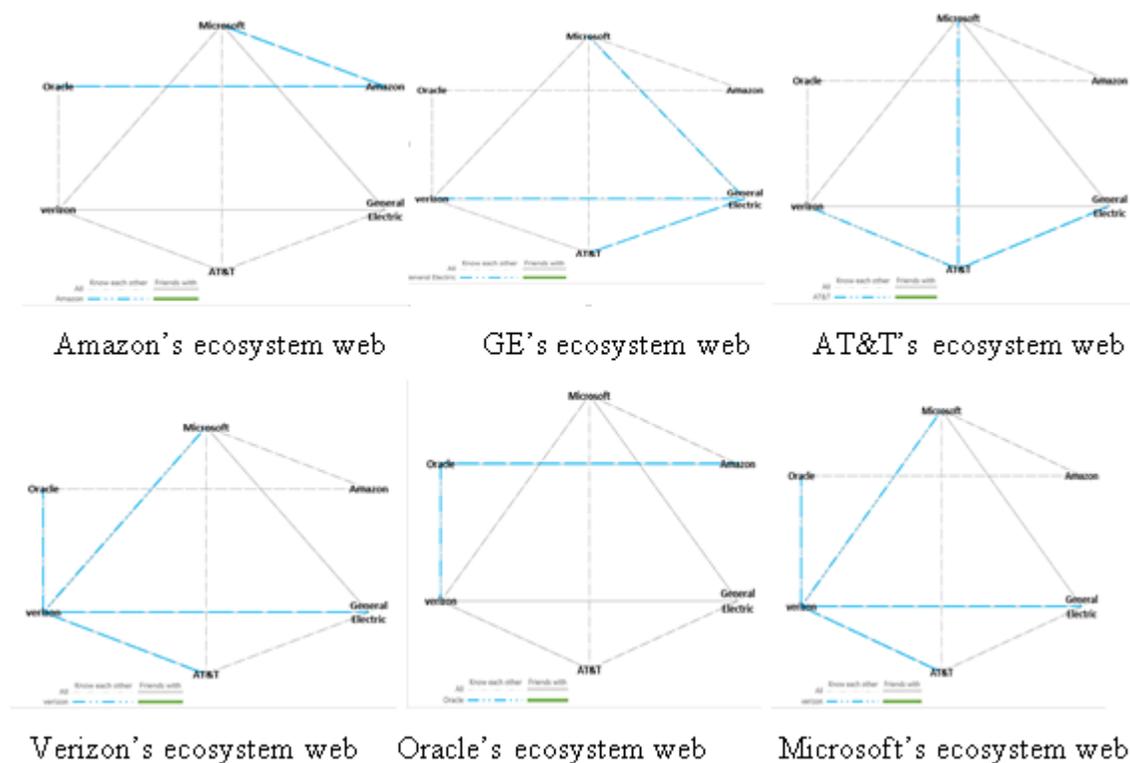
From the cases, it becomes apparent that all the central players engage in multiple ecosystems (Bosch-Sijtsema & Bosch, 2015; Davidson et al., 2015). As such, these central players play different roles (Iansiti & Levien, 2004) with respect to the kind of relationship engagement and the nature of ecosystem. Interestingly, while on one breadth case firms playing the role of keystone are influential in decision-making, determining terms of contractual agreements, influencing and attracting members to its ecosystem (Gulati, Puranam & Tushman, 2012; Bosch-Sijtsema & Bosch, 2015), and benefiting from external resources (Ibarra 1993; Gulati Nohria & Zaheer 2000; Bertrand-Cloudt, Hagedoorn & Van Kranenburg 2011).

On another breadth, the studies have revealed that, keystones sometimes participate in several other ecosystems that they do not occupy a central position. Thus, they play the role of either complementor or just participating in the ecosystem, hence having less or no influence to design, orchestrate or dictate to the ecosystem. This means that, firms play different roles in different ecosystems depending on their leadership position. Following Gulati, Puranam & Tushman (2012), the characteristics of the ecosystems and the role of a firm in that ecosystem can vary and therefore has implications on the way firms manage their ecosystems. A firm's position or role in the ecosystem is very crucial to the health of the ecosystem. As discussed by (Moore 1993; Iansiti & Levien 2004; Li 2009), an ecosystem member affects and is affected by the actions and inactions of another member of the ecosystem. Put differently, the survival of the ecosystem is based on the collective efforts and contributions of all members of the ecosystem. According to Bosch-Sijtsema & Bosch (2015), it is therefore imperative for members of an ecosystem to understand the implications of their role in the ecosystem in order to formulate strategies that will inure to the benefit of the ecosystem as a whole.

The results of the case firms indicate that, of the six cases, each keystone or central player is involved in at least another ecosystem that belongs to another keystone. This suggests that, ecosystems are becoming more and more complex and does not only involve different firms, instead, it involves multiple ecosystems posing the challenge of managing between "power and symbiosis" (Bosch-Sijtsema & Bosch, 2015). Thus, a firm's ability to operate in multiple

ecosystems and strategically adapt to different leadership role in multiple ecosystems is very essential (Bosch-Sijtsema & Bosch, 2015).

Existing literature makes it clear that the activities and leadership role adopted by dominant players and keystones in an ecosystem have great implications for the overall ecosystem health and performance. (Iansiti & Levien 2004; Li 2009). This is true in all the cases studied in this research especially in the case of Microsoft and Verizon who aside being in-charge of their own ecosystem are also involved with four external ecosystems as shown in Figure 18. The results of the cases indicate that, central players often strive on one hand, keeping a healthy balance between being in charge of the ecosystem (ie., the design and major decision-making), and on the other hand, building a healthy relationship with other central players belonging to a different ecosystem (Bosch-Sijtsema & Bosch, 2015). This kind of symbiotic relationship is not only essential for the support of the entire ecosystem; instead, it is equally important for the reputation of the keystone firm (Power & Jerjian 2001; Teece 2007). It also helps the keystone in spreading the risk of losing it all in case something goes on wrong with its ecosystem.



**Figure 18. Case firms' multiple ecosystems and engagement models**

From Figure 18, Microsoft and Verizon promises a strong and healthy support for the survival of their ecosystems. Despite being a keystone to their ecosystems, they form a strategic network with four different keystones. This strategy provides more nutrients for their ecosystems, builds the keystone's reputation, and widens their market reach and customer base as well as spread their risks. Similarly, AT&T and GE follows next in terms of promising survival to their ecosystem members. They each bonds with other keystones for various reason such as resource exchange, ecosystem support and establishing ecosystem symbiosis.

According to the results, Amazon and Oracle offers the least of external support to their ecosystem members in relation to networking with other keystones. Nonetheless, this could be as of result of the nature of their business. For instance, Amazon is an online retailer and therefore only needs to build a strong and sustainable platform that can support its online business. It is not surprising that Amazon forms a strategic network with Microsoft and Oracle. These two firms are telecommunication organizations providing all the technologies and supporting Amazon's platform in order to serve its clients efficiently. Thus, Amazon can deliver its value proposition without networking with for instance General Electrics.

Similarly, according to the results, Oracle networks with only two keystones. Unlike Amazon's case, Oracle, Microsoft and Verizon are in the same or similar industry with Microsoft being the leader in that industry. As such, rival firms sometimes collaborate to compete - co-opetition. As a result, Oracle collaborates with Verizon to innovate and share resources and knowledge to compete in the market. Furthermore, Oracle's collaboration with Amazon can be for marketing and business development purpose. Oracle sells applications and other software and hence needs Amazon's platform to reach out to mass customers.

## **5.5 The role of complementors in ecosystem health**

From all the six cases, the researcher found that complementors play crucial role in maintaining the health of an ecosystem. However, the results indicate that keystones collaborates with complementors on a different engagement models. On the one hand, keystones enter into

strategic engagement with complementors and focus on long-term repetitive relationships and innovative activities. As found in all the six cases, this is especially evidenced in the case of Oracle. As a keystone player, Oracle chose to engage in a more collaborative relationship with for instance Systime Company, a leading global consulting and IT services provider. The type of collaboration is based on mutual trust, interest, co-development, reputation as well as minimizing risk and cost. For instance, in one of Oracle's press releases, Oracle is "*working in close collaboration with dedicated partners like systime we continue to leverage oracle application integration architecture aia to extend the value of our customers' investments. We chose systime due to their industry strength and specialization in oracle's enterprise suite of applications the co-development of this integration will give jd edwards enterpriseone customers new tools to drive product innovation and can also make the full design-to-release process more effective and efficient*". This type of engagement model conforms to previous works that has focused on collaboration that is geared towards stimulating innovation (Powell, Koput & Smith-Doerr 1996; Insiati & Levien 2004; Gawer 2009; Dahlander & Gann 2010; Mazzola & Perrone 2013).

On the other hand, some of the engagement models are rather more competitive for complementors to build on top of an existing product or platform. On the face value, the relationship may seem to be that of a mutual interest. However, the focus is to reduce cost, minimizing risk and integration costs (Bosch-Sijtsema & Bosch, 2015).

The results of the cases indicate that complementors often adopt one of the following models: (i) either to dance to the tune of the central player, or (ii) to try to carve a strategic niche for themselves in order to influence their position and power within the ecosystem. Following Bosch-Sijtsema & Bosch (2015), this influencing strategy can be implemented through collaboration or by actively participating in multiple ecosystems for the sake of influencing the market as well as the end-user. Table 21 below shows the importance of complementors and their engagement with different focal firms.

**Table 21. Top six complementors in multiple engagement models with different keystones**

Complementors	Sum of collaborations	Keystones involved	Amazon	GE	Verizon	Microsoft	AT&T	Oracle
Partners	139	4	0	2	1	105	0	31
Cisco	12	4	0	1	3	4	4	0
Accenture	11	4	4	1	2	4	0	0
hp	55	3	0	0	1	52	0	2
Intel	43	3	0	0	1	41	0	1
Nokia	26	3	0	0	1	22	3	0

As shown in Table 21, not only do keystones engage in multiple ecosystems and play different leadership role. Complementors also strategically take different engagement models with different keystones. The results of the cases show that, complementors such as partners, Cisco and Accenture are involved in different forms of relationships with four out of the six keystones under study. Similarly, Hp, Intel and Nokia also collaborated with three out of the six keystones under discussion. This strategy makes the complementors influential and powerful in negotiations. Existing literature discuss that, the strategies adopted by these complementors allows them to work and survive in ecosystems and conforms to adaptive practices and capabilities (Pierce 2009; Teece 2007).

## **5.6 Cross-case Analysis**

According to Yin (2003), cross case analysis refers to the act of assessing logic and building a basis for reasonable explanation. Put differently, cross case analysis evaluates themes, similarities, and differences across two or more cases (Mathison, 2005). In case study research, this tool is often used as a second level examination mechanism (Eisenhardt, 1989). As can be seen from Table 6, the case companies in this study varied considerably in their sector of operations (i.e., online retailing, industrials, telecommunications and software and technology solutions), sizes base on their market capitalization and annual revenue as of 2017. Furthermore, the six companies examined also varied in terms of the products and service they are rendering and the ecosystem archetypes and size as identified from the within-case analysis. However, despite the above-mentioned diversity, the evaluation metrics (Table 7) enabled comparability and cross case assessment.

Furthermore, the cross-case evaluation metrics permits the researcher to examine and evaluate common traits and features revealed from the processed data. As a result, regardless of the diversity in the case companies' activities and sector of operation, the findings in relation to the roles and strategies employed by these six case companies highlighted various similarities and differences across the case companies. Therefore, the researcher considers the generalization of the results appropriate for answering the research questions.

### 5.6.1 Evaluating the ecosystems of the case firms

Under this section, I examine the robustness, productivity and niche creation of the case firm's ecosystem, using the evaluation metrics in Table 7 by identifying key indicators for measurement base on Tables 8-19 and Figures 12-19. To enable proper evaluation, the researcher scored the case companies as low, medium or high symbolized by (x), (xx) and (xxx) respectively and corresponding to each specific metrics identified.

**Table 22. Evaluation of the case firms' ecosystems**

Criteria		Max. value	Amazon	GE	AT&T	Verizon	Oracle	Microsoft
Robustness	survival	xxx	xxx	xxx	xxx	xxx	xxx	xxx
	solution to multiple ecosystems	xxx	xx	xxx	xx	xxx	xxx	xxx
	Firm role	xxx	xx	xx	xx	xx	xx	xxx
Productivity	Productivity improvement	xxx	xx	xxx	xxx	xxx	xxx	xxx
	delivery of innovations	xxx	xxx	xxx	xxx	xxx	xxx	xxx
	Relational & Technological complexity	xxx	x	xx	xx	xxx	x	xxx
Niche creation	Variety	xxx	xxx	xxx	xxx	xxx	xxx	xxx
	Value creation	xxx	xxx	xxx	xxx	xxx	xxx	xxx
	Orchestration	xxx	xxx	xxx	xx	xxx	xxx	xxx
Ecosystem Size		Large	small	small	small	medium	medium	large

From Table 22 above, a firm is graded either high, medium or low based on their assessment and performance in each component. These scores are allocated to each firm in relation to their ecosystem performance. Thus, a firm attracts a specific grade corresponding to a component based on the activities and actions the company executes and how it contributes to the ecosystem health.

### **5.6.2 Characteristics of the various ecosystem archetypes**

Looking at Tables 8-13 and Figures 12-17, one can see interesting revelations about certain commonalities and attributes about the ecosystems of all the six case firms. These attributes could explain why certain central players adopt a specific leadership strategy.

To begin with, Table 8 and Figure 12 show that, Amazon leads in all of its top four ecosystem archetypes. A critical look at these ecosystem archetypes reveals that, two out of these four are Amazon owned ecosystem. Thus, both “content ecosystem” and “Amazon end-to-end ecosystem” are Amazon owned ecosystem. Amazon has control over how it is designed and managed. Furthermore, Amazon can take all major decisions regarding the orchestration of these two ecosystem without necessarily consulting other partners. Thus, the interdependence relationship surrounding these two ecosystem archetypes is not tight-fitted but somewhat loose.

Regarding the other two ecosystem archetypes (partner ecosystem and innovation ecosystem) Amazon still leads in both. However, this is as result of the industry Amazon operates. As mentioned in the company profile, Amazon is the leading digital retail company in U.S.A and beyond. There is relatively less technological complexities and uncertainties surrounding this industry. The major technology challenge is for Amazon to ensure that it has a strong platform and that’s why Amazon is seen partnering with technology giants like Microsoft and Oracle as shown in figure 18, to support its platform. The rest of the products and services sold on the platform are either Amazon’s own products (e.g. Amazon kindle Fire HD and Amazon Fire TV) or services (e.g. Amazon Web Service and Amazon Prime). In fact, Amazon itself produces majority of the products and services sold on the platform. The remaining products and services

are through either collaborations and partnerships, acquisition or left in the hands of other manufacturers.

Therefore, a careful look at Amazon's ecosystem reveals the following characteristics or attributes surrounding their ecosystems: less technological complexity, less interdependence, semi-open ecosystem, strong platform, amazing wide range of products and service by the owner of the platform, control over the design and orchestration of the ecosystem as well as small to medium size ecosystem.

Analyzing GE's ecosystem strategy and leadership role, Table 9 and Figure 13, reveals that GE employs multiple role in managing its ecosystem complexity. Specifically, GE plays at least two different roles in its top four ecosystem archetypes except in Electric vehicle ecosystem. As the energy giant, the company is relentlessly innovating the energy technologies of the future through its partners. Although GE is a leader in energy technologies, it has succeeded in this role through partnership. That is why the company aside leading in some ecosystem archetypes (platform ecosystem, partner ecosystem and innovation ecosystem), also plays a participatory role alongside. As mentioned by the company, *"The global energy landscape is evolving. Through our continuous partnership with our customers, our commitment to deliver power to people around the world is one thing that will never change"* (ge.com). As it is with most high technology companies, their innovations and new product developments often involves other component manufacturers. Hence, GE aside leading in innovation ecosystem archetype, complement in other firm's innovations as well as sometimes just been part of it without taking any leadership role. One possible explanation to a central player adopting a participatory strategy is to learn or share knowledge. Others could be to legitimize the other firm's innovation, to gain access to the other firm's ecosystem or just to maintain a healthy relationship for other anticipated future projects.

However, when it comes to electric vehicle ecosystem archetype, GE adopts leading strategy only. This is because, energy and power is the core competence of GE. The company creates one-third (1/3) of the world's electricity with a technology that equips 90% of power transmission utilities worldwide and manages forty percent (40%) of the world's energy (ge.com). With this astonishing experience and expertise, it is not surprising that GE only leads in the electric vehicle

ecosystem archetypes as shown in Figure 12.

A look at AT&T's top four ecosystem archetypes (see Table 10 and Figure 14) reveals interesting trend. At a glance, AT&T leads in its entire top four ecosystem archetypes as identified from the data. In addition, AT&T adopts a complementary strategy in two out of these four ecosystems archetypes. A&T is a telecommunication service provider and media company (see Table 6) with core competence in technology, mobility services (i.e. mobile products and services) as well as cloud services and the Internet of Things (IoT) (ge.com). With the recent acquisition of Time Warner, media has also become the company's core competence.

With technology and mobility services as core competences of the company, AT&T employs strategies that ensures its leadership in these two ecosystem archetypes (mobile ecosystem and technology ecosystem). Furthermore, with stiff competition from Verizon communication, T-Mobile US Inc., Sprint Corporations, China Mobile and Telefonica, the company employs strategies to ensure that it stays ahead of its industry and does not lose the market to its competitors.

Nonetheless, the company's products such as cloud services, IoT and network services calls for collaborations with other key players in its platform ecosystem and innovation ecosystem archetypes. As shown in Figure 18, AT&T collaborates with Verizon Communications and Microsoft although these two companies are competitors to A&T in some of its products and services. However, in these collaborations, AT&T still plays a leading role most of the times as well as adopting a complementary role some of the times.

Another interesting outcome from the results is that of Verizon Communication. The total size of the company's ecosystem archetypes is 112 out of which Verizon adopted multiple roles (i.e. leading, complementing and participating) in managing its ecosystem archetypes. Table 11 and Figure 15 show that, Verizon employs different strategies in managing each of its top four ecosystem archetypes.

Verizon like AT&T is among the largest communication technology companies in the world. The company's mission is *to enhance the ability of humans, businesses and society to achieve more.*

This they do through their powerful technology to make breakthroughs in digital media, interactive entertainment, broadband services and IoT for their customers (ge.com). From the mission of the company, Verizon is involved in so many services cutting across different industries from healthcare to agriculture. As shown in Table 11 and Figure 15, Verizon's top four ecosystem archetypes are distinct and unrelated showing how wide the company spreads its tentacle across different sectors.

The company pride itself as “*problem-solvers, engineers, technologists and innovators*” (ge.com). This can be seen in their top four ecosystem archetypes (Table 12 and Figure 14). Because the mission of the company is to impact in every aspect of human, business and the society, Verizon's strategies does not lean towards any specific industry. Hence, Verizon employs multiple roles to manage this complexity in its ecosystem with the exception of healthcare ecosystem. From Figure 14, Verizon participates more in its internet ecosystem archetype than leading and complementing. This is because the IT has the most complexities in terms of different collaborations with complementors, different technologies at play and different complex demands from each customer.

In addition, with reference to the company's mission to empower businesses, it explains why the company is strong in its business ecosystem archetype where the company most of the times employs strategies ensures the company's leadership in the industry. Aside leading, Verizon also complements other business and sometimes just participate for knowledge sharing, knowledge transfers and risk mitigation or ecosystem security.

Furthermore, due to the complexity surrounding the IT industry, Verizon's complementing strategies are at par with its participating strategies in managing its innovation ecosystem. Although the company leads most of the time in its innovation ecosystem, it also allows other collaborating partners to contribute their expertise and take active role in the innovation process.

However, since the healthcare sector is not the core area of operation to Verizon, the company only complements in its healthcare ecosystem archetype. Although it is the third largest ecosystem archetype, Verizon is better off complementing than leading in this ecosystem

archetype.

Another interesting revelation is that of Oracle. The software and technology solutions company in most of its ecosystem archetypes either leads or complements. From Table 12 and Figure 16, Oracle leads all the time in the Java ecosystem. This is because Java is one of Oracle's core products. It is therefore proper that it assumes commanding role in that ecosystem. In addition, Oracle plays leading role in its own ecosystem (Oracle ecosystem) but sometimes complement other members of the ecosystem. This builds trust and loyalty from the ecosystem members to the central player.

Oracle provides leading-edge technologies in platform as a service, software as a service, data as a service and infrastructure as a service in 175 countries with over 430,000 customers in 175 countries (ge.com). Oracle can only serve this huge amount of customer scattered worldwide through its partnerships. Hence, Oracle has a wider and larger partner ecosystem but ensures that it employs strategies that cements its leadership role in this ecosystem.

Like Verizon, healthcare is not the core area of operation for Oracle. Therefore, the company only complement the activities of healthcare industry players through their capabilities enumerated in the preceding paragraph. However, in other small ecosystem archetypes identified, Oracle employs multiple strategies and multiple roles in managing and orchestrating them.

Finally, Microsoft ecosystem also reveals interesting patterns similar to the afore-discussed case companies. Microsoft adopts a complete leading role in two of its top four ecosystem archetypes (see Table 13 and Figure 17). As it was with the rest of the case companies with the exception of Verizon, Microsoft's outright leading role occurs in its Windows and Microsoft ecosystem archetypes. These two ecosystem archetypes are the company's core products and services. Like most central players, Microsoft implements strategies that ensures it stays ahead of competition in fields that it has core competence and competitive advantage.

However, as the IT industry is characterized with complexities and ever-changing business environment, Microsoft adopts multiple strategies and multiple leadership roles to manage their IT ecosystem and partner ecosystem archetypes. This pattern was also noticed in Verizon's ecosystem management strategies for its business and internet ecosystem archetypes. Microsoft

adopts leading role in most cases in its partner ecosystem but adopts a participatory role most of the times in its IT ecosystem.

Again, there is similarity between Verizon’s leadership and Microsoft’s in their internet and IT ecosystems respectively as these two ecosystem archetypes can be categorized under the umbrella of IT ecosystem. Both companies rather participate most of the times as oppose to leading or complementing. Similar pattern can be drawn in the two companies’ business ecosystem and partner ecosystem archetypes. Here too, Verizon and Microsoft both leads the ecosystem majority of the times compared to how often they complement or participate. One can deduce that most partnerships are for business purposes and central players will often like to lead in business deals to get a bigger share of the pie. However, in the IT ecosystem, the technological complexities are high, therefore central plays although adopts leadership role, most of the time will rather participate and complement for knowledge creation and knowledge sharing.

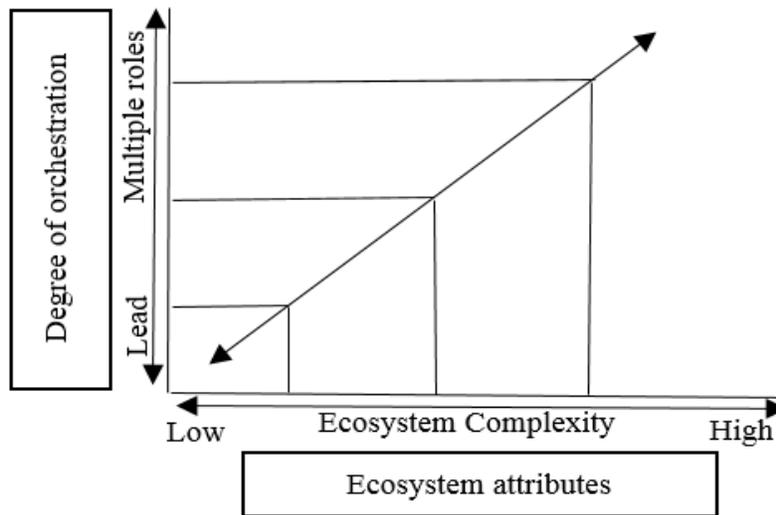
In conclusion, after cross-examining the six case companies, the following similarities, differences, features and patterns can be drawn from the ecosystems of the case companies as shown in Table 22.

**Table 23. Features and patterns of the case companies’ ecosystem**

Features	Amazon	GE	AT&T	Verizon	Oracle	Microsoft
A:Strategic focus	lead	Lead & participate	Lead & complement	Lead, complement & participate	Lead & complement	Lead, complement & participate
B:Openness	Semi-open	Semi-open	Semi-open	open	open	open
C:Diversity of members	high	medium	medium	high	medium	high
D:Interdependence	low	medium	medium	high	high	high
E:Industry diversity	medium	medium	medium	high	high	high
F:Complexities	low	medium	medium	high	low	high
G:Size	small	medium	medium	large	large	large

From the ongoing analysis, one can see direct relationship between the level of orchestration and the ecosystem attributes such that, the more the complexities (i.e. technological complexities,

diversity of industry and relationships, size, openness of the ecosystem etc.) surrounding the ecosystem, the more difficult it is for companies to adopt leading role in managing the complexities. Instead, they adopt multiple (i.e. leading, complementary and participatory) roles. The reverse is true, the less complex the ecosystem is characterized with, the easier it is for central players to orchestrate as shown in Figure 19.

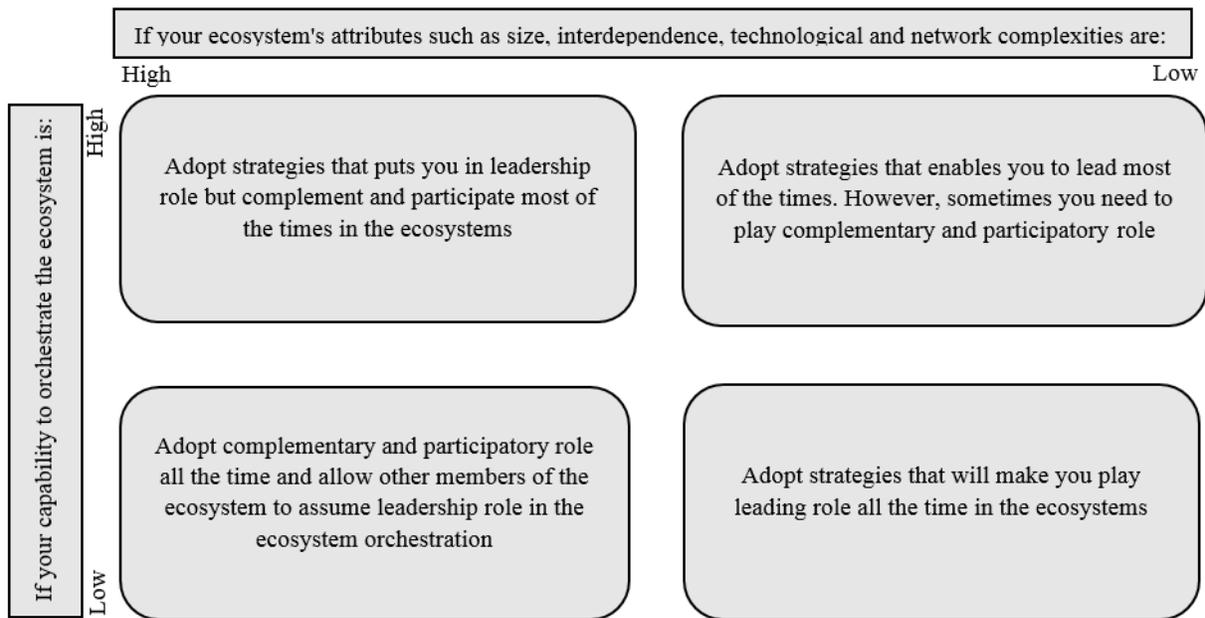


**Figure 19. Relationship between the level of orchestration and ecosystem complexities**

Figure 19 shows that, it is easier for central players in business to play leading role in their ecosystems when it is characterized with low ecosystem complexities. Ecosystem complexities such as wide diversity of members of the ecosystem, cross-interplay and interaction of multiple ecosystems, technological interdependence and uncertainty, and finally yet importantly, size of the ecosystem all makes it difficult for keystones to smoothly orchestrate in ecosystems by adopting a specific role all through. Empirically, the analysis has revealed that firms that operate in less complex ecosystem (i.e. Amazon), is able to manage their ecosystem smoothly by adopting a specific role. On the other hand, firms whose ecosystem is seemingly more complex (i.e. Microsoft and Verizon), adopt multiple leadership role to manage their ecosystems.

To sum up the ongoing analysis, I present Figure 19 below showing when to adopt certain strategies within a specific leadership role in other to manage the complexities surrounding

ecosystems. This model will enable central players know when to adopt certain ecosystem strategies in order to orchestrate and manage their ecosystem complexities.



**Figure 20. Ecosystem strategies and leadership roles**

## 6 DISCUSSIONS

Under this section, the results are discussed, evaluated and compared with the literature review.

### 6.1 Strategies as success factors for ecosystems

Operating in an ecosystem spans between boundaries. The issue becomes more complex when the firm is operating in multiple ecosystems. To succeed in ecosystems, firms must identify their strengths, capabilities and weaknesses and determine which activities must be done in-house, which to be collaborated with partners and which must be taken to the open market (Adner, 2006). From the cases studied, the results indicate that, keystones follow different strategies in their quest to attaining ecosystem leadership (Gawer & Cusumano, 2008). The keystones themselves execute certain strategic and critical activities while other activities are carried out in collaboration with key partners and the rest, left in the hands of complementors and this forms a large portion of the ecosystem.

Furthermore, beyond conducting SWOT on the ecosystem, firms must also assess their position in the ecosystem or the kind of leadership role they want to play. Just like keystones conducting SWOT to assess their capabilities and incentives, ecosystem members also face the problem of choice whether to be a central player in the ecosystem development or being a passive member (Adner, 2017). Iansiti & Levien (2004) argued that, "stand-alone strategies don't work when your company's success depends on the collective health of the organizations that influence the creation and delivery of your product". Having knowledge and understanding about the ecosystem puts you in the right position to determine your organization's role in the ecosystem orchestration. As observed from the cases, all six cases adopted different roles (Adner, 2017) and operated in multiple ecosystems (Bosch-Sijtsema & Bosch, 2015), hence, understanding the ecosystems and what role to play in which ecosystem forms part of ecosystem strategy (see Gawer & Cusumano's (2002) work on Platform Leadership for rich and in-depth exploration on this topic).

From this study, it is interesting to note that all six cases adopted different ecosystem strategies of being a keystone at one point and a complementor or mere participant at other

times. This indicates that, the choice of a firm's ecosystem strategy in part depends on the kind of firm it aims to be as well as the nature of its business operations and ecosystem environment (i.e. open versus closed, complex versus simple, stable versus turbulence etc.). That is why companies like Amazon, an online retail company and operating in a relatively less complex environment and with a semi-opened ecosystem, is seen adopting primarily a keystone and dominator strategies as shown in Table 9. Chiefly among the strategies adopted by Amazon is a traditional point of sales model where many products and services are sold on a single platform. Amazon's strategy is in agreement with the suggestions of Iansiti and Levien (2004) that, a firm may choose to adopt a physical dominator strategy if it operates in a matured industry and a relatively stable business environment.

Furthermore, the analysis revealed that, other companies such as Microsoft and Verizon operate in a complex network with an ever-changing business environment. The pace of innovation in their industry is very rapid and unpredictable. Their firms are also at the center of complex network of assets-distribution relationships (Moore, 1993). As such, Microsoft and Verizon are perceived to be keystones implementing keystone strategies. As argued by Iansiti and Levien (2004), the most effective strategy to adopt by any firm in such position is the keystone strategy. However, in addition to being keystones, Microsoft and Verizon also played complementary as well as participatory roles due to the complex nature of their ecosystems. Among such strategies adopted by these two firms are; (i) working with third parties such as independent software vendors, developers, system integrators and other complementors. (ii) Collaborations with several other keystones for innovation, R&D and standardization of the industry as shown in Figure 8. (iii) Participating in other ecosystems to widen market reach, for ecosystem security, minimize risk and guarantee the survival of the keystone's ecosystem as well as the survival of its members.

## **7 CONCLUSION**

This study contributes to research in its theoretical and managerial aspects. The author elaborated different strategies and leadership roles adopted by six companies in managing their ecosystem complexities. The comparison highlights the relationship between the level of orchestration and ecosystem attributes such as complexity. This serves as a building block for further researches into managing the complexities associated with ecosystems. The empirical analysis contributes immensely to research in that, it serves as a guide for ecosystem leaders and wannabes to know when to adopt which strategies and what specific roles to play.

### **7.1 Theoretical implication**

Under this section, the researcher tries to evaluate the suitability and implications of the theories used and literature adopted for the studies in order to answer the research questions. Given that, ecosystem is an emerging concept and that its strategies are not discrete but varies considerably based on the nature and type of business operations as well the leadership role the firm plays or aims to play, this thesis contributes immensely to the ongoing discussions and fills a clear research gap.

To begin with, due to the complexity and novelty of the study, it was at first glance difficult to determine the appropriate theories to adopt in tackling the topic under investigation. In view of this, the research combined multiple theories from business organizational theories and complexity theories as an integrative theory towards developing deep insight towards understanding the phenomenon. However, theories that form the main literature were ecosystem analogy, ecosystem strategies and ecosystem structure and value creation. Furthermore, literature on managing the ecosystem complexity was also taken into consideration. Combining theories from business and complex adaptive system (CAS) gave a holistic understanding of the study. Generally, this study is a unique opportunity to understanding the ecosystem concept, the leadership roles as well as the strategies employed by both central players and complementors. Hence, the selected theories and literature gave direction to answering the research questions and thus provided a holistic understanding on the topic.

### **i. What roles do focal firms play in their ecosystems orchestration**

Since the emergence of the ecosystem concept by Moore (1993), there has been growing interest in strategic management research to understanding the analogy. However, quite substantial amount of research has focused on leadership roles and/or strategies (e.g. Moore, 1996; Yoffie & Kwak's 2006; Adner, 2012; Dedehayir, Mäkinen & Ortt, 2016), inter-firm relationships or networks (e.g. Moore, 1993; Gawer & Cusumano, 2002; T. Ritter et al., 2004; Adner & Kapoor, 2010; Aarikka-Stenroos & Ritala, 2017). Thus, only few studies investigate how firms can engage in multiple ecosystems with varying engagement models within these different ecosystems (Bosch-Sijtsema & Bosch, 2015). The research contributes to a deeper understanding of the phenomenon. In this study, the researcher investigates with the help of six qualitative cases, how firms (both central players as well as complementors) play varying roles in their ecosystems and the implications of these different roles in relation to managing their ecosystems.

Based on the empirical findings, keystones often engage in multiple ecosystems (Bosch-Sijtsema & Bosch, 2015; Davidson et al., 2015; Panetta, 2017). Interestingly, not only do keystones engage in different ecosystems, rather, they also adopt different roles in these ecosystems. Bosch-Sijtsema and Bosch (2015) argues that, "firms often operate in multiple ecosystems for which they need to dynamically adapt their engagement strategy". In all six cases investigated, the findings show that keystones engage in at least two different ecosystems. This engagement in multiple ecosystems means that, the central players with focal innovation may have either direct or indirect relationship to a host of complementors (Brandenburger & Nalebuff, 1996).

Nonetheless, whether the focal firm's relationship and interaction with complementors is direct or indirect, it has impact on their capacity to co-create value, coordinate investments and share knowledge for the overall health and survival of the ecosystem (Alexy et al., 2013; Brusoni & Prencipe, 2013; Frankort, 2013; Kapoor & Lee, 2013; West & Wood, 2013; Adner, 2017). As such, central players dynamically employ different engagement strategy because of the technological interdependencies among members of an ecosystem and between one ecosystem

and the other. Thus, central players need to examine the interdependencies and interconnectedness in the broader ecosystem since their technologies are embedded in multiple ecosystems (Hughes, 1983; Moore, 1993; Christensen and Rosenbloom, 1995; Iansiti & Levien, 2004; Adner, 2006; Adner and Kapoor, 2010, 2016). Thus, examining the interdependency and what central players can do to influence complementors in shaping ecosystem formation and structure, “can help explain the distinct value creation and capture dynamics within and between ecosystems” (Jacobides et al., 2018).

Furthermore, due to the importance of complementors (Yoffie & Kwak’s 2006), the findings also reveal that, complementors do not only stick to one keystone’s ecosystem, instead, they fill strategic positions in some ecosystems but considered as peripherals in others. Thus, ecosystem members can benefit from greater set of opportunities and options by not stacking to one particular keystone’s ecosystem (Jacobides et al., 2018). From the findings, it can be argued that, the position of a firm in ecosystems depends on the type of niche (unique product, service or technology) that the firm provides. This makes the firm attract and be attracted to other members. In line with the existing literature, it is not enough for keystones to provide only a functioning platform, rather, they actively engage in value creation (Iansiti & Levien 2004) and co-specialization (Teece, 1986, 2018). Thus, ecosystems provide the avenue for firms to co-create value (Adner 2006) since the ecosystem is regarded as a nested system (B. Clarysse et al., 2014), and the synergies contributes to an overarching customer solution (Christensen and Rosenbloom, 1995; Moore, 1996; Iansiti & Levien 2004). In line with the complexity theories, the more connected the members of an ecosystem, the more dependent they are to each other.

From the results, it can be argued that a keystone with the largest number of members is more connected, consequently, more interdependent. The implication of this connection and interdependence is that, information and resources within and between members of the ecosystem move more easily because of the proximity between members of the ecosystem.

Furthermore, having large ecosystem with huge number of members strengthens the central player, increases the overall health and value creation of the ecosystem as well as subjects the ecosystem to new opportunities through interacting and linkages with other ecosystems (Brandenburger & Nalebuff, 1996; Jacobides, Knudsen, & Augier, 2006; Parker, Van Alstyne, &

Choudary, 2016; Panetta, 2017; Adner, 2017). For this reason, the ultimate goal of every business is to be at the centre of a rich proximity to external resources (e.g. innovative contributions, technology, access to other markets and ecosystems) to solve the world's prominent and complex problems which otherwise could not be solved by a single firm (Moore, 1996 p.61; Adner, 2006).

In summary, the findings support Adner's (2017) ecosystem definition where there is alignment of host of actors who interact to create value for the ecosystem. These actors are interconnected and interdependent organizations and individuals (Moore, 1996 p.67; Autio & Thomas, 2014). However, the interconnectedness is within not only a particular ecosystem but spans across multiple ecosystems. As Moore (1993) argues, a firm should be viewed as part of a business ecosystem that crosses a variety of industries rather than been viewed as a member of a single ecosystem. More so, the analysis from the cases show that the interconnectedness between ecosystems partly depends on the business operations of the keystone and the technological complexities of their products or platforms. keystones in the telecommunications, computer and internet service provisions were found to interconnect across different ecosystems than those operating in other sectors, say retail industry. Nonetheless, further research may be conducted separately among firms in the same industry to provide a more generalized and valid deductions for this hypothesis.

**ii. What strategies do central players employ in managing their ecosystem complexities by adopting specific roles?**

Ecosystem actors seem to employ a broad range of strategies depending on their positing or leadership role in the ecosystem. Generally, the strategies employed is to improve the overall ecosystem's health as well as specifically for the keystone's own benefit. From the cases, it turned out that each keystone employed different strategies (See Tables 9; 10; 11; 12; 13; & 14). This indicates that there is no one specific ecosystem strategy in improving a firm's ecosystem health and that it depends on several other factors such as type of business operations, role and position of the firm, network complexity, type of complementarity and availability of resources (i.e. physical, human and financial resources) as inference from the cases (Jecobides et al., 2018).

In a similar vein, these keystones would not have flourished without the presence and contributions of complementors since the success of many innovations today is as a result of pool of resources from different firms (Chesborough, 2003; Ritala, Armila & Blomqvist, 2009; Najda-Janoszka, 2018). For instance, Microsoft creates value to its ecosystem by innovating myriads of products and services. Along with providing productivity-enhancing tools, Microsoft also provide members of the ecosystem access to its valuable intellectual properties (IP). Consequently, complementors enhance Microsoft's success by developing complementary products that not only increases the value of Microsoft's product lines but also extend the reach of these products beyond the borders of Microsoft's immediate ecosystem (Teece (1990; MacCormack & Iansiti, 2009).

Engaging in multiple ecosystems was also a great strategy employed by almost all the six firms investigated. Within this strategy is another where the companies employed different roles by either leading, complementing or participating. It is a common strategy for firms to either lead or complement in ecosystems, however, the participatory strategy is what Sargut & McGrath (2011) refer to as "real-options approach". This means that central players make relatively small investments in other ecosystems which gives them the right to participate or belong to that ecosystem, but not the obligation, to make subsequent investments. However, in future if this ecosystem blossoms, the central player can make further investments to share and reap the fruits of such ecosystem.

Using the evaluation matrix proposed by Iansiti and Levien (2004), each firm performed creditably on a number evaluation criteria but low on others. After assessing the findings from the cases, the researcher gathered the following central strategies featuring in the ecosystem activities of the firms:

1. Working with third parties such as independent software vendors, developers, system integrators, retailers etc. since these third parties play crucial roles and the success of the keystone.
5. Complementors have also engaged in multiple ecosystems to enrich their reputation, secure themselves and be more powerful and influential on the bargaining table.

- |  |  |
|--|--|
| <p>2. Traditional point of sale model where there are sales of many products, services and applications on a single platform.</p>  | <p>6. Collaborations with end-users to gain direct feedback for incremental innovations as well as get ideas for breakthrough innovations.</p>   |
| <p>3. Collaborations with several other keystones for innovation, R&amp;D and standardization of the industry.</p>   | <p>7. Licensing strategy was also featured by some of the keystones to widen their presence, create additional revenue streams as well as reducing cost of R&amp;D for start-ups and small and medium scale firms.</p> |
| <p>4. Participating in other ecosystems to widen market reach, for security, to minimize risks and guarantee the survival of the keystones' ecosystems as well as the survival of its members.</p> | <p>8. Differentiation through product, service, infrastructure, platform and technology superiority as well as diversification of resources in other ventures.</p>   |

However, based on the overall assessment of the findings, the central strategies of the keystone players firms focused more on three components: (i) survival of the ecosystem and its members; (ii) making ecosystem members more efficient and improving their productivity; and (iii) creating value for the ecosystem members. Although other components such as providing solutions to multiple ecosystems, delivery of innovations and providing variety of products and services as a keystone were also perceived to be equally important.

In conclusion, reflections on the findings indicate that, there is no single ecosystem strategy to improving ecosystem health. However, most of the strategies adopted by the case firms is either promoting products and/or platforms of the central player (Gawer & Cusumano, 2007). More so, ecosystem strategy is not discrete but continuous and ever changing as the process of creating or adding value has become more complex in today's interconnected and ever-changing industrial landscape (Normann & Ramirez, 1994; Moore, 1996; Nalebuff & Brandenburger, 1996; Autio & Thomas, 2014). The more complex an ecosystem is, the more frequent the strategies changes since members have to implement strategies to co-evolve, co-exist and co-create. Hence, "crafting an ecosystem strategy hinges on a clear understanding of what the relevant pieces are and where the boundaries of dependence and independence lie" (Adner, 2017). Thus, understanding the nature of the ecosystem and formulating appropriate strategies to take

advantage of the external resources is critical. Conclusively, despite the different strategies employed by ecosystem members especially keystones, it must be able to assure members of their trust in the keystone and their survival, improve productivity and lastly contribute to value creation.

## **7.2 Managerial Implication**

The aim of the research was to understanding the roles of central players in ecosystems and the strategies they adopt in their specific roles. The research findings and analysis revealed important managerial implications which when taken into consideration, will help firms aiming to be keystones or occupy strategic positions in their ecosystems. The managerial recommendation is from a theoretical viewpoint, and based on the empirical inferences.

From the findings, all the components mentioned in the evaluation matrix of Iansiti and Levien (2004) is important to the overall improvement of the ecosystem health. However, based on the assessment of the cases, the findings show that some of the components are critical for both keystones and the rest of the members of the ecosystem, hence the strategic goals tend to focus more on those components. The findings from the research highlight that, having a robust ecosystem hinges strongly on the fact that the system provides assurance of legitimacy and the survival of all the members of the ecosystem. In other words, it makes more sense to believe that, before a firm joins any particular ecosystem, primarily, it assesses the products, services and technologies for legitimacy and survival potential (Gawer & Cusumano, 2007). Therefore, as ecosystem leaders, their strategies should be geared towards building a robust ecosystem that offers confidence, trust and assurance of legitimacy, survival and meaning, which are essential to managing ecosystems. This happens when members have trust in the keystone that its strategies is for the good of the entire ecosystem (Gawer & Cusumano, 2002; Iansiti & Levien, 2004; Agerfalk & Fitzgerald, 2008). This will further attract other members to the keystone and make the ecosystem stronger.

Another interesting revelation was the multiple roles that keystones played and their engagement model. The findings show that ecosystem leaders operated in multiple ecosystems with varying roles (Bosch-Sijtsema and Bosch, 2015) which is a way of minimizing the risk associated with ecosystems (Sargut & McGrath, 2011). Aside varying roles and engaging in multiple

ecosystems, they also identified strategic partners that are critical to their success as a keystone. It is important for managers and ecosystem leaders to understand the importance of their roles in ecosystems regarding their contribution to designing of the ecosystem, influencing the decisions of ecosystem members (Gulati, Puranam & Tushman, 2012; Adner, 2017), and reaping the benefits of the external resources (Ibarra, 1993; Bertrand-Cloodt, Hagedoorn and Van Kranenburg 2011; Gulati, Nohria & Zaheer, 2000). Furthermore, the need to engage in multiple ecosystems means crossing borders and industries to tap external resources and new business opportunities (Najda-Janoszka, 2018). This has great managerial implication such that, managers must consider as part of their relationships, begin to form public-private partnerships since operating beyond geographical borders involves issues beyond the firms' boundaries.

It is not always the case that keystones play leading role in every ecosystem. As a strategy, there are times when the central players complement other ecosystem and other times only participate in the ecosystem. This implies that when they are not functioning as keystones, they become complementors to other members' products, technologies or platforms. Thus, central players simultaneously employ different strategies to function dynamically as keystones in one breath and as complementors in another breath (Gulati, Puranam & Tushman, 2012). This has implications on how central players manage such engagement in multiple ecosystems. To this end, managers and ecosystem actors must understand the roles they play in ecosystems and be able to formulate strategies in managing the complexities since the survival of the members of an ecosystem depends on not any single firm but the entire ecosystem (Moore 1993; Iansiti and Levien 2004; Li 2009; Bosch-Sijtsema & Bosch, 2015).

Furthermore, it was also noticed that the role of complementors and other peripherals (i.e. developers, independent software vendors, retailers, resellers, authors, distributors, partners etc) had direct or indirect influence on the success of the keystones and on the entire ecosystem. As Yoffie and Kwak (2006) argued, complementors are crucial in almost every industry from information technology and communication to car manufacturing, electricity and mobile phones just to mention a few. All the keystones in the case had relationships with complementors in varying numbers due to the nature of the keystone's business operations and the kind of members needed to champion its strategic goals (Helfat & Raubitschek, 2017). Thus, in most cases, the success of central players depends on the healthy relationship with its complementors that

contribute to the value creation and delivery of their innovative technology solutions (Jorde and Teece, 1990; Valkokari et al., 2009). This implies that, ecosystem leaders and managers need to view complementors as extensions of their own business and critical to the survival of the central player and the entire ecosystem (Teece et al., 1990; Accenture Strategy, 2018). Establishing this kind of mutual symbiotic relationship is necessary for enhancing the reputation of the central player as well as supporting entire ecosystem health (Håkansson, 1987; Power and Jerjian 2001; Teece 2007). Microsoft being probably the highest complementor in the world (Yoffie & Kwak, 2006), findings from this study supports this assertion since Microsoft had the highest number of collaborations with complementors. However, the issue is not just about having a certain number of collaborations, instead, how to manage these relationships as well as managing technological complexities and the overall ecosystem (Silverthorne 2002; Bosch-Sijtsema & Bosch, 2015; Jecobides et al., 2018). To this end, I argue that, it is not always the case that, central players are the only ones orchestrating and managing the ecosystem complexities, instead, complementors and other peripheral firms are equally involved in the orchestration process (Pikkarainen et al, 2017).

There is also the need for managers to invest in understanding the operations and business models of their complementors which helps in shaping the appropriate strategies to adopt for managing ecosystems (Yoffie & Kwak, 2006; Jecobides et al, 2018). This can prevent similar conflict that occurred between Intel and Microsoft in 1997 as reviewed in Yoffie and Kwak's (2006) work, where Intel had invested heavily in producing a new microprocessor but needed Microsoft to do some changes to their business model before the microprocessor can function well. At the end of the day, Intel had to succumb to the dictates of their complementor (Microsoft) because they failed to understand their business model. Certainly, complementors contribute to the value creation in the ecosystem, nonetheless, conflicts between complementors and keystones is usually inevitable (Yoffie & Kwak, 2006).

A great way of managing conflicts between keystones and complementors is the dynamic use of soft and hard power (see Yoffie & Kwak's 2006 extensive work on the art of managing complementors). Soft power is the use of diplomacy, influence, negotiation, motivations and other means of attracting a complementor the keystone. Conversely, hard power is the use of

coercion in making complementors agree to the terms of the keystone. Yoffie and Kwak (2006) stressed that; keystones should use “smart power” (combining both soft and hard power at the same time) in managing complementors rather than using either powers separately. From the cases, it can be deduced that, it is one thing for keystones to want to create a win-win situation with their complementors and another to expect complementors to abandon their business model and technology and embrace that of the keystone. Therefore, even the most successful complementor engagement are not free from conflict. However, successfully managing complementors using the right strategies can help ecosystem leaders to minimize the conflict and reap the most from this cooperation (Iansiti & Levien, 2002; Yoffie & Kwak, 2006; MacCormack & Iansiti, 2009).

### **7.3 Limitation and Future Research**

Although the research covered a wide scope, it clearly fills a research gap because it further enriches the understanding of the ecosystem concept. Despite the dynamic nature of the research (huge amount of valuable and compressed information), there is opportunity for further research to broaden its understanding. Here are some future research areas the researcher suggests:

Firstly, there are hundreds of companies in the S&P500, but due to limited time and resources for the thesis, it was prune down to six companies. More so, these selected companies were not strictly in the same industry or sector. Hence, future research could widen the data set and categorize companies in the same or similar industry to allow for more unification and generalization of the findings and interpretations.

Additionally, future research can also focus on the strategies ecosystem leaders employ. With this, the data set should include interviews from the ecosystem heads to get a rounded explanations and clarifications on the strategies mentioned in their press releases. From the data processed, there were hundreds of strategic goals identified in the press releases which was compressed and summarized. Further research could analyze these strategies and generalize the results as the strategies used by these keystones.

Another research could combine the press releases and the annual reports of the companies for

the same periods under investigations for longitudinal research. Furthermore, the findings indicated changing roles of the keystones in different ecosystems. Hence, conducting a longitudinal research to ascertain in which years these changing roles occur and what factors necessitate these changes will be of great interest. The year-to-year comparison of press releases and annual reports could also check whether the strategies mentioned in the press releases were captured and supported by the annual reports or they are just for public relations purposes.

Finally, although complementors are considered critical to the value creation and survival of ecosystems (Yoffie & Kwak, 2006). Existing literature tend to focus on ecosystem strategies adopted by keystones (Moore, 1993,1996; Iansiti & Levien, 2004; Gawer & Cusumano, 2014; Adner, 2017), at the expense of insights on the strategies complementors dynamically employ to create and capture value in ecosystems as well as their interrelations within and between ecosystems (N.-Janoszka, 2018). As shown from the results of this study, complementors are also engaged with multiple keystones and consequently in multiple ecosystems. Considering this relational complexity, it will be interesting to investigate such phenomenon.

## REFERENCES

1. Aarikka-Stenroos, L. & Ritala, P. (2017) Network management in the era of ecosystems: Systematic review and management framework. *Industrial Marketing Management*. 67, 23-36
2. Acs, Z. J., Stam, E., Audretsch, D. B., & O'Connor, A. (2017). The lineages of the entrepreneurial ecosystem approach. *Small Business Economics*, 49(1), 1–10.
3. Adner, R. & Euchner, J. (2014) Innovation Ecosystems, *Research-Technology Management*, 57 (6), 10-14, DOI: 10.5437/08956308X5706003
4. Adner, R. (2006). Match your innovation strategy to your innovation ecosystem. *Harvard Business Review*, 84, 98–110.
5. Adner, R. (2012). *The wide lens: A new strategy for innovation*. London, England: Penguin.
6. Adner, R. (2017). Ecosystem as structure: An actionable construct for strategy. *Journal of Management*, 43(1), 39–58.
7. Adner, R. and Kapoor, R (2016) Innovation Ecosystems and the Pace of Substitution: Re-Examining Technology S-Curves. *Strategic Management Journal*, 37 625-648
8. Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations. *Strategic Management Journal*, 31(3), 306–333.
9. Agerfalk, P. J., & Fitzgerald, B. (2008). Outsourcing to an unknown workforce: Exploring opensourcing as a global sourcing strategy. *MIS Quarterly*, 32(2), 385-409.
10. Ahuja, G., (2000), The Duality of Collaboration: Inducements and Opportunities in the Formation of Interfirm Linkages. *Strategic Management Journal* Vol. 21(3) Special Issue: Strategic Networks (Mar., 2000), pp. 317-343
11. Alexy, O., George, G., & Salter, A. J. (2013). Cui bono? The selective revealing of knowledge and its implications for innovative activity. *Academy of Management Review*, 38, 270–291.
12. Amazon Press Releases. [www document] [Accessed 02.06.2016] Available at: <http://phx.corporate-ir.net/phoenix.zhtml?c=176060&p=irol-newsSearchResult&t=Search&nyo=0>

13. Amazon.com 2017 Annual Reports. [www document][Accessed 27.05.2018] Available <http://www.annualreports.com/Company/amazoncom-inc>
14. Anderson, P. (1999). Complexity theory and organization science. *Organization Science*, ISSN 1047-7039, 10(3), 216-232.
15. AT&T Company Profile. (www document) (Accessed 16.03.2918) Available at: [https://about.att.com/pages/company\\_profile](https://about.att.com/pages/company_profile)
16. AT&T Press Releases (www document) (Accessed 01.06.2016) Available at: <https://www.corp.att.com/worldwide/att-press-release.html>
17. AT&T.com Company profile [www document][Accessed 30.05.2018] Available [http://about.att.com/sites/company\\_profile](http://about.att.com/sites/company_profile)
18. Autio, E., & Thomas, L. D. W. (2014). Innovation ecosystems: Implications for innovation management. In M. Dodgson, D. M. Gann, & N. Phillips (Eds.), *Oxford Handbook Of Innovation Management*: 204-228. Oxford, UK: Oxford University Press.
19. Barratt, M. & Oliveira, A. (2001). Exploring the experiences of collaborative planning initiatives. *International Journal of Physical Distribution & Logistics Management*, 31 (4), 266-289.
20. Benbasat, I., Goldstein, D.K & Mead, M. (1987) The case research strategy in studies of information systems. *MIS Quarterly*, 11, 369-386.
21. Bengtsson, M., & Kock, S. (1999). Cooperation and competition in relationships between competitors in business networks. *Journal of Business and Industrial Marketing*, 14(3), 178–194.
22. Bengtsson, M., and S. Kock. 2000. “Coopetition” in business networks—To cooperate and compete simultaneously. *Industrial Marketing Management* 29 (5): 411–26.
23. Berger, E. S., & Kuckertz, A. (2016). Female entrepreneurship in startup ecosystems worldwide. *Journal of Business Research*, 69, 5163–5168.
24. Bertrand-Cloudt, D., Hagedoorn, J. & Van Kranenburg, H., (2011). The strength of R&D network ties in high-tech sectors –a multi-dimensional analysis of the effects of tie strength on innovation performance. *Technology Analysis & Strategic Management* 23(10), 1015-1030.
25. Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital

- Business Strategy: Toward a Next Generation of Insights. *MIS Quarterly*, 37(2): 471–482.
26. Bosch-Sijtsema, P.M. & J. Bosch (online). Plays Nice With Others? Multiple ecosystems, various roles and divergent engagement models. *Online Technology Analysis and Strategic Management journal*. DOI:10.1080/09537325.2015.1038231
  27. Brandenburger A. M., & Nalebuff, B. J. 1996. *Co-Opetition: A Revolution Mindset That Combines Competition and Cooperation*. Doubleday: New York.
  28. Brusoni, S., & Prencipe, A. (2013). The organization of innovation in ecosystems: Problem framing, problem solving, and patterns of coupling. *Advances in Strategic Management*, 30, 167–194.
  29. Bryman, A., 2006. Integrating quantitative and qualitative research: how is it done? *Qualitative Research*, 6(1), pp.97–113. Available at: <http://dx.doi.org/10.1177/1468794106058877>.
  30. Camarinha-Matos, L.M. et al., 2009. Collaborative networked organizations – Concepts and practice in manufacturing enterprises. *Computers & Industrial Engineering*, 57(1), pp.46–60. Available at: <http://dx.doi.org/10.1016/j.cie.2008.11.024>.
  31. Cannella, S., Ciancimino, E. & Framinan, J.M., 2011. Inventory policies and information sharing in multi-echelon supply chains. *Production Planning & Control*, 22(7), pp.649–659. Available at: <http://dx.doi.org/10.1080/09537287.2010.512276>.
  32. Cantwell, J. 1989. *Technical Innovations in Multinational Corporations*. London:Blackwell
  33. Carbone, P. (2009). The Emerging Promise of Business EcoSystems. *Open Source Business Resource*, (February 2009). <http://timreview.ca/article/227>
  34. Carlson, C.R. & Wilmot, W.W. (2006) ‘Innovation: The Five Disciplines for Creating What Customers Want’, New York, NY; Random House
  35. Cassiman, B., and R. Veugelers. 1998. R&D co-operation and spillovers: Some empirical evidence. Working paper 328, Universitat Pompeu Fabra, Barcelona.
  36. Chen, P.-L., Tan, D. & Jean, R.-J. “Bryan,” 2016. Foreign knowledge acquisition through inter-firm collaboration and recruitment: Implications for domestic growth of emerging market firms. *International Business Review*, 25(1), pp.221–232. Available

at: <http://dx.doi.org/10.1016/j.ibusrev.2015.01.009>.

37. Cheney, G. & Christensen, L.T. (2001) “Organizational Identity: Linkages Between Internal and External Communication” ”, In: Jablin, Fredric M. & Putnam, Linda L. (Eds.): *The New Handbook of Organizational Communication: Advances in Theory, Research and Methods*, Thousand Oaks (Calif.)/ Sage, pp. 197-230.
38. Chesbrough, H.W., (2003). The era of open innovation. *MIT Sloan Management Review* 44 (3), 35–41
39. Christensen, C.M. and Rosenbloom, R.S. (1995). Explaining the attacker’s advantage: technological paradigms, organizational dynamics, and the value network. *Research Policy* 24(2) 233–257.
40. Clarysse, B., Wright, M., Bruneel, J., & Mahajan, A., 2014. Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, 43(7), pp.1164–1176. Available at: <http://dx.doi.org/10.1016/j.respol.2014.04.014>.
41. Cornelissen, J., Bekkum, T. van & Ruler, B. van (2006). Corporate communications: A practice-based theoretical conceptualization. *Corporate Reputation Review*, 9, 114–133.
42. Dagnino, G., Padula, G., (2002). Coopetition strategy: a new kind of interfirm dynamics for value creation. In: *Proceedings of the EURAM – The European Academy of Management Second Annual Conference – “Innovative Research in Management”* Stockholm, May 2002, pp. 9–11.
43. Dahlander, L. and Gann, D., 2007. How open is innovation? Paper presented at the DRUID Summer Conference 2007 ‘Appropriability, Proximity, Routines and Innovatio”, Copenhagen, CBS, Denmark, June 18-20.
44. Darke, P., Shanks, G. & Broadbent, M., 1998. Successfully completing case study research: combining rigour, relevance and pragmatism. *Information Systems Journal*, 8(4), pp.273–289. Available at: <http://dx.doi.org/10.1046/j.1365-2575.1998.00040.x>.
45. Davidson, S., Harmer, M., & Marshall, A. (2015). Strategies for Creating and Capturing Value in the Emerging Ecosystem Economy. *Strategy & Leadership*, 43(2): 2–10. <http://dx.doi.org/10.1108/SL-01-2015-0003>
46. Dawson, B. K., Young, L., Tu, C., & Chongyi, F. (2014). Co-Innovation in Networks

- of Resources – A Case Study in the Chinese Exhibition Industry. *Industrial Marketing Management*, 43(3), 496–503.
47. Day, G. S. (2000). Managing market relationships. *Journal of the Academy of Marketing Science*, 28(1), 24 – 30.
  48. Dedehayir, O., Mäkinen, S. J., & Ortt, J. R. (2016). Roles during innovation ecosystem genesis: A literature review. *Technological Forecasting and Social Change*. DOI: 10.1016/j.techfore.2016.11.028
  49. Dhanaraj, C. & Parkhe, A., 2006. Orchestrating Innovation Networks. *Academy of Management Review*, 31(3), pp.659–669. Available at: <http://dx.doi.org/10.5465/amr.2006.21318923>.
  50. Dodgson, M. (1993). Learning, trust, and technological collaboration. *Human Relations*, 46(1), 77 – 95
  51. Dubois, A. & Gadde, L.-E. (2002) Systematic combining: an abductive approach to case research. *Journal of Business Research* 55, 553–560
  52. Durst, S., & Poutanen, P. (2013). Success factors of innovation ecosystems: a literature review. In Smeds, R & Irrmann, O. (eds.) *CO-CREATE 2013: The Boundary-Crossing Conference on Co-Design in Innovation*, 27-38.
  53. E Mitleton-Kelly, 2003. Complex systems and evolutionary perspectives on organisations: the application of complexity theory to organisations. Available at: <http://eprints.lse.ac.uk/25937/>.
  54. Eamonn Kelly, 2015. Business ecosystems come of age. Deloitte Insights. [www document] [retrieved on 23.06.2018] Available: <https://www2.deloitte.com/insights/us/en/focus/business-trends/2015/business-ecosystems-come-of-age-business-trends.html>
  55. Eisenhardt, K. M., (1989). Building Theories from Case Study Research. *The Academy of Management Review*, 14(4), 532-550.
  56. Eisenhardt, K.M. & Schoonhoven, C.B., 1996. Resource-based View of Strategic Alliance Formation: Strategic and Social Effects in Entrepreneurial Firms. *Organization Science*, 7(2), pp.136–150. Available at: <http://dx.doi.org/10.1287/orsc.7.2.136>.
  57. El Sawy, O. A., Malhotra, A., Park, Y. & Pavlou, P. A. (2010). Seeking the

- Configurations of Digital Ecodynamics: It Takes Three to Tango. *Information Systems Research* 21 (4), 835–848
58. Ellonen, R., Blomqvist, K-M. and Puumalainen, K., (2008) The role of trust in organizational innovativeness”, *European Journal of Innovation Management*, Vol. 11, No. 2, pp. 160-181.
  59. Estrin, J. (2009) *Closing the Innovation Gap. Reigniting the spark of creativity in a global economy*. McGrawHill: San Francisco.
  60. Fayoumi A. (2016). Ecosystem-Inspired Enterprise Modelling Framework for Collaborative and Networked Manufacturing Systems. *Computers in Industry*, Elsevier. <http://dx.doi.org/10.1016/j.compind.2016.04.003>
  61. Ford, D. (Ed.) (1997). *Understanding business markets* (2nd ed.). London: Dryden Press.
  62. Ford, D., & Saren, M. (1996). *Technology strategy for business*. London: International Thomson Business Press.
  63. Frankort, H. T. W. (2013). Open innovation norms and knowledge transfer in interfirm technology alliances: Evidence from information technology, 1980-1999. *Advances in Strategic Management*, 30, 239–282.
  64. Frosch, R.A.; Gallopoulos, N.E. (1989). Strategies for manufacturing. *Scientific American*, 261, 144-152.
  65. Frow, P., McColl-Kennedy, J.R. & Payne, A., 2016. Co-creation practices: Their role in shaping a health care ecosystem. *Industrial Marketing Management*, 56, pp.24–39. Available at: <http://dx.doi.org/10.1016/j.indmarman.2016.03.007>.
  66. Futuyma.D.J., 1979. *Evolutionary Biology*, Oxford University Press, Incorporated, ISBN-100878931996
  67. Gao, L.S. & Iyer, B., 2006. Analyzing Complementarities Using Software Stacks for Software Industry Acquisitions. *Journal of Management Information Systems*, 23(2), pp.119–147. Available at: <http://dx.doi.org/10.2753/mis0742-1222230206>.
  68. Gao, L.S. & Iyer, B., 2008. Partnerships between Software Firms: Is There Value from Complementarities? *Proceedings of the 41st Annual Hawaii International Conference on System Sciences (HICSS 2008)*. Available at: <http://dx.doi.org/10.1109/hicss.2008.344>.

69. Garcia, D. & Gluesing, J.C., 2013. Qualitative research methods in international organizational change research. *Journal of Organizational Change Management*, 26(2), pp.423–444. Available at: <http://dx.doi.org/10.1108/09534811311328416>.
70. Garud, R., (1994). Cooperative and competitive behaviors during the process of creative destruction. *Research Policy* 23 (4), 385–394.
71. Gawer A, Cusumano M (2008) How companies become platform leaders. *MIT Sloan Management Review*. 49(2) 28–35.
72. Gawer, A. & Cusumano, M.A., 2013. Industry Platforms and Ecosystem Innovation. *Journal of Product Innovation Management*, 31(3), pp.417–433. Available at: <http://dx.doi.org/10.1111/jpim.12105>.
73. Gawer, A. 2009, 'Platforms, Markets and Innovation: An Introduction'. In Gawer, A. ed., *Platforms, Markets and Innovation*, Cheltenham, UK and Northampton, MA, US: Edward Elgar
74. Gawer, A., Cusumano, M.A. (2007). A strategy toolkit for platform leader wannabes. Working paper, presented at the DRUID summer conference 2007.
75. Gawer, M. Cusumano (2002). *Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation*. Harvard Business School Press, Boston, MA (2002)
76. General Electric Press releases [Accessed 16.06.2016] Available at: <https://www.ge.com/power/about/press-releases>
77. General Electric.com 2017 Annual reports [www document][Accessed 27.05.2018] Available <https://www.ge.com/investor-relations/ar2017/downloads>
78. Ghazawneh, A., and Henfridsson, O. 2013. “Balancing platform control and external contribution in thirdparty development: the boundary resources model,” *Information Systems Journal* 23(2), pp. 173– 192. doi:10.1111/j.1365-2575.2012.00406.x
79. Ghoshal, S & C.A. Bartlett (1994). Linking Organizational Context and Managerial Action: The Dimension of Quality Management, *Strategic Management Journal*, 15 (Special Issue Summer 1994) pp.91-112
80. Gnyawali, D.R. & Park, B.-J. (2011). Co-opetition between giants: Collaboration with competitors for technological innovation. *Research Policy* 40, 650–663
81. Golafshani, N. (2003). Understanding Reliability and Validity in Qualitative Research. *The Qualitative Report*. 8 (4), pp.597-607.

82. Grunig, J. (2006). Furnishing the edifice: ongoing research on public relations as a strategic management function. *Journal of Public Relations Research*, 18(2), pp. 151–176.
83. Gulati, R., Nohria, N., and Zaheer, A. (2000). Strategic Networks. *Strategic management journal* 21, 203-215.
84. Gulati, R., Puranam, P. & Tushman, M., (2012). Meta-organization design: Rethinking design in interorganizational and community contexts. *Strategic Management Journal* 33(6), 571–586.
85. Håkansson, H. & Ford, D., 2002. How should companies interact in business networks? *Journal of Business Research*, 55(2), pp.133–139. Available at: [http://dx.doi.org/10.1016/s0148-2963\(00\)00148-x](http://dx.doi.org/10.1016/s0148-2963(00)00148-x).
86. Håkansson, H., & Snehota, I. (1995). *Developing relationships in business networks*. Boston: International Thomson Press.
87. Hamel, G. 1991. Competition for competence and inter-partner learning within international strategic alliances. *Strategic Management Journal* 12 (Summer Special Issue): 83–103.
88. Helfat, C.E. & Raubitschek, R., 2000. Product Sequencing: Co-Evolution of Knowledge, Capabilities and Products. *SSRN Electronic Journal*. Available at: <http://dx.doi.org/10.2139/ssrn.237288>.
89. Henry Chesbrough (2011). Everything You Need to Know About Open Innovation. *Forbes* [www document] [Accessed 26.12.2017] [Available at <https://www.forbes.com/sites/henrychesbrough/2011/03/21/everything-you-need-to-know-about-open-innovation/#79190a6275f4>]
90. Hoepfl, M. C. (1997). Choosing qualitative research: A primer for technology education researchers. *Journal of Technology Education*, 9(1), pp.47-63.
91. Hosmer, L T (1995). Strategic Planning as if Ethics Mattered, *Strategic Management Journal*. 15 (Special Issue Summer 1994) pp.17-34
92. Hosmer, L.T., 1995. Strategic planning as if ethics mattered. *Strategic Management Journal*, 15(S2), pp.17–34. Available at: <http://dx.doi.org/10.1002/smj.4250151003>.
93. Hughes, H., Williamson, K. and Lloyd, A. (2007). Critical incident technique. In: Lipu, Suzanne, (ed.) *Exploring methods in information literacy research*. Topics in

- Australasian Library and Information Studies, Number 28. Centre for Information Studies, Charles Sturt University, Wagga Wagga, N.S.W., pp. 49-66.
94. Hughes, T.P. (1983) *Networks of Power: Electrification in Western Society 1880–1930*. Johns Hopkins University Press: Baltimore, MD.
  95. Hurmelinna-Laukkanen, P., Nätti, S., & Helin, S. (2014). Innovation Network Orchestrators – Distinction between Types and Roles. In Proceedings of 30th EGOS Colloquium, Rotterdam, The Netherlands, July 3–5, 2014.
  96. Iansiti M., Lakhani K. 2017. Managing our hub economy. *Harvard Business Review*, September/October issue: 84-92.
  97. Iansiti, M., & Levien, R. 2002. Keynotes and Dominators: Framing Operating and Technology Strategy in a Business Ecosystem. Harvard Business School Working Paper, No. 03-061. Cambridge, MA: Harvard Business School.
  98. Iansiti, M., & Levien, R., (2004a). Strategy as Ecology. *Harvard Business Review*, 82(3): 68–80.
  99. Ibarra, H. (1993). Network centrality, power and innovation involvement: Determinants of technical and administrative roles. *Academy of Management Journal* 36(3), 471-502.
  100. Ireland, R., 2002. Alliance Management as a Source of Competitive Advantage. *Journal of Management*, 28(3), pp.413–446. Available at: [http://dx.doi.org/10.1016/s0149-2063\(02\)00134-4](http://dx.doi.org/10.1016/s0149-2063(02)00134-4).
  101. Isenberg, D., 2010. The big idea: how to start an entrepreneurial revolution. *Harvard Business Review* 88 (6), 40–50.
  102. Isherwood, D. & Coetzee, M., 2011. Enhancing Digital Business Ecosystem trust and reputation with centrality measures. 2011 Information Security for South Africa. Available at: <http://dx.doi.org/10.1109/issa.2011.6027535>.
  103. Iyer, B., Lee, C.-H. & Venkatraman, N., 2006. Managing in a “Small World Ecosystem”: Lessons from the Software Sector. *California Management Review*, 48(3), pp.28–47. Available at: <http://dx.doi.org/10.2307/41166348>.
  104. J. Stanley, G. Briscoe, The ABC of digital business ecosystems, *Commun. Law* 15 (1) (2010) 12–25.
  105. Jaatinen, M. & Lavikka, R. (2008). Common understanding as a basis for

- coordination. *Corporate Communications, an International Journal*, 13, 147–167.
106. Jacobides, M. G., Cennamo, C., & Gawer, A. (2015). Platforms, ecosystems, architectures: Rethinking the aggregate? Working paper
  107. Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal*, 39, 2255–2276.
  108. Jacobides, M. G., Knudsen, T., & Augier, M. (2006). Benefiting from innovation: Value creation, value appropriation and the role of industry architectures. *Research Policy*, 35, 1200-1221.
  109. Jarillo, J. C. (1988). On strategic networks. *Strategic Management Journal*, 9, 31 – 41.
  110. John C. Chambers, Satinder K. Mullick & Donald D. Smith (1971). How to Choose the Right Forecasting Technique. *Harvard Business Review*
  111. Johnson, L.K., (2004). Execute your strategy — without killing it. *Harvard Management Update* 9 (12), 3–6.
  112. Jorde, T.M. & Teece, D.J., 1990. Innovation and Cooperation: Implications for Competition and Antitrust. *Journal of Economic Perspectives*, 4(3), pp.75–96. Available at: <http://dx.doi.org/10.1257/jep.4.3.75>.
  113. Josh Bersin (2013). The World Is Not Global, It's Local. *Forbes*. [www document] [Accessed on 29.06.2018] Available <https://www.forbes.com/sites/joshbersin/2013/04/23/the-world-is-not-global-its-local/#20452e5b4f3b>
  114. Kanter, R. M. (2011). Competitive Strategy: How Great Companies Think Differently. *Harvard Business Review*
  115. Kapoor, R., & Lee, J. M. (2013). Coordinating and competing in ecosystems: How organizational forms shape new technology investments. *Strategic Management Journal*, 34(3), 274–296.
  116. Korhonen, J., 2001. Four ecosystem principles for an industrial ecosystem. *Journal of Cleaner Production*, 9(3), pp.253–259. Available at: [http://dx.doi.org/10.1016/S0959-6526\(00\)00058-5](http://dx.doi.org/10.1016/S0959-6526(00)00058-5).
  117. Lars Huemer (1998) Trust in Business Relations: Economic Logic or Social Interaction? Borea Bokforlag. WSOY
  118. Lehoux, P. et al., 2014. How do business model and health technology design

- influence each other? Insights from a longitudinal case study of three academic spin-offs. *Research Policy*, 43(6), pp.1025–1038. Available at: <http://dx.doi.org/10.1016/j.respol.2014.02.001>.
119. Lewin, R. (1999). *Complexity: Life at the edge of chaos*, Chicago, IL: The University of Chicago Press, ISBN 0226476553
  120. Luo, Y. (2002). Building trust in cross-cultural collaborations: Toward a contingency perspective. *Journal of Management*, 28(5), 669–694.
  121. Luo, Y., (2004). *Co-opetition in International Business*. Copenhagen Business School Press, Copenhagen, Denmark.
  122. Lusch, R.F., Vargo, S.L., & Tanniru, M. (2010). Service, Value networks and learning. *Journal of the Academy of Marketing Science*, 38(1), 19-31.
  123. M. Peltoniemi (2006). Preliminary Theoretical Framework for the Study of Business Ecosystems. *Emergence: Complexity & Organization*, 8(1) 10-19.
  124. M.E. Porter, *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press, New York, 1985.
  125. MacCarthy, B. L. & Jayarathne, P.G.S.A., 2011. Sustainable collaborative supply networks in the international clothing industry: a comparative analysis of two retailers. *Production Planning & Control*, 23(4), pp.252–268. Available at: <http://dx.doi.org/10.1080/09537287.2011.627655>.
  126. MacCormack, A., & Iansiti, M., (2009). Intellectual Property, Architecture, and the Management of Technological Transitions: Evidence from Microsoft Corporation. *Journal of Product Innovation Management* 26, 248–263
  127. Mark Barratt, (2004) "Understanding the meaning of collaboration in the supply chain", *Supply Chain Management: An International Journal*, Vol. 9 Issue: 1, pp.30-42,
  128. Marschan-Piekkari, R., and Welch, C. 2004. *Qualitative Research Methods*. In *International Business: The State of the Art*. In: Marschan-Piekkari, R. and Welch, C. (eds.), *Handbook of qualitative research methods for international business*, Cheltenham, UK and Northampton, MA: Edward Elgar, pp. 25-55.
  129. Mathison, S. (1988). Why Triangulate? *Educational Researcher*, 17(2), pp.13-17.
  130. Mathison, S. (2005). *Encyclopedia of evaluation* Thousand Oaks, CA: SAGE

Publications Ltd doi: 10.4135/9781412950558

131. Mazzola, E. & Perrone, G., 2013. How the purpose of the inter-firm relationships influences the choice of the governance form: evidence from the machine tool and the pharmaceutical industries. *Technology Analysis & Strategic Management*, 25(9), pp.1009–1025. Available at: <http://dx.doi.org/10.1080/09537325.2013.832745>.
132. Merry, U. (1999). Organizational strategy on different landscapes: A new science approach. *Systemic Practice and Action Research*, ISSN 1094-429X, 12, 257-278
133. Microsoft Annual Report (2017). [www document] [Accessed 13.05.2018] Available <https://www.microsoft.com/investor/reports/ar17/index.html>
134. Microsoft Annual Reports (2017). (www document) (Accessed 01.07.2018) Available at: <https://www.microsoft.com/investor/reports/ar17/index.html>
135. Microsoft Press Releases (www document) (Accessed 01.06.2016) Available at: <https://news.microsoft.com/category/press-releases/>
136. Minna Pikkarainen, Mari Ervasti, Pia Hurmelinna-Laukkanen, and Satu Natti (2017) Orchestration Roles to Facilitate Networked Innovation in a Healthcare Ecosystem. *Technology Innovation Management Review* September 2017 (Volume 7, Issue 9)
137. Mitleton-Kelly, Eve. (2007). The emergence of final cause. In Mika Aaltonen (Ed.). *The third lens: Multi-ontology sense-making and strategic decision-making*. Aldershot: Ashgate Publishing Limited. Forthcoming
138. Möller, K. & Svahn, S., 2003. Managing Strategic Nets. *Marketing Theory*, 3(2), pp.209–234. Available at: <http://dx.doi.org/10.1177/14705931030032002>.
139. Moore, J. H. (1993). Predators and Prey: A New Ecology of Competition. *Harvard Business Review*, 71(3): 75–86.
140. Moore, J.F. (1996). *The death of competition: leadership & strategy in the age of business ecosystems*. New York, Harper Business.
141. Nachira, F. 2002. Towards a Network of Digital Business Ecosystems Fostering the Local Development. European Commission Discussion Paper. Bruxelles. 23 p. [http://www.digitalecosystem.org/html/repository/dbe\\_discussionpaper.pdf](http://www.digitalecosystem.org/html/repository/dbe_discussionpaper.pdf)
142. Nachira, F., Nicolai, A., Dini, P., Le Louarn, M., and Rivera Leon, L., 2007. ´Eds., *Digital Business Ecosystems*. European Commission.
143. Najda-Janoszka, M. (2018). *Towards Platform Defined Business – Complementarity*

- at the Spotlight. *Entrepreneurship and Management*, 19(6), 107–117.
144. Nambisan S., & Sawhney, M. (2011). Orchestration Processes in Network-Centric Innovation: Evidence From the Field. *Academy of Management Perspectives*, 25, 40–57.
  145. Normann, R. & Ramirez, R., 1994. *Designing Interactive Strategy*, Wiley
  146. Normann, R., & Ramirez, R. (1994). *Designing interactive strategy. From value chain to value constellation*. Chichester, UK: John Wiley & Sons.
  147. Oh, D.S., Phillips, F., Park, S., Lee, E., 2016. Innovation ecosystems: a critical examination. *Technovation* 54, 1–6.
  148. Oracle Corporation. 2017 Annual reports. [www document][Accessed 01.06.2018] Available <http://www.annualreports.com/Company/oracle-corporation>
  149. Oracle Corporations Annual report. (www document) (Accessed 17.03.2018) Available at: <http://www.annualreports.com/Company/oracle-corporation>
  150. Oracle Press Releases (www document) (Accessed 01.06.2016) Available at: <https://www.oracle.com/search/press>
  151. Oxley, J. E., and R. C. Sampson. 2004. The scope and governance of international R&D alliances. *Strategic Management Journal* 25 (8–9): 723–49
  152. Panetta, K. (2017) 8 Dimensions of Business Ecosystems. Gartner [www document] [Accessed on 17.02.2018] [Available] <https://www.gartner.com/smarterwithgartner/8-dimensions-of-business-ecosystems/>
  153. Parker, G. G., Van Alstyne, M. W., & Choudary, S. P. (2016). *Platform revolution*. New York, NY: Norton and Co.
  154. Pellikka, J. & Ali-Vehmas, T., 2016. Managing Innovation Ecosystems to Create and Capture Value in ICT Industries. *Technology Innovation Management Review*, 6(10), pp.17–24. Available at: <http://dx.doi.org/10.22215/timreview/1024>.
  155. Peltoniemi, M. (2005). Business ecosystem. A conceptual model of an organisation population from the perspectives of complexity and evolution. E-Business Research Center. Research Reports 18 Tampere. ISSN 1459-0166.
  156. Peltoniemi, M.; Vuori, E. (2004). Business ecosystem as the new approach to complex adaptive business environments. *Proceedings of eBusiness Research Forum, Tampere*.

157. Pilinkienė, V. & Mačiulis, P., 2014. Comparison of Different Ecosystem Analogies: The Main Economic Determinants and Levels of Impact. *Procedia - Social and Behavioral Sciences*, 156, pp.365–370. Available at: <http://dx.doi.org/10.1016/j.sbspro.2014.11.204>.
158. Pilinkienė, V. & Mačiulis, P., 2014. Comparison of Different Ecosystem Analogies: The Main Economic Determinants and Levels of Impact. *Procedia - Social and Behavioral Sciences*, 156, pp.365–370. Available at: <http://dx.doi.org/10.1016/j.sbspro.2014.11.20>
159. Porter, M.E., 1981. The Contributions of Industrial Organization to Strategic Management. *The Academy of Management Review*, 6(4), p.609. Available at: <http://dx.doi.org/10.2307/257639>.
160. Powell, W.W., Koput, K.W. & Smith-Doerr, L., 1996. Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology. *Administrative Science Quarterly*, 41(1), p.116. Available at: <http://dx.doi.org/10.2307/2393988>.
161. Power, T., G. Jerjian. (2001). *Ecosystem: Living the 12 principles of networked business*. Pearson Education Ltd.
162. Prügl, R. & Schreier, M. (2006) Learning from leading-edge customers at the Sims: opening up the innovation process using toolkits. *R&D Management*, 36(3), 237–250. <https://doi.org/10.1111/j.1467-9310.2006.00433.x>
163. Rao, P.M. & Klein, J.A., 1994. Growing importance of marketing strategies for the software industry. *Industrial Marketing Management*, 23(1), pp.29–37. Available at: [http://dx.doi.org/10.1016/0019-8501\(94\)90024-8](http://dx.doi.org/10.1016/0019-8501(94)90024-8).
164. Rausher, M.D., 2001. Co-evolution and plant resistance to natural enemies. *Nature*, 411(6839), pp.857–864. Available at: <http://dx.doi.org/10.1038/35081193>.
165. Rickmann, T., Wenzel, S., & Fischbach, K. (2014). *Software Ecosystem Orchestration: The Perspective of Complementors*. Twentieth Americas Conference on Information Systems, Savannah.
166. Ritala, P., & Almpantopoulou, A. (2017). In defense of ‘eco’ in innovation ecosystem. *Technovation*, 60, 39-42.
167. Ritala, P., Armila, L. & Blomqvist, K., (2009). Innovation orchestration capability –

- defining the organizational and individual level determinants. *International Journal of Innovation Management*, 13(4), 569-591
168. Ritala, P., Golnam, A., & Wegmann, A. (2014). Coopetition-based business models: The case of Amazon.com. *Industrial Marketing Management*, 43(2), 236–249.\*\*\*
  169. Ritala, P., Hurmelinna-Laukkanen, P., Blomqvist, K., (2009). Tug of war in innovation—coopetitive service development. *International Journal of Services Technology and Management* 12 (3), 255–272.
  170. Ritter, T., Wilkinson, I. F., & Johnston, W. J. (2004). Managing in complex business networks. *Industrial Marketing Management*, 33(3), 175–183.
  171. Rohrbeck, R, Hölzle, K., & Gemünden, H. G. (2009). Opening for Competitive Advantage – How Deutsche Telekom Creates an Open Innovation Ecosystem. *R&D Management*, 39(4): 420–430.
  172. Roijackers, N., Leten, B., Vanhaverbeke, W., Clerix, A., & Van Helleputte, J. 2013. Orchestrating Innovation Ecosystems\_IMEC. In *Proceedings of the 35th DRUID Conference 2013, Barcelona, Spain, June 17-19, 2013*.
  173. Sargut, G. and McGrath, R. G., (2011) *Learning to Live with Complexity*. Harvard Business Review
  174. Saunders, M., Lewis, P. and Thornhill, A. (2009). *Research methods for business students (5th Ed.)*. Pearson education, Prentice Hall Financial Times, Rotolito Lombarda, Italy.
  175. Selander, L., Henfridsson, O., and Svahn, F. 2013. “Capability search and redeem across digital ecosystems,” *Journal of Information Technology* 28 (3), pp. 183–197.
  176. Silverthorne, S. (2002). *The Secret of How Microsoft Stays on Top*. Harvard Business School Working Knowledge. [www document] [Accessed 27.07.2018] Available <https://hbswk.hbs.edu/item/the-secret-of-how-microsoft-stays-on-top>
  177. Sivadas, E., & Dwyer, F. R. (2000, January). An examination of organizational factors influencing new product success in internal and alliance based processes. *Journal of Marketing*, 64, 31 – 49.
  178. Smith, M. Y. & Stacey, R. (1997). Governance and cooperative networks: An adaptive systems perspective. *Technological Forecasting and Social Change*, ISSN 0040-1625, 54(1), 79-94.

179. Sponsor Content From Accenture Strategy, 2018. How B2B Companies Can Grow with Ecosystem Orchestration. Harvard Business Review.
180. Stacy, R. (1996). Complexity and Creativity in Organizations. San Francisco: Berrett-Koehler Publishers.
181. Stank, T.P., Daugherty, P.J. and Auty, C.W. (1999), "Collaborative planning: supporting automatic replenishment programs", Supply Chain Management, Vol. 4 No. 2, pp. 75-82.
182. T. K. Das and B.-S. Teng (2000), A resource-based theory of strategic alliances. Journal of Management, vol. 26, pp. 31–61,
183. Tansley, A.G., 1935. The Use and Abuse of Vegetational Concepts and Terms. Ecology, 16(3), pp.284–307. Available at: <http://dx.doi.org/10.2307/1930070>.
184. Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. Strategic Management Journal 28(13), 1319–1350.
185. Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. Research Policy, 15(6), 285–305.
186. Teece, D. J. (2018). Profiting from innovation in the digital economy: Standards, complementary assets, and business models in the wire-less world. Research Policy (Forthcoming)
187. Teece, D. J., G. Pisano and A. Shuen. 'Firm capabilities, resources, and the concept of strategy', Mimeo. University of California at Berkeley, Haas School of Business, September, 1990.
188. Teece, D. J., Pisano, G. & Shuen, A. (1990). 'Firm capabilities, resources, and the concept of strategy'. CCC Working Paper, Center for Research on Management, University of California, Berkeley, CA.
189. Thomas Kude, Jens Dibbern, and Armin Heinzl (2012), Why Do Complementors Participate? An Analysis of Partnership Networks in the Enterprise Software Industry. IEEE Transactions On Engineering Management, Vol. 59 (2) pp. 250-265
190. Thorelli, H.B (1986). Networks, between Markets and Hierarchies, Strategic Management Journal, 7, pp.37-51

191. University of Michigan. The Concept of Ecosystem. [www document] [Accessed on 09.03.2018] Available <https://globalchange.umich.edu/globalchange1/current/lectures/kling/ecosystem/ecosystem.html>
192. Valen, V.L., (1973). "A new evolutionary law". *Evolutionary Theory* 1, 1-30.
193. Valkokari, K., Paasi, J., Luoma, T., & Leen, N. 2009. Beyond Open Innovation – The Concept of Networked Innovation. In *Proceedings of the 2nd ISPIM Innovation Symposium, Stimulating Recovery – The Role of Innovation Management*. International Society for Professional Innovation Management (ISPIM), New York, December 6–9, 2009.
194. van Angeren, J., Blijleven, V. and Jansen, S., 2011, November. Relationship intimacy in software ecosystems: a survey of the dutch software industry. In *Proceedings of the International Conference on Management of Emergent Digital EcoSystems* (pp. 68-75). ACM.
195. van den Berk, I., Jansen, S., and Luinenburg, L. 2010. “Software ecosystems: A software ecosystem strategy assessment model,” in *ECSA 2010 proceedings: Fourth European Conference on Software Architecture (ECSA 2010) 23-26 August, 2010, Copenhagen, Denmark*, [New York, N.Y.]: ACM Press, pp. 127–134. doi>10.1145/1842752.1842781
196. Verizon Communications Company Profile. (www document) (Accessed 16.03.2018) Available at: <https://www.verizon.com/about/our-company>
197. Verizon Communications Press Release (www document) (Accessed 01.06.2016) Available at: <https://www.nasdaq.com/symbol/vz/press-releases>
198. Verizon Communications. Company profile [www document][Accessed 30.05.2018] Available <https://www.verizon.com/about/our-company/who-we-are>
199. Vilma Luoma-aho and Saara Halonen (2010). Intangibles and Innovation: The Role of Communication in the Innovation Ecosystem. *Innovation Journalism* Vol 7(2) pp. 1-20
200. Walley, K., (2007). Coopetition: an introduction to the subject and an agenda for research. *International Studies of Management & Organization* 37 (2), 11– 31.
201. Walter, A., Ritter, T., & Gemünden, H. G. (2001). Value-creation in buyer – seller

- relationships: Theoretical considerations and empirical results from a supplier's perspective. *Industrial Marketing Management*, 30(4), 365 – 377.
202. Wang, J. & De Wilde, P., 2008. Evolution-generated communications in Digital Business Ecosystem. 2008 IEEE Conference on Cybernetics and Intelligent Systems. Available at: <http://dx.doi.org/10.1109/iccis.2008.4670899>
203. Wessner, C. W. (2007). Innovation policies for the 21st century. Report of a symposium. Washington, D.C: The National Academies Press.
204. West, J., & Wood, D. (2013). Evolving an open ecosystem: The rise and fall of the Symbian platform. *Advances in Strategic Management*, 30, 27–67.
205. Wilkinson, I. F., & Young, L. C. (1994). Business dancing: The nature and role of interfirm relations in business strategy. *Asia-Australia Marketing Journal*, 2(1), 67 – 79
206. Williamson, P.J. & De Meyer, A., 2012. Ecosystem Advantage: How to Successfully Harness the Power of Partners. *California Management Review*, 55(1), pp.24–46. Available at: <http://dx.doi.org/10.1525/cmr.2012.55.1.24>.
207. Yawson, R.M., 2009. The Ecological System of Innovation: A New Architectural Framework for a Functional Evidence-Based Platform for Science and Innovation Policy. SSRN Electronic Journal. Available at: <http://dx.doi.org/10.2139/ssrn.1417676>.
208. Yin, R. (1984). *Case Study Research*. Beverly Hills, CA: Sage Publications
209. Yin, R. K. (2003). *Case Study Research: Design and Methods*. Thousand Oaks, Calif.: Sage Publications.
210. Yin, R. K. (2009). *Case study research: Design and methods* (4th Ed.). Thousand Oaks, CA: Sage.
211. Yin, R.K. (1994) *Case Study Research: Design and Methods*, 2nd edition. Sage Publications, Thousand Oaks.
212. Yoffie, D., and Kwak, M. 2006. “With friends like these: the art of managing complementors,” *Harvard business review* 84 (9), pp. 88–98.
213. Yoffie, D.B. & Kwak, M., 2002. Judo Strategy: 10 Techniques For Beating A Stronger Opponent. *Business Strategy Review*, 13(1), pp.20–30. Available at: <http://dx.doi.org/10.1111/1467-8616.00198>.

## APPENDIX 1

Summary of the ecosystem archetypes which the six case companies functioned as central players (played leading roles).

Column1	Electric	Amazon	AT&T	verizon	Oracle	Microsoft
911 Service ecosystem	0	0	0	0	1	0
Amazon end-to-end ecosystem	0	9	0	0	0	0
Application ecosystem	0	0	0	0	0	1
Business ecosystem	0	1	4	9	3	9
Cloud computing ecosystem	0	0	0	0	1	0
Cloud ecosystem	0	0	0	2	0	0
Communications ecosystem	0	0	0	1	0	0
Complex sales ecosystem	0	0	1	0	0	0
Computing ecosystem	0	0	0	0	0	1
Content ecosystem	0	20	3	0	1	0
Cyberspace ecosystem	0	0	0	1	0	0
Digital ecosystem	0	1	0	0	0	1
Electric vehicle ecosystem	6	0	0	0	0	0
Enterprise ecosystem	0	0	0	0	2	0
financial ecosystem	0	0	0	2	0	0
Healthcare ecosystem	0	0	2	0	0	0
Healthcare IT ecosystem	1	0	0	0	0	0
Hudson/product/technology ec	0	0	0	0	1	0
ICT ecosystem	0	0	0	0	0	1
Identity management/Mobile s	0	0	0	0	2	0
Independent software vendor i:	0	0	0	0	0	1
Industrial software ecosystem	1	0	0	0	0	0
Innovation ecosystem	7	3	13	5	0	6
Integrated ecosystem	0	0	0	0	0	1
Internet ecosystem	0	0	0	12	0	0
lptv ecosystem	0	0	0	0	0	2
IT ecosystem	0	0	0	1	0	1
Java ecosystem	0	0	0	0	11	0
Linux ecosystem	0	0	0	0	1	0
machine-to-machine m2m ecos	0	0	0	0	1	0
manufacturing ecosystem	3	0	0	0	0	0
Marketing technology ecosyste	0	0	0	0	2	0
Microsoft ecosystem	0	0	0	0	0	31
Mobile app content ecosystem	0	1	0	0	0	0
mobile ecosystem	0	0	12	1	0	0
Multi-vendor/Platform ecosyste	1	0	0	0	0	0
MySQL/Product ecosystem	0	0	0	0	1	0
open ecosystem	0	1	0	0	0	0
Open/ video-collaboration ecos	0	0	0	2	0	0
Oracle ecosystem	0	0	0	0	22	0
Partner ecosystem	9	9	3	4	61	168
Platform ecosystem	10	0	5	0	0	2
Product	0	0	0	0	0	2
Product ecosystem	3	0	1	1	1	0
Security ecosystem	0	0	1	0	0	0
Social ecosystem	0	0	0	0	1	0
Software ecosystem	0	0	0	0	0	4
software-as-a-service	0	0	0	1	0	0
Solutions ecosystem	1	0	0	0	0	1
Sustainable open/ Security ID/ \	0	0	0	0	0	6
Symbian mobile os ecosystem	0	0	0	0	1	0
systems integrators and vendor	0	0	0	0	1	0
Technology ecosystem	3	0	6	3	0	1
Trust ecosystem	0	0	0	0	0	1
verizon ecosystem	0	0	0	1	0	0
Windows ecosystem	0	0	0	0	0	20
Workplace ecosystem	0	0	0	0	0	1
<b>Total</b>	<b>45</b>	<b>45</b>	<b>51</b>	<b>47</b>	<b>113</b>	<b>261</b>

## APPENDIX 2

Summary of complementors' collaborations with the six keystone firms.

Complementors	Sum	number of com	Amazon	General Electri	verizon	Microsoft	AT&T	Oracle	
partners	139	4	4	0	2	1	105	0	31
Cisco	12	4	4	0	1	3	4	4	0
accenture	11	4	4	4	1	2	4	0	0
hp	55	3	3	0	0	1	52	0	2
Intel	43	3	3	0	0	1	41	0	1
Nokia	26	3	3	0	0	1	22	3	0
Microsoft	11	3	3	8	2	0	0	1	0
capgemini	10	3	3	2	0	0	7	0	1
netflix	5	3	3	1	0	1	3	0	0
ibm	14	2	2	2	0	0	12	0	0
ericsson	12	2	2	0	0	1	11	0	0
service providers	12	2	2	0	0	0	11	0	1
developers	8	2	2	7	0	1	0	0	0
harris	7	2	2	0	0	0	6	1	0
toshiba	7	2	2	1	0	0	6	0	0
alcatel-lucent	6	2	2	0	0	1	0	5	0
juniper networks	6	2	2	0	0	0	5	0	1
at&t	5	2	2	0	2	0	3	0	0
bea systems	4	2	2	0	0	0	1	0	3
linux	4	2	2	0	1	0	0	0	3
novell	4	2	2	1	0	0	3	0	0
oracle	4	2	2	3	0	1	0	0	0
Deloitte	3	2	2	2	0	1	0	0	0
entrepreneurs	3	2	2	0	2	1	0	0	0
sap ag	3	2	2	1	0	0	2	0	0
vodafone	3	2	2	0	0	2	0	1	0
Cloudera	2	2	2	0	0	1	0	0	1
General Electric	2	2	2	0	0	1	1	0	0
orange	2	2	2	0	0	1	0	1	0
SAP	2	2	2	0	0	1	0	0	1
telefonica	2	2	2	0	0	1	0	1	0
verizon	2	2	2	0	0	0	1	1	0
wipro	2	2	2	1	0	0	0	0	1
wipro technologies	2	2	2	0	0	0	1	0	1