<u>Chapter 4.0</u>

Ecosystems Thinking and Modern Platform-Based Ecosystem Theory

4.1 Introduction

The emergence of business ecosystems (Moore: 1996) and platforms (Tiwana; 2014; Choudary: 2016; Parker *et al.,* 2016) represents a very recent development that is having a significant impact upon traditional industries and product/service markets (Downes and Nunes: 2013). The speed at which this new form of business model innovation has gained momentum has been largely the result of new technologies in the ICT sector such as the Internet (Web 1.0 and Web 2.0), the increasing digitization and dematerialisation of products, the rapid diffusion of mobile communications as well as big data and cloud computing (Simon: 2013). This trend is set to continue with the roll out of the Internet-of-Things (IOT) and the increasing connectedness that will result from this (McKinsey Global Institute: 2015).

This chapter will define what is meant by the terms ecosystem and platform and evaluate a broad range of theories relating to these two highly inter-related concepts. This will build on and reinforce theories discussed in Chapter 2 relating to value networks and relationships as well as complexity and chaos theory covered in Chapter 3.

4.1 Ecosystem Theory

The ecosystem concept is derived from the biological sciences. Although there are limitless definitions for the term ecosystem, one of the most lucid was coined by a pioneer in the science of ecology, Arthur Tansley (1935), who defined an ecosystem as the interactive system established between biocoenosis (a group of living creatures) and their biotope (the environment in which they live). Central to Tansley`s (1935) ecosystem concept was the idea that living organisms were continually engaged in a set of relationships with every other element constituting the environment in which they existed. Ecosystems could therefore be described as any situation where there were relationships between organisms and their environment.

However, it wasn't until the 1990s that James Moore (1996: 26) applied ecosystem theory to business. Moore is rightly credited with being the first person to produce a formal definition of the business ecosystem. In fact, Moore produced two separate definitions, one for the biological ecosystem and one for the business ecosystem. Moore (1996) defined a biological ecosystem as a community of organisms that interacted with one-another and their environment. This included lakes, forests and tundra and all abiotic components (non-living) such as mineral ions, organic compounds plus the rainfall and other physical factors (climate). The biotic (living) components included primary producers, such as green plants, macro-consumers, such as animals (which ingested other organisms or organic matter) and micro-consumers, such as bacteria and fungi that broke down the organic compounds upon the death of other organisms (Moore 1996: 26)

Moore (1996) then produced his own definition of the business ecosystem which he referred to as an economic community that was supported by a foundation of interacting organisations and individuals that produced goods and services of value to customers who were also members of the ecosystem. The members of the community (organisms) also included suppliers, lead producers, competitors and other stakeholders. Over time these community members would co-evolve their capabilities and align themselves with one another. The companies that succeeded in developing leadership roles would change over time but the ecosystem leaders would be instrumental in curating the overall health of the ecosystem through the achievement of shared visions and mutually supportive roles (Moore 1996: 26).

There are strong similarities between these three definitions. Tansley (1935) refers to the existence of an interactive system between living creatures and the environment thereby implying the continuous engagement in relationships. Moore`s (1996) biological ecosystem definition also highlights interaction between organisms and the environment but he also refers to a community and the existence of a terrestrial food chain that generates energy within the system. In his business ecosystem definition he also refers to interaction between organisations and individuals and uses the term economic community, not just community. He also refers to a food chain or energy source which is the production and consumption of goods and services of value to customers. However, Moore takes the interaction element of the ecosystem to a new level when he refers to co-evolution, alignment, shared visions and mutually supportive roles. Finally, Moore also referred to the existence of leadership roles within business ecosystems. These are sometimes known as the keystone firms (Iansiti and Levien: 2004) or the economic catalyst (Evans and Schmalansee: 2007).

This approach is in stark contrast to the rational, industry structure approach analysed in Chapter 2 – particularly the Porter`s Five Forces model (1980). In Porter`s framework, bargaining power and barriers to entry were the key determinants of success and monopolistic power was the goal, not co-creation, co-evolution or shared value involving a large community of participants or members. Moore (1996) also insisted that company`s should be viewed not as members of a single industry but as part of a business ecosystem that crossed a variety of industries. This was one of the reasons for the blurring of industry and market boundaries along with new technologies. The concepts of co-creation, co-evolution and continuous innovation also brought a dynamic perspective to the ecosystem model which was absent from conventional economic models such as Porter`s Five Forces framework (1980).

Moore (1993), also stated that innovative businesses couldn`t evolve in a vacuum and that an ecosystem community was therefore better positioned to out-innovate firms operating within conventional market/industry structures or silos. The only true sustainable advantage for a company came from out-innovating the competition at every stage of the ecosystem`s evolutionary cycle from Stage 1 (birth), to Stage 2 (expansion) as well as Stage 3 (leadership) but particularly in Stage 4 (self-renewal).

Despite the seminal nature of Moore`s (1993; 1996) business ecosystem theory, his research was undertaken before the Internet had gained any traction and did not therefore draw on any examples and evidence from online platform companies. The biological analogies used by the author were also very metaphorical and based on fragmented references to different types of terrestrial ecosystems (lakes, rivers, forest and grassland) and no single overarching biological ecosystem is used (Pickett and Cadenasso: 2002). In Chapter 5 a deep sea hydrothermal vent ecosystem is used to address some of these shortcomings (Van Dover: 2000).

Marco Iansiti and Roy Levien (2004) also undertook important ecosystem research and identified an important difference between biological ecosystems and business ecosystems. They found that although a biological ecosystem was self-organising a business ecosystem did not necessarily follow a similar type of development. A business ecosystem frequently benefited from having a leader or what Iansiti and Levien (2004) referred to as a keystone. In fact the authors identified four main types of ecosystem strategy which were keystone, physical dominator, niche` and commodity.

We will now look at each of these strategies in more depth starting with the keystone approach. The *keystone strategy* implemented by the keystone organisation played a very important role in improving the overall health of the ecosystem through the provision of a stable and predictable set-of common assets. Microsoft`s original personal computer operating system and Google`s Android mobile software and development tools (that other organizations used to build their own offerings) were good examples of this. Keystones can also significantly improve ecosystem productivity by making it easier to connect network participants to one another or by facilitating the creation of new products by third parties. Ecosystem robustness is also enhanced by incorporating technological innovations as well as encouraging niche` creation by making innovative technologies available to a wide variety of third party organisations. The opening up of ecosystems to third party software and app developers is a very good example of this i.e. Microsoft in personal computer software (Gawer and Cusumano: 2002) and Apple and Google in mobile apps. Iansiti and Levien (2004) also stated that by continually trying to improve the ecosystem as a whole, keystones sought to ensure their own survival and prosperity. As in biological ecosystems, keystones subsequently exercise a system-wide role despite being only a small part of their ecosystems` mass (Iansiti and Levien: 2004).

An effective keystone strategy consists of two aims. The first is to create value within the ecosystem. This is essential otherwise it will fail to attract or retain members. Second, the keystone must share the value it creates with other participants in the ecosystem. Google created value by giving away its Android mobile software to the telecoms operators. This resulted in a large ecosystem of customers who purchased cheaper Android-enabled hand-sets (which benefited hardware firms such as Samsung) and who also subscribed to mobile contracts for Android phones (benefiting the telecoms operators). This large user-base also enhanced the attractiveness of the software standard to app developers who became part of the ecosystem. These developers also received software development kits (SDKs or `devkits`) i.e. development tools to facilitate the creation of software applications for Android. The Android ecosystem is also an open system (open source software) as opposed to a closed ecosystem. This is the main reason for its enormous pervasiveness (more than 80% market share) compared to the Apple iOS mobile software ecosystem (over 13% market share) which is semi-closed or proprietary in comparison i.e. a “walled garden”.

The Android software acts as a platform which forms the foundation of Google`s mobile ecosystem. Iansiti and Levien (2004) described a platform as an asset in the form of services, tools or technologies that offer solutions to others in the ecosystem. Iansiti and Levien (2004) developed their definition further by saying that the platform could be a physical asset such as the efficient manufacturing capabilities that Taiwan Semiconductor Manufacturing offered to computer chip design companies (that didn`t have their own silicon wafer foundries) or an intellectual asset such as the Windows or Android software platforms. The keystone therefore leaves the vast majority of the value creation to others in the ecosystem. However, the keystone must also retain some of the value that has been created for themselves. Google achieves this by capturing large amounts of data from the users of the Android software which is monetised in the form of advertising revenues - which also creates benefits for advertisers.

Keystone organisations must ensure that the value of their platforms increase sufficiently to cover the cost of creating, maintaining and sharing them with the ecosystem members who choose to use the platforms. This allows the keystone players to share the surplus with their communities. However, during the Internet boom, many businesses failed because - although the value of the keystone platform was increasing with the number of customers (theoretically) - the actual operating costs rose resulting in margin erosion and ultimate collapse (Abramson: 2005).

This approach to strategy is in stark contrast to Porter`s Five Forces (1980) Industry structure paradigm. Unlike, Porter`s industry structure approach, there is no attempt to develop monopolistic rents through high bargaining power and the creation of barriers to entry. Instead of preventing entry and substitution (reductionism), the ecosystem approach is designed to increase the size of the community (expansionism) and its contribution to innovation, not to reduce it. This approach also contrasts with the resource-based view (RBV) of strategy where competitive advantage is achieved by firms developing superior resources and capabilities to competitors. These are resources that are owned and/or controlled by the firm and there is a strong internal rather than external orientation. With an ecosystem approach, the keystone doesn`t primarily seek ownership or control but access to producer-consumer networks and enhanced value from a broader range of external capabilities (Parker *et al.,* 2016) thereby inverting the resource-based view (RBV). The ecosystem approach therefore focuses on the co-creation and co-evolution of capabilities at an ecosystem level rather than at a firm or industry level (Teece: 2012).

The ***physical dominator strategy*** resembles the traditional approach to strategy identified in Porter`s Five Forces model (1980) where players seek to gain some form of monopoly power or domination. Whereas keystones exercise indirect power, the physical dominator aims to integrate vertically or horizontally to own and manage a large proportion of a network directly (Iansiti and Levien: 2004). Once a dominator takes control, this will impact negatively on the ecosystem and there will be little opportunity for a meaningful ecosystem to emerge. Iansiti and Levien (2004) use IBM as an example and how the firm dominated the mainframe computing ecosystem. This strategy was effective because it allowed IBM to create and extract enormous value for long periods of time (Pugh: 1995). However, it failed when the personal computer (PC) ecosystem emerged which was more open and distributed and was supported by keystone strategies from Apple, Microsoft, Intel and even IBM at the beginning.

Where a ***value dominator strategy*** is adopted, Iansiti and Levien (2004) stated the firm has little control over its ecosystem, occupying just a single hub in some cases. It creates little, if any value for the ecosystem. A value dominator would extract as much as it could by extracting from the network most of the value created by other members. It would subsequently leave too little to sustain the ecosystem, which could ultimately collapse and bring the value dominator down with it. Although the digital music ecosystem hasn`t shown any signs of collapsing there is evidence of value dominator strategies by key players such as Google`s YouTube music service which is supported by advertising. The monetary returns to artists and music companies are extremely small representing 40% of music played but only 4% of overall revenues (*Financial Times*: 2016a). This is in contrast to streaming subscription services provided by firms such as Spotify which have generated $6billion in revenues for the industry (*Financial Times:* 2016a). The only factor sustaining the ecosystem is the exposure that artists gain from their music being played on what is the largest global music platform. Another example is the cable TV industry in the US where cable companies have continued to charge high prices for poor services and inappropriate programing leading to a decline in subscriptions as customers migrate on to the Internet (*Financial Times*: 2015).

In business ecosystems, it is normal for most organisations to follow *niche` strategies.* The purpose is to develop specialised capabilities that differentiate them from other companies in the network. These firms leverage complementary resources from other niche` players or from the ecosystem keystone. When they are allowed to thrive, niche` players represent the bulk of the ecosystem and they are responsible for most of the value creation and innovation. They operate in the shadow of a keystone which offers its resources to niche` players (Iansiti and Levien: 2004). Modern examples of niche` players are the software development firms (apps), the small independent computer games companies (`Indies`) and the microprocessor design firms (Arm Holdings).

According to Iansiti and Levien (2004), where innovation was low and relationships were less complex, ***commodity strategies*** would often prevail. The authors claimed that an ecosystem strategy was largely irrelevant in such instances, since firms operated relatively independently of one another using price competition. Such strategies have been evident in the telecommunications sector where telecoms operators and cable companies have been slow to adapt to new technologies and have been competing on price rather than the development of new products and services. Only recently have these firms begun to move towards the provision of bundled quad play products based on content and high speed broadband strategies. However, the broadband networks, speeds and mobile coverage still remain underdeveloped. The low levels of expenditure on R&D as a percentage of sales relative to other ICT ecosystem companies has resulted in commodity strategies emerging. This viewpoint is reinforced by an Ernst and Young report in 2014 entitled: *Top 10 Risks in Telecommunications 2014.* This revealed that telecoms firms were failing to adopt new routes to innovation and failing to realise roles in industry ecosystems (Ernst and Young 2014: 2).

It is also important to note that roles in ecosystems aren`t static. A company may be a keystone in one domain and a dominator or a niche` player in others. For example, Microsoft was a keystone in the personal computer (PC) ecosystem but became a dominator in browsers and search (Arthur: 2014). Microsoft implemented a platform envelopment (Eisenmann, Parker and Van Alstyne: 2010) strategy (this occurs when a platform absorbs the functions and the user base of an adjacent platform) to win the browser wars with Netscape in the mid-1990s (Arthur: 2014). Airbnb and Uber started as niche` software apps but became keystones in online accommodation and transport respectively.

Meanwhile, the telecoms companies are trying to move away from commodity strategies to becoming value dominators as they upgrade their networks and threaten to introduce ad blocking software to monetise value from high data traffic from the media platforms they serve (*Financial Times*: 2016b).

Finally, Iansiti and Levien`s (2004) research provides an important development of Moore`s (1993; 1996) original business ecosystem model. However, their work (although useful) was produced within the "shadow" of the dot-com crash (Abramson: 2005) and the analysis of technology architecture does not incorporate more recent technological developments in ICT such as Web 2.0, cloud computing and big data which have had a transformational impact on the growth of ecosystem platforms. Therefore, the chapter will now consider Martin Fransman`s (2010) work entitled: *The New ICT Ecosystem: Implications for Policy and Regulation* (Fransman: 2010).

Fransman`s (2010: 9) research viewed the entire information and communications technology (ICT) sector as a system which he represented in an ecosystem layered model (ELM) consisting of four interconnected layers comprising the following (see Table 4.1 below):

1) Networked element providers who produced items such as PCs, mobile phones and their operating systems including telecommunications switches, routers, servers and transmission systems.
2) Network operators who create and operate telecoms networks including mobile, fibre, copper, cable TV and satellite networks.
3) Content and application providers (including ICAPs) i.e. the Internet.
4) Final consumers.

Level 4:	**Final Consumers**
Level 3:	**Content & Applications – Internet Platform**
Level 2:	**Networks – Mobile, Fibre, Copper, Cable & Satellite**
Level 1:	**Networks – Switches, Routers, Servers, PCs & Phones**

Table 4.1: A Simple Ecosystem Layered Model – ELM (Adapted from Fransman: 2010)

The interactions between the various firms in the New ICT Ecosystem` were considered to be symbiotic. Symbiosis implied high inter-dependence between organisms which were mutually beneficial. According to Fransman (2010), the symbiotic relationships also existed within the layers of the ecosystem as well as within firms and between the various layers.

The Six Symbiotic relationships are summarised as follows (Fransman 2010: 37):

1) Relationship between networked element providers and network operators.
2) Relationship between network operators and content and applications providers.
3) Relationship between content and applications providers and final consumers.
4) Relationship between networked element providers and final consumers.
5) Relationship between networked element providers and content and application providers.
6) Relationship between network operators and final consumers.

Fransman`s (2002; 2010) model is very useful in providing a number of beneficial insights. First, the model makes it possible to conceptualise the entire ICT sector as a system and understand interdependencies and complex interactions within the system. Second, it allows readers to identify the role played by markets, firms and other institutions in co-ordinating the activities undertaken within the system. Third, it allows observers to analyse corporate specialisation and corporate strategy and the evolutionary drivers that shape industrial structure in the different layers. The ELM helps to illustrate the role that specific, key companies play in the new ICT ecosystem and to analyse co-evolving demand. Finally, it is also possible to analyse the different levels of profitability in different levels of the system.

There are, however, problems with the depiction of a topographical structure (Fransman: 2002). For example, the ELM model fails to show the dynamics of the system including the innovation processes that are a key part of the dynamics. The model is therefore not unlike many other frameworks in that it is relatively static (Afuah: 2015). More importantly, the model suffers from the same drawbacks as Porter`s Five Forces framework (1980) in that the demarcation between the different layers becomes blurred due to changes in technologies and therefore the underlying functionalities. For example, product convergence due to bundling and envelopment (Eisenmann *et al.,* 2006) make it difficult to classify which firms are performing which functions in which layer. Telecoms companies have now become content providers whilst Internet firms such as Google have also moved into the network operator sector (with Google Fibre) and the network equipment segment (with its handsets). Instead of these being symbiotic relationships they have become disruptive competitive relationships (Downes and Nunes: 2013).

Finally, since the model conceptualises the ICT ecosystem as a set of functionalities these become quickly outdated or obsolete (Fransman: 2002) and therefore the model needs constantly updating in the current hyper-competitive (D`Aveni: 1994) environment. The fact that the current model doesn't incorporate new developments such as big data and cloud computing is evidence of this drawback. However, Fransman (2010: 1) did state very emphatically that innovation was at the heart of the new ICT ecosystem and that the Internet had become a key and ubiquitous infrastructure that was shaping virtually all economic activity (Fransman 2010: 22).

4.2 Platform Theory

This section will now look at a critical component of modern ecosystems which is the platform. In the modern ICT sector, an ecosystem will inevitably be anchored by a platform and platforms are now pervasive in high-technology industries (Gawer: 2009; Downes and Nunes: 2013). A platform exists when the elements of the ecosystem depend upon common standards and interfaces (Robertson and Ulrich: 1998). Fransman (2010) also stated that symbiotic interactions were shaped by platforms. Gawer (2009) defined a platform as being a building block which could be a product, service or technology that acted as a foundation upon which other organisations could develop complementary products, services or technologies (Gawer 2010: 3-4). In an earlier work Gawer and Cusumano (2008) referred to the emergence of modern high tech-platforms that were evolving systems made of interdependent pieces where each part could be innovated upon (Gawer and Cusumano 2008: 30).

Platforms usually emerge in the context of modular industries (Baldwin: 2008) or industry ecosystems (Iansiti and Levien, 2004). Therefore, Gawer and Cusumano`s (2008) belief that platforms were `core` to a technological system (essential to its function) as well as being highly inter-dependent with other parts of the technological system, should not be overstated. Research has shown (Iansiti and Levien: 2004; Eisenmann, Parker and Van Alstyne: 2008; 2009) that the organisation of these ecosystems appears to follow a regular structure, with platform leaders acting as `keystone` members of the network of firms (as discussed earlier in the chapter) who coordinate and orchestrate the platform complementors, with strong inter-dependencies (strategic and technological) between the `core` that is the platform and the other parts of the ecosystem (technological system). The complementors also occupy a peripheral position (Iansiti and Levien`s niche` strategies) in the network with fewer links between them.

Technological platforms have become increasingly pervasive as new computing technologies have become embedded within industrial ecosystems transforming the industrial and competitive landscapes (Hitt *et al.*, 2003) and disrupting the balance of power between firms. This trend has been referred as `The Age of the Platform` (Simon: 2011; Downes and Nunes: 2013).

Annabelle Gawer (2009: 44-77), developed a detailed typology of platforms which she broke down into four classifications, namely: internal platforms (within the firm), supply chain platforms (within a supply chain), industry platforms (industry ecosystems) and multi-sided markets or double-sided platforms. The chapter will now analyse these in more detail to determine their relevance to the ICT sector and ecosystem theory.

According to Gawer (2009: 46), the first widespread use of platforms occurred in the early 1990s within the context of product development. Gawer (2009: 46) referred to these as ***internal platforms*** otherwise known as ***`product platforms`*** . Meyer and Lehnerd (1997) defined product platforms as a set of sub-systems and interfaces that formed a common structure from within a stream of derivative products that were efficiently developed and produced. The benefits of designing and using product platforms were to reduce fixed costs, gain efficiency in product development (through the re-use of common parts), the ability to produce a large number of derivative products as well as gaining flexibility in product design and mass customisation.

Although most of the product platform literature was manufacturing based (i.e. automotive), most of the concepts and variables could also be applied to the context of services. The processes involved in the design of services could be broken down into parts that could then be assembled or integrated and later customised. However, Gawer`s (2009) internal (product development) platform is not an appropriate methodology or perspective when analysing the ICT ecosystem because all the activity takes place within the organisation and only involves a single firm. There is subsequently no external economic community with which the platform interacts to co-create and co-evolve new products (Moore: 1993; 1996) and the platform configuration is linear (Afuah: 2015) and silo-oriented.

Gawer`s (2009) second platform typology was the ***supply chain platform.*** According to Gawer, the supply chain platform extended the product platform concept to firms within the context of a supply chain. The main difference between the two platforms was that product design, development and manufacture happened externally and not internally, involving different suppliers and final assemblers. This often involved formal alliances and cross-ownership such as in the automotive industry where all the leading firms were in some form of partnership agreement. The objectives of the supply chain platforms were similar to the internal platforms in that they sought to improve efficiency, reduce costs, reduce the variety of parts and increase product variety (involving the systematic re-use of modular components).

However, the supply chain platform typology is also an inappropriate methodology or perspective for the analysis of the ICT ecosystem for a number of important reasons. First, there are frequently divergent incentives between the members of the supply chain or alliance and trade-offs often occur between optimizing the performance of sub-systems and optimizing the performance of the overall system. This is at odds with Moore`s (1993; 1996) definition of a business ecosystem where there is a shared vision between the members of economic community based on mutually supportive roles.

The members of the economic community should also co-evolve themselves and not just co-create products. Moreover, within these supply chain platforms there is a clear hierarchy with the bargaining power resting with the final assembler. However, in the business ecosystem, coordination is through symbiotic inter-dependent relationships which add value. According to Fransman (2010), successful platforms actually shaped symbiotic relationships. Finally, supply chain platforms are industry-based and still conform to the principles of Porter`s positioning school of strategy (1985). They are also linear and do not benefit from broader network effects (Choudary: 2015) outside the supply chain silo.

Gawer`s (2009) third typology was the ***industry platform.*** A key distinction between supply chain platforms and industry platforms is that within industry platforms the firms developing complements don`t necessarily buy or sell from each other, they are also not part of the same supply chain nor is there any need for cross-ownership.

These platforms consist of a large number of firms that Gawer referred to as industrial ecosystems which develop complementary technologies, products and services. Examples include, the Microsoft Windows, Apple iOS and Android operating systems, the Linux operating system, Intel and Qualcomm microprocessors, the Google Internet search engine, social networking sites such as Facebook, video game consoles (Sony, Microsoft and Nintendo) and more recently payment platforms. This range of platforms is increasing all the time as the cost of computing power, storage and bandwidth declines (Deloitte Centre for the Edge: 2013) i.e. new financial technology (Fintech) and health platforms are also emerging.

Gawer`s (2009) industry platform typology, industry ecosystems, is well suited to the ICT ecosystem model. In fact, the first studies of industry platforms were based on computing, telecommunications and other information-technology-intensive industries. For example, in their study of the emergence of computer platforms, Breshnahan and Greenstein (1999) defined platforms as a bundle of standard components around which buyers and sellers coordinated their activities. West (2003) also defined a computer platform as an architecture of related standards which allowed modular substitution of complementary assets such as software and peripheral hardware. Iansiti and Levien`s (2004) `keystone firm` could also be compared to what Gawer and Cusumano (2002; 2008) called a platform leader i.e. a firm that drives industry-wide innovation for an evolving system of separately developed components. Meanwhile, Gawer and Henderson (2007) described a product as a platform when it was one component or subsystem of an evolving technological system i.e. when it was functionally dependent with most of the other components of the system.

As mentioned earlier, there are important differences between industry platforms and internal or supply chain platforms insofar as industry platform leaders (or platform owners) aim to leverage the innovative capabilities of external firms (which are not necessarily part of their supply chain) particularly where there is an `open` as opposed to a closed or semi-closed platform ecosystem (Eisenmann, Parker and Van Alstyne: 2009). Platform leaders therefore strategically facilitate and stimulate complementary third party innovation through careful management of the ecosystem relationships (Gawer and Cusumano: 2002; Iansiti and Levien: 2004).

Gawer and Cusumano (2002) therefore proposed four levers designed to facilitate platform governance. The first lever was *firm scope* where the platform leader needed to decide which activities would be performed in-house and which should be left for other firms to undertake i.e. should some complements be developed in-house? The second lever was *technology design and intellectual property* where the platform leader needed to decide what functionality or features they should include in the platform and whether the platform should be modular. The degree to which the platform interfaces would be open to outside complementors (and at what price) were also important decisions. The third lever concerned *external relationships with complementors.* This is where the platform leader had to manage the complementors and to encourage them to make a contribution to the ecosystem. The fourth and final lever was concerned with *internal organisation* and how platform leaders should use their organisational structure and internal processes to facilitate and enhance the role of external complementors.

This approach is in stark contrast to Porter`s industry attractiveness, Five Forces model (1980) where the driving forces consist of bargaining power, barriers to entry and monopolistic power. The four governance levers can therefore be viewed as alternative coordination mechanisms that focus on achieving long-term Schumpeterian (1942) rents from innovation rather than short-term monopoly rents (Porter: 1980; 1985) from monopolistic competition (Farrell and Katz: 2000).

The fourth and final typology that Gawer (2009) considered was the ***double-sided (or multi-sided) market.*** The term, two-sided markets was coined by two French economists Jean Charles Rochet and Jean Tirole (2003) following earlier research by William Baxter (1983). Double-sided markets (also known as two-sided markets, multi-sided markets or multi-sided platforms) are technologies, products or services that create value primarily by enabling direct interaction between two or more customers or participant groups.

Prominent examples of double-sided markets and the participants they connect include Alibaba.com, eBay, Taobao and Rakuten (buyers and sellers); Airbnb (dwelling owners and renters); the Uber app (professional drivers and passengers); Facebook (users, advertisers, third party game or content developers and affiliated third party sites); Apple`s iOS (application developers and users); Sony`s Playstation and Microsoft`s Xbox gaming consoles (game developers and users); American Express, Pay Pal and Square (merchants and consumers); shopping malls (retail stores and consumers); Fandango (cinemas and consumers) and Ticketmaster -vents venues and consumers (Evans and Schmalansee: 2016).

Baldwin and Woodward`s (2009) research found common features between the architecture of multi-sided markets and the industry platforms (industry ecosystems). This is reinforced by the long list of examples of double-sided markets above. The similarities that Baldwin and Woodward (2009) identified were the existence of indirect network affects (sometimes referred to as cross-side network effects) that arise between the two sides of the market when participants have to affiliate with the platform in order to be able to transact with one-another.

However, Gawer (2009), was critical in her research when she stated that not all double-sided or multi-sided markets were industry platforms based on the earlier definitions in this chapter. Gawer (2009) indicated that these platforms were not always building blocks that acted as foundations upon which other firms could develop complementary products, technologies or services. She singled out those double-sided markets that were pure exchange or trading platforms (i.e. dating sites) where the role of the platform was purely to facilitate transactions between different sides of the markets without the possibility for other players to innovate and she therefore considered this typology to belong to a different category:

However, as the diffusion of smart phones, apps and cloud computing have increased exponentially since the publication of Gawer`s research (2009), the number of multi-sided platforms has proliferated (Evans and Gawer: 2016). A key driver of this proliferation has been business model innovation which has occurred in three ways: first, through de-linking assets from value; second, through re-intermediation and third, through market aggregation (Parker, Alstyne and Choudary 2016: 69-73).

Airbnb and Uber are good examples of how a multi-sided platform using a low-cost base *de-links assets from value*. These app-based platforms do not own real estate or automobiles (fixed assets) but through the use of their software insfrastructures and network effects they are able to generate significant value for buyers and sellers by leveraging the under-utilised assets of third parties that would otherwise not yield any likely return i.e. the assets have little (if any additional value) without the complementary effects of the two-sided platforms (Parker *et al.*, 2016). This is counter to the resource-based view (Grant: 2016) where competitive advantage is achieved through the ownership and/or control of resources and capabilities that are valuable and distinctive and largely internal.

Further evidence of business model innovation on the part of two-sided markets occurs when an industry platform (industry ecosystem) disintermediates an existing supply chain such as travel agents. However, we are now seeing *re-intermediation* platforms emerge such as Skyscanner and Trip Advisor (Chaffey and Ellis-Chadwick: 2012). These services are not only free but accessible 24/7 thereby enhancing the value proposition. In fact, multi-sided platforms have created a new layer of reputational information by leveraging social feedback relating to producers (Parker *et al.*, 2016). Platforms such as Yelp, Angie`s List and Trip Advisor have created an entirely new industry based on certifying the quality of product and service providers.

The third form of business model innovation is *market aggregation*. Two-sided platforms create new efficiencies by aggregating unorganised markets (Parker *et al.*, 2016). This is the process whereby the platforms provide centralised markets to serve widely distributed individuals and organisations. Market aggregation provides information and power to users who previously engaged in interactions in a haphazard fashion often without access to reliable or up-to-date market data and/or infrastructure. Platforms such as Upwork bring thousands of skilled professionals together making it easier for potential employers to evaluate, compare and hire them.

Both the industry platform (industry ecosystem) and the multi-sided market/platform typologies are appropriate for the analysis and evaluation of the ICT sector. Both of these platform typologies conform to Moore`s (1996: 26) definition of a business ecosystem. They both involve an economic community of suppliers, buyers, competitors and other stakeholders within the broader community. The community participants are also aligned with the directions of a `keystone` (Iansiti and Levien: 2014) or platform leader (Gawer and Cusumano: 2002) and there are shared visions relating to intended outcomes and value.

This is in contrast to the linear, single or one-sided businesses such as the internal (product development) and supply chain platforms (see Figure 4.1). These theoretical approaches are not relevant to the ICT ecosystems.

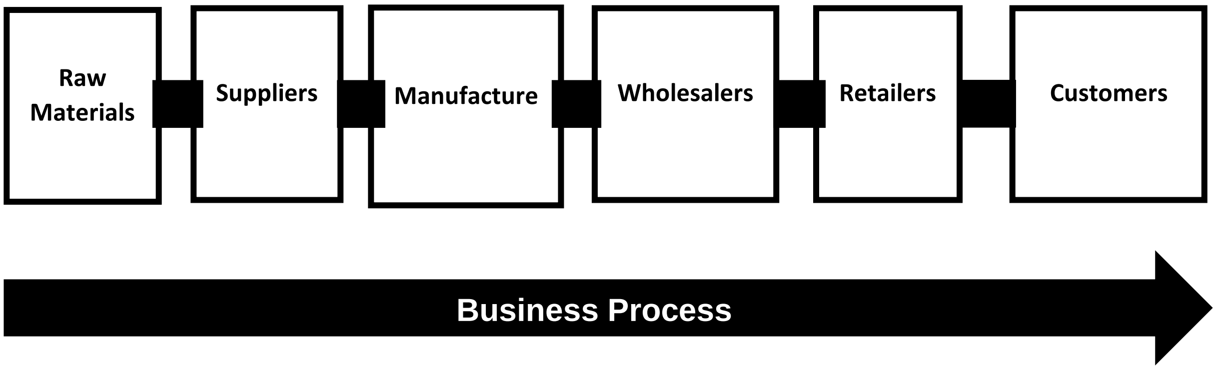

Figure 4.1: The Traditional One-Sided Business (Walton: 2017)

In a one-sided market the consumer is located at the end and value is pushed out to them. The functions of production and consumption are also clearly demarcated. One-sided firms also compete through resource ownership and control and scaling through vertical integration and mergers and acquisitions. With the platform ecosystem model, value is enabled by the platform leaders and is co-created via a network of participants. Successful, modern ecosystem platforms create huge value not through their access to physical resources but through leveraging data to coordinate physical and digital resources across the ecosystem (Tiwana: 2014).

4.3 ICT Platform-Based Ecosystem Diffusion and the Need for a New Architectural Perspective

ICT platform-based ecosystems are now restructuring the ways that businesses create and deliver value across a broad range of markets and industries, not just the informationintensive sectors (Downes and Nunes: 2013). According to Choudary (2015: 23), we are in the midst of a transformative shift in business design as business models move from `pipes` (linear one-sided businesses) to `platforms` (multi-sided ecosystems). Although the one-sided business model served as the dominant design throughout the capitalist industrial era, new trends are now emerging at an exponential rate due to Moore`s Law (Ismail *et al.*, 2014) as more platform-based ecosystems are disrupting a broader range of sectors including media (newspapers, magazines, books, music and TV); financial services and insurance, travel and tourism, real estate and hotels, automobiles, health and many others (Mc Kinsey Quarterly: 2016).

The key drivers behind the increasing growth and pervasiveness of platform ecosystems has been new technological trends such as the rapid adoption of smart phones, 3G and 4G Internet connectivity, apps, cloud computing services, software embeddedness and digitisation, the Internet-of-Things and big data (Deloitte Centre for the Edge: 2013). The proliferation of smart phone adoption and the ubiquity of Internet connectivity via 3G and 4G networks has made it possible for new platforms to engage with a vast consumer audience.

According to the Deloitte Centre for the Edge (2013: 9-10), the cost of computing power has decreased significantly from $222 per million transistors in 1992 to $0.06 per million transistors in 2012. This has in turn decreased the cost-performance of computational power. Secondly, the cost of data storage has decreased considerably from $569 per gigabyte of storage in 1992 to $0.03 per gigabyte in 2012. The decreasing cost performance of digital storage enables the creation of more and richer digital information. Thirdly, the cost of Internet bandwidth has also steadily decreased from $1,245 per 1000 megabits per second (Mbps) in 1999 to 423 per 1000 Mbps in 2012. The declining cost performance of bandwidth enables faster collection and transfer of data, facilitating richer connections and interactions. Additionally, the use of the Internet continues to increase creating widespread sharing of information as more people are now connected via mobile devices (Deloitte Centre for the Edge 2013: 9-10).

Apps and cloud computing services (software as a service, platform as a service and infrastructure as a service) have meant that entrepreneurs can scale new platforms very cheaply and very rapidly with minimal capital outlay i.e. Airbnb, Uber, Snapchat and Spotify (Downes and Nunes: 2013). As more products have become Internet-enabled (the Internet-of-Things) with sensors or dematerialised through digitisation; and as many activities have been substituted by software robots; the rise and spread of platform ecosystems has increased. The data deluge created by these changes has also led to the emergence of platform firms with `Big Data` capabilities (using structured and unstructured data) such as Google, Amazon, Microsoft, Facebook and Alibaba who can perform high speed predictive and prescriptive analytics (Sharda *et al.*, 2014) which enables them to reduce costs, enhance their marketing and risk management capabilities and to outperform conventional one-sided businesses (Arthur: 2014).

Although companies across industries are actively building platforms, these individual platforms are broadly different. For example, from the perspective of software developers, Android, Salesforce and Facebook Connect are vastly different. Medium and Wordpress are blogging platforms but have little in common with software development platforms. You Tube, Facebook, Instagram and Snapchat are described as social platforms, while Uber and Airbnb are referred to as marketplace platforms (Evans and Gawer: 2016: 7). This becomes even more complex when one considers that the Nest Thermostat is called a platform and Nike is working on a platform to connect shoes, while GE claims to be using a platform approach to manage its factories (the Internet-of-Things).

The fact that these businesses are vastly different from each other creates problems when trying to plan strategies from two perspectives (Choudary: 2015). First, how to plan strategy from the position of a newly evolving or established platform and second how to plan strategy from the position of an incumbent firm in an industry that is under the threat of disruption from a platform ecosystem i.e. Nokia`s recent demise at the hands of the Apple iPhone. Research undertaken by Choudary (2015), revealed that across all types of platform three distinct architectural layers repeatedly emerged. These three layers consisted of:

1) The network or marketplace community.
2) The infrastructure.
3) The data.

This has made it possible to formulate a unifying architectural framework - referred to as the `Platform Stack` (see Figure 4.2 below) - to explain the different types of platform configuration. This forms an important basis from which future platform strategies can be planned. Each of these configurations will now be analysed in more detail starting with the network-marketplace community.

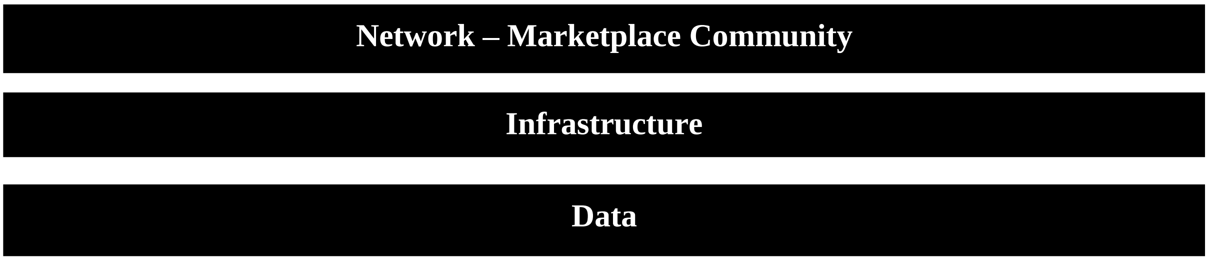

Figure 4.2: The Platform Stack (Adapted from Choudary 2015)

<u>*Network-Marketplace-Community-Layer:*</u> the first layer of the platform comprises participants and their relationships and includes social networks. This also involves the matching of buyers and sellers with regards to goods and services. Some platforms may have

an implicit community layer. For example, users of Mint.com are not connected to each other but every user`s financial analytics are benchmarked against that of similar users. According to Choudary (2015), every user benefits implicitly from the community without the requirement to connect with others explicitly. So the external network of producers creates value in the network layer. However, to enable this value creation, platforms need a second layer: infrastructure.

Infrastructure Layer: this layer encapsulates the tools, services and rules that enable interaction to take place, this is sometimes referred to as "plug-and-play" (Choudary: 2015). This layer has little value on its own unless users and partners create value on the platform. External producers build on top of this infrastructure. For example, on Android, developers produce apps, on YouTube video creators host videos and on eBay, sellers host product availability.

On development platforms such as Android, the infrastructure layer may be very dominant. On other platforms such as Instagram the infrastructure layer may be thinner. Therefore, the infrastructure layer provides the infrastructure on top of which value can be created i.e. the software upon which application programmes can run or other services. However, large-scale value creation leads to the problem of abundance. With an abundance of production, search costs increase for consumers. Too many videos on You Tube may make it harder for consumers to make a selection. To solve this problem, the platform stack needs a third layer: data.

Data Layer: this is the final platform layer. Every platform uses data since the data helps the platform to match supply with demand. The data layer creates relevance and matches the most relevant content/goods/services with the right users. In some cases the data layer may play a very dominant role. For example, GEs Predix, Internet-of-Things (IOT) factory platform is data-intensive.

While platforms function across these three layers, the degree to which each one dominates may vary. The platform stack helps to reconcile the differences between different platforms while also acknowledging the similarity of the business models across all these instances (Choudary: 2015). To understand the different types of platforms, the chapter will now explore three basic configurations of the platform stack in more depth.

Basic Configuration 1 – The marketplace/community platform: Airbnb and Uber and most marketplace platforms have a thick marketplace/community layer and the network is the key source of value. Online communities like Reddit, social networks like Twitter and content platforms like You Tube benefit from thick or dense community layers. All three layers play a role although one may be more dominant than the others. The stack helps to illustrate that every platform will have its unique configuration. Certain platforms, like Craigslist and some online platforms, focus almost exclusively on the marketplace or community layer with almost no infrastructure and without much leveraging of data.

Basic Configuration 2 – The Infrastructure Platform: development platforms such as Android provide the infrastructure on top of which apps may be created. In tandem with the Google Play marketplace, Android`s development infrastructure is the key source of value for developers. Traditionally development platforms have focused on the infrastructure layer without a marketplace for apps. As a publishing platform, WordPress provides infrastructure exclusively. It doesn`t provide network benefits or any value through data.

Basic Configuration 3: The data platform: the third basic configuration is the one where the data layer plays a dominant role. The data layer plays an important role on every platform. Facebook uses data to fashion newsfeeds and Airbnb uses data to match hosts to travellers. However, on certain platforms the data layer itself constitutes the key value created on the platform. Some of them may not even seem like platforms but they follow the same stack while focusing almost exclusively on the data layer. Wearables are a good example, Nike`s shoes and Fuelband constantly stream data to an underlying platform that integrates the user experience across the shoe, the wearable and the mobile apps. Wearables such as Jawbone create value through the data platform. The wearable produces data constantly and the platform provides analytics back to the user based on the data. The platform also pools data from many users to create network-level insights. Wearables therefore benefit from implicit network effects (Baldwin and Woodward: 2009).

The Nest thermostat and the Internet of things are also good examples. The Nest thermostat uses a data platform to aggregate data from multiple thermostats. This aggregation of data enables analytics for thermostat users and powers services to the city`s utilities board. The Internet-of-Things (IOT) will also give rise to new business models in similar ways through the creation of data platforms.

Finally, GE is focusing on the `Industrial Internet` which is another example of a data platform. Machines embedded with sensors constantly stream activity data into a platform that helps each machine learn from other machines and provides network intelligence. These machines benefit from implicit network effects and every machine learns from the community of machines it is concerned with.

If a platform is to scale successfully it must be centred on the goal of value creation. In terms of the Platform Stack, this is known as the `core value unit` concept (Choudary: 2015). The core value unit is the minimum standalone unit of value that is created on top of the platform. This will depend to a large extent on how the platform is configured. For example, the core value unit could be network/marketplace/community-dominated, infrastructure-dominated or data-dominated.

The core value unit on platforms that have a dominant network/market place/community will be the goods and services that they offer. Where the platform acts as the underlying infrastructure on top of which value is created then apps form the core value unit i.e. on development platforms. Meanwhile, the minimum unit of content constitutes the core value unit on a content platform i.e. videos on You Tube. Finally, on data-dominated platforms, the data itself is the source of value. For example, on a retail loyalty platform the data profile of the consumer is the value unit. It is the core source of value to a retailer interested in targeting that consumer.

When implementing platform scale, successful platforms such as Uber, Airbnb, Facebook, You Tube and Upwork always start at the infrastructure layer first (Choudary: 2015). It is important to build the infrastructure first in order to enable interactions to take place in the layer above. As the infrastructure gains adoption, an ecosystem of producers and consumers starts to evolve. For example, drivers and travellers start using Airbnb and developers and users start adopting Android. This becomes the next discernible stage in the evolution of the platform. Finally, activity by producers and consumers on the platform generates significant amounts of data. The data layer then serves to make future interactions more efficient and keeps users regularly engaged in the platform. As the data layer grows stronger, the network or ecosystem layer also increases in strength.

Most multibillion dollar start-ups (Choudary 2015: 319) have achieved platform scale using this architecture (Amazon, Google, Facebook and Alibaba etc.). However, although this template works for start-ups it doesn't work for traditional one-sided businesses seeking to develop a platform. Traditional businesses according to Choudary (2015: 320), lack a culture of data acquisition and data management. Choudary (2015: 320) therefore recommended that the journey to platform scale needed to start with the data layer, followed by the infrastructure layer and then the development of the network-marketplace community. Choudary (2015) recommended five key stages in this evolutionary development:

1) Build a culture of data acquisition.
2) Enable data porosity and integration.
3) Leverage implicit data-driven network effects.
4) Build explicit communities.
5) Enable explicit exchange.

The first stage for a traditional business, according to Choudary (2015: 321), was to create a culture of data acquisition. The firm needed to understand that higher data acquisition meant greater monetisation opportunities. All digital services that are introduced to users should be integrated at the data layer and every service should seek to acquire data that can be monetised in some form in the business. A strategy that intended to leverage platform scale should therefore start with a coherent data strategy.

Once a strategy of data acquisition had been established, the second stage was to institute infrastructural change by integrating the internal organisation. According to Choudary (2005), the firm must integrate all processes, workflows and touchpoints at the data layer. Firms must restructure their internal systems to be more data-porous with internal application programming interfaces (APIs) and avoid silos that prevent cross-communication. The third stage is where the firm starts to leverage its existing user base. Once users have been profiled on the database the business can start to target them with recommendations etc. Once the first three stages are complete the firm should then start to build a community. There has been a tendency (Choudary 2015: 324) for traditional firms to skip the first three steps and then fail because of the inability to leverage intelligence due to the lack of integration at the data layer.

If the firm reaches the final stage it will be able to operate as effectively as a modern platform company.

4.4 The Implications for Strategy and Competition

The platform stack concept (Choudary: 2015) and the architectural approach to the analysis of complex platform ecosystems is in stark contrast to the classical (Ansoff: 1965; Andrews (1971), positioning (Porter, 1980; 1985) and the RBV (Grant: 2016) approaches to strategy discussed so far. It is therefore worth exploring the benefits of the approach and making some comparisons with well-established models from the classical, positioning and RBV schools.

First, the platform stack provides a useful tool that helps to understand the different types of platforms that exist. It can be used to identify potential threats from both new and established platforms and/or highlighting opportunities to provide complementary assets. Second, the platform stack helps to decide which layers a platform should differentiate itself in and how. This can be likened to the resource based view (RBV) where a strategy is selected based on the most appropriate fit between the resources at hand and the demands of the external environment and marketplace (Barney: 1991; Grant: 2016).

Third, the platform stack helps platform-builders to understand the key drivers of value and how to benchmark a platform on these key parameters against competition and substitutes. In this instance the platform stack can be viewed as a substitute for the Value Chain (Porter: 1985) model. It not only helps to identify the core value units but also how the value is configured. It also provides an easy to use benchmarking tool when analysing the value configurations of competitors.

Fourth, although we have focused on the differential aspects of the platform stack and how firms often dominate specific layers over others, some of the very large Internet firms

(Amazon, Alibaba and Google) are dominant in all three layers and this is known as `building-out-the stack` (Choudary: 2015). This could be likened to Porter`s (1980) monopolistic power (Five Forces Framework) where a small number (oligopoly) of very large data-rich firms hold a dominant position. This is likely to strengthen as these firms develop artificial intelligence capabilities. These are also what Tidd and Bessant referred to as high involvement in innovation (HII) companies (Tidd and Bessant: 2013).

It can be seen from this analysis that the ecosystem and platform theories are more appropriate for the analysis of the ICT sector. The analysis also highlights the differences in approach between the classical, rational view of strategy (Ansoff: 1965) and the platform-ecosystem paradigm (Moore 1996; Gawer: 2009).

However, the analysis does still raise a number of important questions. The speed at which technological change is occurring has meant that the current theories now need updating. Gawer`s (2009) typology of platforms does not take account of the business model innovation and disruption being created by the new multi-sided platforms (Downes and Nunes: 2013) and how this type of platform is becoming even more pervasive than the original industry ecosystem (Evans and Gawer: 2016). In fact the two types of platform ecosystem are now converging and the boundaries between them blurring or disappearing altogether in some instances. Meanwhile Fransman`s (2010) layered ICT ecosystem model doesn’t recognise how the sectors boundaries have now extended to include artificial intelligence (AI) and all forms of data transmitted via the Internet. Nevertheless, Fransman did state quite emphatically that the Internet was not only a network of networks but it was also a platform of platforms (Fransman 2010: 19).

These issues will, to a large extent, be addressed in Chapter 5 where a hydrothermal vent ecosystem model is used to provide a new and more dynamic perspective. However, before analysing the new model, the chapter will conclude with a summary and discussion of the key differentiators that characterise the classical (Ansoff: 1965; Andrews: 1971) and resource-based views (RBV) of strategy (Grant: 2016) and the platform-ecosystem approach (Choudary: 2015; Moore: 1996).

4.5 The Key Differences between the Classical and RBV Approaches to Strategy and the Platform-Ecosystem Perspective

The purpose of this section is to clarify and illustrate the key differences between the traditional industry structure (Porter: 1980) and resource based views (RBV) of strategy (Barney: 1991; Grant: 2016) and the platform-based ecosystem model (Moore: 1996; Iansiti and Levien: 2004; Fransmen: 2010; Gawer: 2009) and emphasise the limitations of the conventional approaches to strategy.

We will start by considering Porter`s (1980; 1985) industry structure approach that was analysed in Chapter 2 and has its routes firmly set in the industrial and manufacturing age. Porter`s strategic approach, using the Five Forces Framework (1980), is based upon supply-side economies of scale (Van Alstyne *et al.*, 2016). In the manufacturing era, firms had massive fixed costs and low marginal costs which meant that they had to achieve higher sales than their competitors in order to lower the average unit cost of production. High scale enabled them to reduce prices - which in turn increased volume further - and this permitted more price cuts thereby creating a virtuous feedback loop that produced monopolies - hence Porter`s (1980) monopolistic rents were the source of competitive advantage.

In supply-side economies, firms achieve market power by controlling resources, increasing efficiency and fighting off challenges from the Five Forces. The goal, according to Van Altsyne *et al.*, (2016) was to build a “moat” around the business that protected it from rivals and channelled the competition towards other firms. However, the driving force behind the Internet economy is different. This is based upon demand-side-economies of scale that are also referred to as network effects (Van Alstyne *et al.,* 2016: 58).

Van Alstyne *et al.*, (2016: 58) also stated that these network effects were enhanced by technologies that created efficiencies in social networking, demand aggregation, app development and other phenomena that helped networks to expand. Therefore, in the Internet economy, companies that achieved higher "volume" than competitors (attracted more platform participants) and offered a higher average value per transaction. Due to their larger networks, these firms were able to provide a closer match between supply and demand from the different sides of the platform (owing to their possession of larger and "richer" troves of data). Subsequently, greater scale generated more value, which attracted more participants, which created even more value. This created another virtuous feedback loop that also produced monopolies. Van Alstyne *et al*., (2016: 58) suggested that network effects created Alibaba, which now accounts for 80% of Chinese e-commerce transactions; Google, which now accounts for 82% of mobile operating systems and 94% of mobile search and Facebook, the world`s most dominant social media platform which now has 1.6 billion users.

A key weakness of the Five Forces model (not emphasised in Chapter 2) is that it doesn`t factor in network effects (Eisenmann *et al.*, 2006) and the value that this creates. Porter`s (1980) model views external forces as "depletive" or "extracting" value from a firm (Van Alstyne *et al.*, 2016: 58) and therefore proposes building barriers against them (barriers to entry). However, in demand-side economies, external forces are normally "accretive" and add value to the platform business. Consequently, the power of suppliers and customers that are considered threatening in a supply-side world become an asset in a platform world. Therefore, understanding when external forces may add or extract value in an ecosystem is a key aspect of platform strategy which also has to contend with competition from other platform ecosystems.

Moreover, in traditional businesses, the five forces are clearly defined and stable. For a steel manufacturer or an airline, the customers and competitors are well understood and the boundaries separating the suppliers, customers and competitors are clearly delineated. However, in platform-ecosystems the various boundaries can shift very rapidly and also converge.

We will now consider the relevance of the resource-based view (RBV) of strategy (Barney: 1991; Grant: 2016) and its appropriateness for the analysis of platform-based ecosystems (since this wasn`t covered in any detail in Chapter 2). According to Van Alstyne, Parker and Choudary (2016: 56-57), the emergence of platform-ecosystems has seen three types of shift occurring relating to traditional business models. These include a shift from resource control to resource orchestration; a shift from internal optimisation to external interaction and a shift from a focus on customer value to a focus on ecosystem value. We will now consider each of these in more detail.

The shift from resource control to resource orchestration is very important. According to the resource-based view (RBV) of strategy an organisation gains an advantage by controlling valuable, rare and inimitable (VRIO) resources (Barney, 1991) that are difficult to copy or to replicate. In one-sided firms, these resources would include tangible assets such as plant, equipment and raw materials and intangible resources such as brands and intellectual property. With platforms, the resources that are difficult to copy or replicate are the external community and the capabilities that its members own and contribute. These may include cars (Uber`s transportation capabilities), rooms (Airbnb`s accommodation capabilities) or ideas and information (Google`s innovation capabilities). Therefore, the network of external producers and consumers becomes the main resource and capability.

The second important shift has been from internal optimisation to external interaction. Platforms therefore invert the firm, with the bulk of the value being created by the community of users (Parker *et al.*, 2016: 11). Firms in the `old` economy organise internal labour and resources (Barney: 1991) to create value by optimizing a linear chain of product activities from material sourcing to sales and service. Platform ecosystems, on the other hand, create value by facilitating interactions between external producers and consumers. This external orientation means that the platform firms also divest themselves of the variable costs of production (Rifkin: 2014). The emphasis also shifts from controlling and dictating processes to persuading participants to join and contribute to the platform. Ecosystem governance therefore becomes an essential strategic skill and Gawer and Cusumano`s (2002) four governance levers, discussed earlier in the chapter, are relevant in this respect.

Finally, Van Alstyne *et al.*, (2016) identified a shift from focusing on customer value to a focus on ecosystem value. Traditional one-sided businesses featured in established strategic models always sought to maximise the lifetime value of individual customers of products and services. These customers always appeared at the end of the linear process illustrated in Figure 4.1. Platforms, on the other hand, set out to maximise the total value of a growing ecosystem based on a feedback process that is circular and iterative in nature.

4.6 Conclusion

These three shifts in emphasis illustrate that competition is more complicated and dynamic in a platform world. In platform ecosystems, competitive forces behave differently and new factors come into play that are not embraced in traditional strategic models and approaches (Afuah and Prakah: 2015).

A much broader perspective of the ecosystem and platform concepts is therefore needed if we are to completely understand and appreciate the full extent of the creative destruction (Schumpeter: 1942) being caused by these platforms both within traditional industries and the technology sector as well (Arthur: 2014). Choudary`s (2015) `Platform Stack` architectural model provided a very useful high level framework for analysis of platform dynamics. However, this model still failed to highlight the true role of data, information, knowledge and innovation (wisdom) in driving platform-ecosystem dynamics. As data has become the new form of capital (McAfee and Brynjolfsson: 2012), Chapter 5 of the dissertation will consider the Internet as a platform-ecosystem using a deep sea hydrothermal vent ecosystem model. It will draw analogies with the ICT sector and the role of data, information and innovation as the new source of competitive advantage in the post-industrial technology era (Brynjolfsson and Saunders: 2009; MIT-Oracle: 2016).

References

Afuah, A.N. and Prakah Asante, K.O. (2015) `Innovation Models`. *Technology and Innovation Management.* Vol. 13. Wiley Online. 22 January 2015.

Andrews. K.R. (1971) *The Concept of Corporate Strategy.* Homewood: Richard D. Irwin.

Ansoff, H. I. (1965) Corporate Strategy. London: Penguin.

Arthur, C. (2014) *Digital Wars: Apple, Google, Microsoft and the battle for the Internet* (2nd ed.). London: Kogan Page.

Baldwin, C. Y. and Woodward, C. J. (2009) `The Architecture of Platforms: A Unified View`. In: Gawer, A. (ed.) *Platforms, Markets and Innovation* Cheltenham: Edward Elgar.

Baldwin, C. Y. (2008) `Where do transactions come from? Modularity, transactions and the boundaries of firms`. *Industrial and Corporate Change.* 17 (1): 155-195.

Barney, J. B. (1991) `Firm Resources and sustained competitive advantage`. *Journal of Management`.* Vol. 17. No.1: 99-120.

Baxter, W. F. (1983) `Bank Interchange of Transactional Paper: Legal Perspectives`. *Journal of Law and Economics.* 26: 541-588.

Breshnahan, T. and Greenstein, S. (1999) `Technological competition and the structure of the computer industry`. *Journal of Industrial Economics.* 47: 1-40.

Brynjolfsson, E. and Saunders, A. (2009) *Wired for Innovation: How Innovation Technology is Reshaping the Economy.* Cambridge: MIT Press, 2009

Choudary, S. P. (2015) *Platform Scale: How a new breed of start-ups is building large empires with minimum investment.* Boston: Platform Thinking Labs.

D`Aveni, R. (1994) *Hyper-Competition: Managing the Dynamics of Strategic Maneuvring.* New York: Free Press.

Deloitte Centre for the Edge (2013) *From Exponential Technologies to Exponential Innovation: Report 2 of the 2013 Shift Index.* Deloitte University Press.

Downes, L. and Nunes, P. (2013) `Big Bang Disruption`. *Harvard Business Review.* March 2013: 44-56.

Eisenmann, T. R., Parker, G. and Van Alstyne, M. W. (2009) `Opening platforms: how, when and why?` In Gawer, A. (ed.) *Platforms, Markets and Innovation.* Cheltenham: Edward Elgar. 131-162

Eisenmann, T. R., Parker, G. and Van Alstyne, M. W. (2008) `Opening platforms: how, when and why?` *Harvard Business Review.* Working Paper. 31 August 2008: 131-162.

Eisenmann, T.R., Parker, G. and Van Alstyne, M.W. (2006) `Strategies for Two-Sided Markets`. *Harvard Business Review.* October, 2006.

Ernst & Young (2014) *Top 10 Risks in Telecommunications 2014.* *http://www.ey.com/Publication/vwLUAssets/EY_-Top_10_risks_in_telecommunications_2014/$FILE/EY-top-10-risks-in-telecommunications-2014.pdf* Accessed 28/07/2016 Accesed: 12/04/2016

Evans, C. and Gawer, A. (2016) *The Rise of the Platform Enterprise: A Global Survey.* The Centre for Global Enterprise. January 2016.

Evans, S. and Schmalansee, R. (2016) *Matchmakers.* Harvard Business Press.

Evans, D.S. and Schmalensee, R. (2007) *Catalyst Code: The Strategies Behind the World`s Most Dynamic Companies.* Boston (MA): Harvard Business School Press.

Financial Times (2016a) `YouTube music terms put labels in a spin`. Matthew Garrahan. 11 April 2016: 19.

Financial Times (2016b) `Media companies worried as ad blocking goes mobile`. Robert Cookson. 22 February 2016: 15

Financial Times (2015) `TV flickers as viewers find new screens`. David Crow and Shannon Bond. 14 August 2015: 11.

Fransman, M. (2010) *The New ICT Ecosystem: Implications for Policy and Regulation.* Cambridge: Cambridge University Press.

Grant, R.M. (2016) *Contemporary Strategy Analysis* (9th edn). Chichester: Wiley.

Gawer, A. (2010) *Towards a General Theory of Technological Platforms.* Paper presented at the `Opening-up Innovation: Strategy, Organisation and Technology` conference at Imperial College, London, June 16 -18, 2010.

Gawer, A. (2009) *Platforms, Markets and Innovation.* Cheltenham: Edward Elgar: 45-77.

Gawer, A. and Cusumano, M.A. (2008) `How Companies Become Platform Leaders`. *Sloan Management Review.* 49(2): 28-35.

Gawer, A. and Henderson, R. (2007) `Platform owner entry and innovations in complementary markets: Evidence from Intel`. *Journal of Economics and Management Strategy.*

Gawer, A. and Cusumano, M.A. (2002) *Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation.* Boston (MA): Harvard Business School Press.

Hitt, M.A., Ireland, R.D. and Hoskisson, R.E. (2003) *Strategic Management: Competitiveness and Globalisation.* Mason (OH): Thomson-South-Western.

Iansiti, M. and Levien, R. (2004) *The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation and Sustainability.* Boston (MA): Harvard Business School Press.

Ismail, S., Malone, M. S. and Van Geest, Y. (2014) *Exponential Organisations: Why new organisations are ten times better, faster and cheaper that yours (and what to do about it).* New York: Diversion Books.

McAfee, A. and Brynjolfsson, E. (2012) `Big Data: The Management Revolution`. *Harvard Business Review.* October 2012.

Meyer, M. H. and Lehnerd, A. P. (1997) *The Power of Product Platforms: Building Value and Cost Leadership.* New York: Free Press.

MIT-Oracle (2016) `The Rise of Data Capital`. *MIT Technology Review Custom*. Produced in partnership with Oracle. April, 2016.

Moore, J. F. (1996) *The Death of Competition: Leadership & Strategy in the Age of Business Ecosystems.* New York: Harper Collins.

Moore, J.F. (1993) `Predators and Prey: A New Ecology of Competition`. *Harvard Business Review.* May-June, 1993: 75-86.

Parker, G. G., Van Alstyne, M. W. and Choudary, S. P. (2016) *Platform Revolution: How Networked Markets are Transforming the Economy and How to Make Them Work for You*. London: Norton.

Pickett, S.T.A. and Cadenasso, M.L. (2002) `The Ecosystem as a Multidimensional Concept: Meaning, Model, and Metaphor`. Vol. 5 (1): 1-10. *Ecosystems*. January 2002.

Porter, M.E. (1985) *Competitive Advantage.* New York: Free Press.

Porter, M.E. (1980) *Competitive Strategy.* New York: Free Press.

Rifkin, J. (2014) *The Zero Marginal Cost Society: The Internet of Things, The Collaborative Commons and the Eclipse of Capitalism.* Basingstoke: Palgrave Macmillan.

Schumpeter, J.A. (1942) *Capitalism, Socialism and Democracy.* London: Routledge. 82-83.

Sharda, R., Delen, D. and Turban, E. (2014) *Business Intelligence: A Managerial Perspective on Analytics* (3rd edn). Harlow: Pearson.

Tansley, A. G. (1935) `The Use and Abuse of Vegetational Concepts and Terms`. *Ecology*. Vol.16 (3): 284–307. 1 July 1935.

Teece, D.J. (2012) `Next Generation: New Competition for Understanding How Innovation Shapes Competition and Policy in the Digital Economy`. *Journal of Law, Economics and Policy.* Vol. 9:1. 97-118.

Tidd, J. and Bessant, J. (2013) *Managing Innovation: Integrating Technological, Market and Organisational Change* (5th edn.). Chichester: Wiley.

Tiwana, A. (2014) *Platform Ecosystems: Aligning Architecture, Governance and Strategy.* Waltham (MA): Morgan Kaufman.

Van Alstyne, M. W., Parker, G. G. and Choudary, S. P. (2016) `Pipelines, Platforms and the New Rules of Strategy`. *Harvard Business Review.* April, 2016. Vol. 94. Issue 4: 54-62.

Van Dover, C. L. (2000) *The Ecology of Deep Sea Hydrothermal Vents.* New Jersey: Princeton University Press.

West, J. (2003) `How open is open enough? Melding proprietary and open source platform strategies`. *Research Policy.* 32: 1259-1285.