New Internet-Based Technology Ecosystems

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Abstract

Marketing in today's highly competitive environment needs to consider forces that go beyond most firms' available resources and capabilities. Work by Adomavicius et al. (among others) regarding the differentiation between product – infrastructure – ecosystem has gained increasing importance over the last 30 years (2008). One result of this shifting power is expressed by the concept of convergent technologies. However, it seems too short-sighted to take this concept as the only consequence of external market forces that are threatening companies.

A recent observation relates to the practice of analysing companies within the context of strategic groups, industry structures and business models. This has become increasingly irrelevant since it only comprises a narrow view of a much bigger sphere of influence (which has been caused by modern technologies). What is now evolving is a new internet-based ecosystem threatening the traditional ecosystems of established firms. Once a company's product or service is challenged by a (new) bigger or more pervasive ecosystem, there is often no defensive response. This can be seen by the invasion of the book and publishing industry, the Home Entertainment Industry and first signs are emerging that 3-D laser printers will threaten incumbents in the area of commodity products, especially those made of plastic. Even the personal computer, seen 35 years ago as the foundation of the new Internet-based technology ecosystem, could be under threat as consumers migrate to cloud computing using interoperable mobile devices.

However, these developments do not necessarily need the Internet as the primary link; they can use ICT as a facilitator of interaction and strategic orientation. This draws attention to another huge threat, which is created by German car manufacturer Volkswagen, which entered a strategic alliance with an alternative energy supplier (Lichtblick, Hamburg). Both companies have started to democratise electricity production by creating small units manufacturing electricity in a family home. The market response is already huge and incumbent energy suppliers have no viable response yet.

These shifting ecosystems may be considered as a new symbiosis, which will restructure the industrial landscape more and more, requiring a different approach to markets than the simple application of established (analytical) tools that have lost their relevance. An organisation can decide to either re-invent itself or - in the case of Microsoft - it can fill gaps in resources and capabilities through mergers and acquisitions or alliances. Although Microsoft has pursued a non-organic strategy in a variety of areas, such competence and resource shopping has not always been successful. Many of Microsoft's approaches have failed to yield positive outcomes, which would suggest that the co-existence of an old ecosystem besides a new and stronger ecosystem cannot guarantee future success.

This paper is considered to be of importance since very little prior research has been undertaken and the work that was carried out tended to pre-date the inception and rapid growth of the Internet. It is therefore considered as a starting point for fundamental research using grounded theory with regard to the development of a new concept, which may help to explain the new competitive structures, which facilitate opportunities for small firms and increasingly provide obstacles for well-established corporations, which may find themselves in a position in which even their resources and capabilities will not be sufficient to withstand the power of newly emerged ecosystems.

The purpose of this paper is to shed light on the factors which drive ecosystems, which make new ecosystems more viable than established ones and to help create foundations for better understanding of the influencing factors on the existing and future marketplace. Such influences are not only seen in economic but also in biological theory.

Keywords: Ecosystem, resources and capabilities, autopoiesis, innovation, competitive environment

Introduction

It is the purpose of this paper to analyse the concept of the biological ecosystem and to explore the extent to which it can be applied to modern business thinking. The paper begins with a definition of the meaning of the term 'biological ecosystem' before analysing the business ecosystem concept of James Moore (1993). A new concept is then introduced called the "New Internet-Based Technology Ecosystem" which explains the extent to which the Internet has become an ecosystem in its own right based on a life cycle model spanning 35 years (Walton et al. 2011). Business cluster theory is also analysed and how this relates to the concept of the Internet as an ecosystem. This is followed by an analysis of the impact of the new paradigm on information-intensive industries and why they have failed to respond to this new competitive threat.

What is an Ecosystem?

The term ecosystem was coined in 1930 by Roy Clapham and is defined as a biological environment consisting of all the organisms living in a particular area, as well as all the nonliving physical components of the environment with which the organisms interact … [i.e.] a biological community and its physical environment (Campbell. 2008).

A core feature of the ecosystem is the idea that living organisms interact with every other element in their local environment (which refers also to the following chapter about autopoiesis). According to Odum (1971):

"Any unit that includes all of the organisms (i.e. the "community") in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structure and biodiversity and material cycles (i.e. exchange of materials between living and non-living parts) within the system is an ecosystem".

A wide range of species (or biodiversity) also contributes to a more robust ecosystem. For example, where more species are present at a particular location they can respond to change and they are able to "absorb" or reduce the effects of change. According to Owen et al. biodiversity will promote ecosystem integrity in changing climates because high diversity ensures that functional groups will retain at least one species that is able to tolerate altered conditions (1999). This reduces the effect of the ecosystem's structure from being fundamentally changed to a different state.

The introduction of new elements into an ecosystem also tends to have a disruptive effect which can lead to ecological collapse and the death of many species within the ecosystem. However, ecosystems do have the ability to rebound from a disruptive agent and this ability to recover is determined by two factors – the toxicity of the new element and the robustness of the original ecosystem.

Finally, ecosystems vary in size (i.e. they can be both large and small) as well as co-existing alongside one another.

The Business Ecosystem

According to Gruber companies should be viewed as organisms that exist within an evolutionary landscape (2001). Gruber believed that Darwinian logic should influence the way we perceive business. Since Charles Darwin was the founder of ecological theory ('The Origin of the Species'), then Darwinian principles should be applied to competitive business strategy, i.e. only the fittest companies survive as the business ecology changes (1859).

The idea of the business ecosystem was actually conceived in the early 1990s when Moore wrote *The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems.* Moore defined the business ecosystem as (1993):

"An economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world. This economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organizations also include suppliers, lead producers, competitors, and other stakeholders. Over time, they co-evolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. Those companies holding leadership roles may change over time, but the function of ecosystem leader is valued by the community because it enables members to move toward shared visions to align their investments and to find mutually supportive roles".

When formulating his concept Moore used a number of ecological metaphors saying that the firm is embedded in a (business) environment and that it needs to co-evolve with other companies and that "the particular niche' a business occupies is challenged by newly arriving species" (Moore. 1996). According to Moore, companies therefore needed to become proactive in developing mutually beneficial ("symbiotic") relationships with customers, suppliers and even competitors.

The use of ecological metaphors to describe business structure and operations has become increasingly common particularly in the information technology sector. De Long likened "business ecosystems" to a pattern of launching new technologies emerging from Silicon Valley (cited in Cohen et al. 2000). He defined business ecology as a "more productive set of processes for developing and commercialising new technologies" that is characterised by the "rapid prototyping, short product-development cycles, early test marketing, options-based compensation, venture funding [and] early corporate independence". De Long also said that the ecological model was probably more sustainable than the traditional vertical model used by Xerox PARC (Palo Alto Research Centre) since it was a more productive set of processes for rapidly developing and commercialising new technologies (cited in Cohen et al. 2000).

Gruber used Ford Motor Company as an example of an early business ecosystem when Henry Ford developed assembly line mass production techniques and in-sourcing (vertical integration) during the early 1900s. Gruber also stated that evolution in the ecology of the business world is "punctuated now and then by radical changes in the environment" and that "globalisation and the Internet are the equivalents of large-scale climate change" (2001).

Mangrove defined business ecology as "the interaction and correlation of economic conditions, technology, customers, employees, corporate partners, shareholders and competitors forming the environment under which a business operates" (2001).

The Montague Institute defined business ecology as "interacting systems consisting of companies, their customers and suppliers and other players in the business environment" (1993).

According to Kaminsky, the application service provider (ASP) industry has now moved toward relationship networks and focuses on core competencies (2000). For example, this ecosystem concept is widely used by Cisco Systems Inc throughout the world. Kaminsky said that "[according to] the gospel of Cisco Systems, companies inclined to exist together within an 'ecosystem' facilitate the imminence of Internet-based application delivery" (2000). Cisco leverages partners for all business functions except developing core products and business strategy. Partners support sales, marketing, manufacturing, technical support and new installations. This has been termed the 'locally global' approach and was in contrast to the traditional vertical models implemented by Cisco's competitors Lucent, Nortel and 3Com.

Finally, the need for successful organisations to view their competitive environment from an ecosystem perspective was echoed by Abe et al. who said (1998): "Business ecology is based on the elegant structure and principles of natural systems. It recognises that to develop healthy business systems, leaders and their organisations must see themselves and their environments through an *ecological lens*".

The Concept of a New Internet-Based Technology Ecosystem

Most of the earlier business ecosystem theory precluded the rapid growth and development of the Internet including the definitions coined by Moore and De Long with the latter author tending to perceive them as tightly-knit high technology clusters (1993, 1999, Porter. 2000, Holstein. 2011).

This is still a commonly held view since high-technology innovation clusters have played a major role in the financial success of many companies and countries. According to Holstein new clusters of high-technology innovation have emerged in key American states such as Pittsburgh, Pennsylvania (advanced robotics), Orlando, Florida (computer simulation) and San Diego, California (genomics), but there are European centres, too, like, e.g. Grenoble, Sophia Antipolis or Dresden (2011).

The second perspective, adopted by Gruber, when analysing business ecosystem theory, was the role of environmental factors in driving ecosystem development. Gruber stated that globalisation and the Internet were the equivalent to large scale climate change and – according to Moore's theory – companies were now embedded within this [business] environment.

Analysing these two observations in more depth, it is generally agreed that Silicon Valley is the most pre-eminent high-technology innovation cluster in the world in terms of both its technology outputs and wealth creation. It provides a prime example of what Moore and De Long were referring to when they espoused their original business ecosystem theories. The combined output from Silicon Valley over the last forty years has culminated in the global technology platform we now refer to as the Internet. This raises questions regarding the two schools of thought that business ecosystems are merely high technology innovation clusters and are influenced by climatic change [i.e. globalisation and the Internet] (De Long. 1999). For example, the Internet is no longer simply a driver of ecosystem growth and evolution but could now be classed as a "new technology-based ecosystem" in its own right (Gruber. 2001, Walton et al. 2011).

Even as early as 2000, Stephen Abraham (Vice President of Micromedia Ltd.) said that the web was "maturing as a business ecology". Moreover, a year earlier Dar stated that (1999): "[e]volution on the Internet is no different from physical evolution but with vastly compressed life cycles and faster generic mutation". Since these comments were made the Internet has undergone enormous exponential growth. The development of e-commerce and – more critically – the impact of digitisation and the development of sophisticated search engine technology have had a major impact on the other established ecosystems such as

book publishing, music, videos, computer and mobile phone software, media and travel etc. In fact, any company or industry that has data/information processing as a core activity is being threatened by the new Internet-based technology ecosystem.

This paper will now analyse the concept of the new Internet-based technology ecosystem in more depth using the 'New Internet-Based Technology Ecosystem' life cycle model (Table 1) to illustrate how the ecosystem has evolved over the last forty years.

Gruber used the term "mass collaboration technology" when explaining the Internet in his 2001 paper entitled "2021: Mass Collaboration and the Really New Economy". The development of this mass collaboration technology has an ecological DNA stretching back over forty years and displays all the core components of a biological ecosystem.

Table 1: The New Internet-Based Technology Ecosystem (Walton et al. 2011)

Foundation Stage **(1976 -1991)**	**Growth Stage 1** **(1992-2000)**	**Growth Stage 2** **(2000-2011)**
Key Technologies	**Key Technologies**	**Key Technologies**
• **Microprocessor** • **MS Dos/Killer Apps** • **Intel 486 & Pentium chips**	• **World Wide Web** • **Digitisation** • **Fibre optic cable** • **Encryption**	• **Linux** • **3G Smartphones; iPads; e-readers** • **Phone Apps**
Key Developments	**Key Developments**	**Key Developments**
• **Birth of the PC industry** • **1976-1977: Apple 1-2** • **IBM: open architecture and the clones** • **The industry standard – WINTEL**	• **'Global Village'** • **E-commerce** • **Dot Com boom** • **Early search engines**	• **Web 2.0** • **Digital downloads and streaming** • **Open source software** • **Cloud computing**

The early signs of the Internet-based technology ecosystem occurred in 1971 with the birth of the microprocessor chip from Intel. Intel's process of miniaturization culminated in the creation of a "computer on a chip". The "microprocessors" proved capable of performing the millions, then billions, of humble "on-off" switches that were at the heart of a computer's operation. This marked the definitive turning point in processing power.

The silicon chip was so important that the 'biological community' that created it soon adopted its name. The name Silicon Valley was coined by Ralph Vaerst, a Central Californian entrepreneur in 1971. *Valley* refers to the Santa Clara Valley and *Silicon* refers to the high concentration of companies involved in the semi-conductor and computer industries that were concentrated in the area (silicon being used to produce most commercial semiconductors).

This is what Clapham, Odum and Campbell referred to as a biological community of interacting organisms living in a particular area(1930, 1971, 2009). The biodiversity and robustness of the ecosystem also gathers

pace following the invention of the microprocessor chip as new 'species' enter the community in the form of personal computer entrepreneurs (Steve Wozniak and Steve Jobs) as we witness the birth of the personal computer industry in 1976 (i.e. Apple 1).

The Foundation Stage (1976-1991)

This is referred to as the Foundation Stage (1976-1991) of the Internet based technology ecosystem. Although the Internet exists at this point in time it is only used by the military and has not been commercialised. However, the future monetisation of Internet technology on a global scale is not possible without the establishment of a large network of compatible personal computers (PCs). This is why the birth of the PC industry and its meteoric growth is so important. Although semiconductors are a major breakthrough during this period, Silicon Valley was also responsible for innovations in software for operating systems and computer interfaces. Xerox's PARC played a pivotal role in many of these developments although it was the Silicon Valley entrepreneurs who were responsible for commercialising the new technologies.

When IBM entered the PC market in 1981 (following the success of the Apple 1 and Apple 2 personal computers) they decided to adopt an open architecture and hired Microsoft and Intel to provide the software operating systems and microprocessor chips for their personal computer. This signals the endorsement of the personal computer as a serious business machine and the birth of software as an industry. Bill Gates develops MS Dos and then a range of new operating systems and 'killer' software applications over the next ten years. Intel, meanwhile, develops a range of faster and more efficient microprocessor chips ranging from the Intel 386 to the full Pentium range (1-4).

The 'Foundation Stage' is important because it is during this period that the Internet infrastructure (or technology platform) is being established. From 1981 to 1991 a battle occurs for the ownership of the personal computer industry standard between the two rival ecosystems consisting of IBM compatible PCs using Microsoft software and Intel chips and the Apple-Motorola standard. Apple refused to license its technology to third parties and continued to develop its own operating system's software as a vertically integrated manufacturer and only its microprocessor chips were bought-in from Motorola. This resulted in a more costly production base compared to the IBM's compatible standard. PC manufacturers who were able to buy their operating system software from Microsoft and their microprocessor chips from Intel at very low prices could undercut Apple thereby building up a larger installed base of IBM compatible machines. These companies were referred to as the 'clones' because they simply piggybacked on the R&D of other companies and adopted 'me-too' strategies, i.e. Compaq and Dell etc. A new industry standard of compatible PCs was therefore established which became known as the WINTEL standard. This is an abbreviated acronym for the names Windows and Intel whose components the standard was based on. IBM decided to revert to a new PS2 standard in 1987 which lost them huge market share and forced them to make a strategy rethink since the WINTEL standard was now firmly embedded.

Growth Stage 1 (1992-2000)

The foundations upon which the Internet could now be commercialised on a global scale had now been established. There was also widespread PC ownership amongst a large population of computer literate consumers in both the domestic, corporate, government and educational markets. These personal computers were technologically compatible so they could now share data with one another without any difficulty. In 1990 Tim Berners-Lee introduced the World Wide Web (WWW), which was a system of interlinked hypertext

documents that could be accessed via the Internet. This meant that it was now possible for PC owners to send and receive information to one another anywhere in the world where there was an Internet broadband network.

The 1990s therefore sees the rapid global roll out of broadband networks where digital data is sent along fibre optic cables at high speed. Digitisation and encryption technologies are also key technologies which enable the safe and rapid transfer of data across long distances. This gives rise to the term "Global Village" where communication takes place free of charge across large distances in 'real time'. E-commerce becomes the next 'industrial (r)evolution' as we witness the rise and fall of the Dot Com companies. However, despite the Dot Com crash, the Internet has now become fully established as a global technology platform. The Internet is also proving to be a very resilient and robust ecosystem as it gathers increasing strength with more organisms entering the Internet community and adding to its biodiversity.

This biodiversity takes another leap forward as the "New Internet-Based Technology Ecosystem" moves from Growth Stage 1 into growth Stage 2. The key inflection point is the arrival of search engine technology. The web search engine is designed to search for information on the World Wide Web and FTP servers. Although a number of search engines had existed since 1996 (including Yahoo, Magellan, Lycos, Infoseek, Lycos and MSN) it was the rise of Google in 2000 which was to have the greatest impact. Google achieved better search results because of an innovation called 'page rank'. This was an iterative algorithm that ranked web pages based on the number and page rank of other web sites and pages that linked to them.

Growth Stage 2 (2000-2001)

The robustness of the ecosystem took on greater significance as the Dot Com crash was followed by the development of Web 2.0 and the social networking phenomena. Web 2.0 sites allowed users to interact and collaborate with each other in a social media dialogue as creators ('prosumers') of user-generated content in a virtual community, in contrast to websites where users (consumers) were limited to the passive viewing of content that was created for them. Examples of Web 2.0 now include social networking sites, blogs, wikis, video sharing sites, plus hosted services and web applications, etc.

The nature of the interactions between organisms within the ecosystem was also starting to change as new entrants arrived. No longer did the Internet have to be accessed via personal computers but new portable/mobile devices had been developed including the 3G smartphone, the iPlayer and the iPad. Meanwhile, media content (news, sport, music, films and books) were now downloaded or streamed via the Internet and open source software and computer applications were being accessed online using the cloud computing concept. Finally, the arrival of the phone application added another dimension to the way consumers were able to acquire information.

According to Peachey biodiversity promotes ecosystem integrity in changing climates because high diversity ensures that functional groups will retain at least one species that is able to tolerate altered conditions (1999). This has certainly happened with respect to the "New Internet-Based Technology Ecosystem" as a number of very powerful Internet-based companies have emerged which Bloomberg[1] recently referred to as "the gang of four". These giant four companies are Google, Apple, Amazon and Facebook. Owen et al. also said that the introduction of new elements into an ecosystem tends to have a disruptive effect which can lead to

[1] www.bloomberg.com

ecological collapse and the death of many species (1999). The gang of four have all introduced radical new elements or innovations that are having disruptive effects on other adjacent ecosystems and the ability of these ecosystems to survive. The full impact of these disruptions is dependent on two factors: (1) the toxicity of the new elements and (2) the robustness of the ecosystems that are under threat.

The ecosystems that are threatened include any companies which are involved in the processing of data/ information as a core operational process – usually information-intensive service industries such as:

- Book publishers and resellers.
- Music companies (record labels) and resellers.
- DVD and CD hardware manufacturers, resellers and rental chains.
- Computer software and hardware providers.
- Mobile phone hardware and software providers.
- Airlines and travel agents.
- Media/advertising companies.

The 'gang of four's' Internet-based business models have resulted in the accumulation of an extensive database of customers (and customer traffic) to whom they are able to give or sell digitised content and/or generate huge advertising revenues. This is having a profound impact upon the business models of many companies (including those listed above) as customers switch to digital instead of hard copy content which in many instances they would rather rent than own. The sheer convenience of shopping online from the comfort of one's own home has also lead to serious disintermediation of the supply chains reducing the need for manufactured DVDs and CDs and the need for bricks and mortar retailers. Cloud computing is also likely to have a similar effect. For example, as we access our data and computer applications online there will no longer be any need for bulky personal computers or laptops.

As early as 2001, Tom Gruber spoke of a new economy which would be based on a central nervous system of mass collaboration technology in which businesses and consumers would have almost perfect information about goods and services which they obtained from sharing their collective experience. He also said that political and economic power would flow to the source that delivers the greatest value as perceived by consumers. Gruber also went on to say that the winners in this new ecology would be the most socially intelligent organisms; those that were both highly intelligent as organisations (having highly evolved internal communication as well as external sense organs) and who were highly effective at developing relationships with other corporate organisms (2001).

It would appear that Gruber's new economy based on mass collaboration technology has arrived in the form of the "New Internet-Based Technology Ecosystem" (2001, Walton et al. 2011). The ecosystem has demonstrated huge biodiversity and hence integrity and resilience. The interaction of tightly knit organisms is evident whilst the toxicity of the ecosystem in terms of its impact on adjacent information-intensive service ecosystems is immense whilst the adjacent ecosystems are not robust.

The Internet is therefore no longer the by-product of a high technology innovation cluster named Silicon Valley nor is it merely an environmental driver of other ecosystems. The Internet has now become a fully

fledged ecosystem and competitive force in its own right with highly disruptive characteristics capable of creative destruction (Schumpeter. 1942).

Business Cluster vs. Business Ecosystem Theory?

So far this paper has defined the meaning of both the biological ecosystem and business ecosystem concepts (Moore. 1993). However, there has only been limited discussion of the business cluster concept. So one of the key questions is the extent to which the concept of a business ecosystem is little more than another term for business cluster. If this is the case then what are the implications for the "New Internet-Based Technology Ecosystem" model (Walton et al. 2011)? One way of exploring this in more depth is to define what is meant by a business cluster and how this compares to the "New Internet-Based Technology Ecosystem" model.

According to Porter a business cluster is a geographic concentration of interconnected businesses, suppliers, and associated institutions in a particular field (2000). Clusters are considered to increase the productivity with which companies can compete both nationally and globally. Moreover, in urban studies the term agglomeration is used (Porter. 1998).

The term business cluster (also known as an industry cluster, competitive cluster or Porterian cluster) was introduced and popularised by Porter in *The Competitive Advantage of Nations* (1990). However, the underlying concept which economists have referred to as agglomeration economies dates back to 1890 and the work of Alfred Marshall.

Porter claimed that clusters had the potential to affect competition in three ways (1998):

- By increasing the productivity of the companies in the cluster
- By driving innovation in the field
- By stimulating new businesses in the field.

In the modern global economy comparative advantage is based on certain locations having special endowments:

"… a business cluster is a geographical location where enough resources and competencies amass and reach a critical threshold, giving it a *key position* in a given economic branch of activity and with a decisive *sustainable competitive advantage* over other places or even a world supremacy in that field (i.e. Silicon Valley and Hollywood)".

There are subsequently a number of different ways that clusters can be identified such as:

- Geographic cluster i.e. location.
- Sectoral cluster: a cluster of businesses operating together from within the same commercial sector.
- Horizontal cluster: interconnections between businesses and the sharing of resources e.g. knowledge management.
- Vertical cluster, i.e. a supply chain cluster.

Three types of business clusters based on different kinds of knowledge are also important:

- Techno clusters - These clusters are high technology-oriented, well adapted to the knowledge economy and have renowned universities and research centres adjacent to them i.e. Stanford University andSilicon Valley.
- Historic know-how-based clusters - These are based on more traditional activities that maintain their advantage in know-how over the years. They are often industry specific i.e. London as financial centre.
- Factor Endowment clusters - They are created because a comparative advantage they might have is linked to a geographical position. For example, wine production clusters because of sunny regions surrounded by mountains, where good grapes can grow i.e. certain areas in France, Spain, Chile or California.

Finally, clusters are also categorised using industrial classifications such as the Standard Industrial Classification (SIC code) in the UK and the National American Industry Classification System (NAICS).

On the basis of this extensive definition of business cluster theory, it is apparent that the "New Internet-Based Technology Ecosystem" model cannot be categorised as a business cluster for a number of key reasons.

- First, geographic location is irrelevant because of the nature of the World Wide Web.
- Moreover, sectoral clusters and industry classifications do not apply because the Internet is not industry-specific owing to the pervasiveness of the technology.
- Vertical clusters and the supply chain are also irrelevant since the Internet has been responsible for the disintermediation of physical supply chains as many 'products'/services are now downloaded or streamed in digital formats.
- Factor endowment clusters (because they are linked to geographic position) are not applicable whilst the historic know-how cluster is difficult to apply because of the speed of technological development which renders know-how as outdated in a short period of time.

The only two forms of cluster that come close to defining the Internet are possibly horizontal clusters and techno clusters. However, this is where the paper challenges existing theories regarding business clusters and business ecosystems. Many ecosystems are clusters based on the categorisations explained earlier. For example, Silicon Valley is both a techno cluster (linked to Stanford University) and a horizontal cluster as well (i.e. with the sharing of resources such as R&D, legal services and funding sources, including venture capital).

The authors therefore believe that the Internet is a technology-based ecosystem which consists of a broad range of interacting organisms. These organisms consist of techno clusters, horizontal clusters and even sectoral clusters that contribute to a clearly defined and powerful trophic structure (Owen et al. 1999). The sheer diversity of the organisms (clusters) has also created a highly robust and resilient ecosystem with high levels of toxicity.

Competitive Responses to the New Internet-Based Technology Ecosystem

The toxicity of the "New Internet-Based Technology Ecosystem" is already having an impact on information/data intensive service industries in what can be seen as a Schumpeterian 'gale of creative destruction' (1942, Walton et al. 2011). One of the key reasons for this destruction has been the inability of organisations and corporate business leaders to understand the nature of the external threat and to implement appropriate strategies. This is partly due to the problems of dyed in the wool strategic recipes (Huff. 1982, Spender. 1989), out-dated business models and inappropriate paradigms. The strategic tools used to analyse the external competitive environment are also outdated. For example, Porter's Industry Structure approach based on the famous Five Forces Model is inappropriate because it is impossible to define modern industry

boundaries due to the blurring effect of technology. When Apple Corporation lost the battle for the industry standard and its position as the second largest computer firm in the world in 1991, the competitive threat was not from a direct rival in the form of another computer manufacturer but two component suppliers called Microsoft and Intel. In technology markets new business models are now needed to analyse the competitive threats from the external environment. Traditional vertical strategies based on a helicopter view (Muna. 2003) are no longer effective. The sheer size and pervasiveness of the Internet as a global ecosystem means that a satellite view (Walton et al. 2011) is now required since the helicopter perspective is simply too narrow.

Porter's Value Chain and Grant's resource-based view of strategy are also superfluous since mass collaboration, global outsourcing and open source innovation have resulted in virtual mini-multinationals that can now trade globally using very few resources (1985, 2008). This view was endorsed by Iansiti et al. who said (2004):

"Many industries today behave like a massively interconnected network of organizations, technologies, consumers and products. Perhaps the most dramatic and widely known example is the computing industry. In contrast with the vertically integrated environment of the 1960s and 1970s, today's industry is divided into a large number of segments producing specialized products, technologies and services. The degree of interaction between firms in the industry is truly astounding, with hundreds of organizations frequently involved in the design, production, distribution, or implementation of even a single product. And because of this increasingly distributed industry structure, the focus of competition is shifting away from the management of internal resources, to the management and influence of assets that are outside the direct ownership and control of the firm."

Analysing business clusters and strategic groups is also of limited use since many of the external threats to an organisation's survival do not come from the same industry or resource base but from a completely different industry. Google, Amazon and Apple are not record labels, publishers, movie studios, media companies, travel agents or mobile phone companies. However, by virtue of the "New Internet-based Technology Ecosystem" they are having a highly disruptive and toxic impact on all of these markets and industries. So to reiterate the words of Abe et al. "… leaders and their organisations must see themselves and their environments through an ecological lens" (1998). Those organisations that fail to view their competitive environment from an ecosystem perspective using a satellite view will therefore struggle to implement appropriate strategies as the new economy develops and mass collaboration technology changes the rules of the competitive game (Walton et al. 2011).

Finally, Iansiti et al. stated that organisations competing in an environment dominated by dynamic business ecosystems should consider three possible strategic options consisting of keystone, dominator or niche' strategies (2004). This is again in contrast to Porter's model of generic strategies. They said that keystone and dominator strategies can be pursued by firms that occupy important hubs in their business networks. Keystone strategies shape and coordinate the ecosystem, largely by the dissemination of platforms that form a foundation for ecosystem innovation and operations. The famous 'gang of four' (Apple, Amazon, Google and Facebook) can all be said to be pursuing keystone strategies since they are shaping the Internet as an ecosystem by leveraging the technology platform and the customer database and 'traffic' they are generating. This enables them to enter different markets using a core competency approach.

The dominator strategy, however, is somewhat different. Companies pursuing this strategy attack the ecosystem, absorbing and integrating external assets into internal operations. This strategy is being pursued by Microsoft which is acquiring assets through aggressive takeovers and mergers in order to remain a competitive force. Nevertheless, as many examples provide evidence, Microsoft's success is comparatively limited.

Lastly, the niche strategies are pursued by the much larger number of firms that make up the bulk of the ecosystem. These firms emphasise differentiation by focusing on unique capabilities and leveraging key assets provided by others.

Iansiti et al. also said that traditional models of strategy that emphasised internal competencies failed to account for these dynamics because they focused on the evolution of firm capabilities and business models instead of the relationship between the firm and its external ecosystem (2004).

Product – Infrastructure – Ecosystem

The product – infrastructure - ecosystem triangle has considerable significance in the new competitive game(s) and it refers to the triangular thinking that management needs to adopt, if they want to manage the many complexities that a global Internet-based ecosystem creates (Keidel. 2010, Oestreicher. 2011[1]). This is even more advantageous for satellite perspectives.

Recently Adomavicius stated, too, that a new theory-centred conceptual approach, which includes a new methodology, is necessary to make sense of the new developments (cited in Adomavicius et al. 2008). This supports what was argued earlier that many theoretical frameworks used as standards in management and management education have lost their relevance. It is also assumed that managements still relying on these theoretical models but managing contemporary issues created by the Internet's influence, may experience more disadvantages than advantages as a result of this. In terms of new methodology, Adomavicius et al. suggest utilisation of the process theory approach (2008). However, due to the limitations of this paper we are restrained from following this path further. Instead a more geometrically informed model is proposed in the form of the Triangle which is the most stable geometric form for strategic thinking (Keidel. 2010).

Using this geometrical approach the product – infrastructure – ecosystem is viewed as a triangle. For example, it has been stated that Apple's iPod was not capable of success on its own but it was the combination of both the iPod and iTunes concepts that were responsible for Apple's success, i.e. the product is the iPod but it needs an infrastructure, which is provided by iTunes as the online shop [and other components which have emerged over time] (Oestreicher. 2011[1]). However, iTunes is not viable without products to sell such as the songs and movies (the content) which can be downloaded. It was also suggested that the creation of the new ecosystem was not made by different consumption patterns alone but by Steve Jobs' ability to convince major music labels to provide the relevant songs. The difference between the old ecosystem and the new was the toxic factor in the form of the new entrant Apple, reorganising the rules of the game and consequently poisoning the established business model in which the (established) chain of distribution became threatened by obsolescence. This may be directly linked to Schumpeter and his 'gale of creative destruction' (1942).

A new triangle was born consisting of product (iPad), its infrastructure (music labels with their songs, iTunes) and the ecosystem (Apple – music labels and content producers – consumers). This directly opposed the traditional model (music labels with their songs – distribution chain – consumers). It is easy to understand that the new economic model (or better triangle) could not work without the Internet ecosystem which is considered as macro-infrastructure (online shop, up- and download functions, etc.). The disruptive factors or the toxic elements are everywhere. For example, iTunes and music labels have become incumbent factors and can be excluded since music and other producers of content can be easily dematerialised which therefore leads to the exclusion of all institutional and organisational participants. This is what von Hippel refers to as the democratisation of innovation which in this case is facilitated by the Internet. Hence another new triangle

was formed by music (the product), the infrastructure (Internet, up- and download platforms) and the (new) ecosystem (content producers and consumers in a peer-to-peer interaction without labels) (2005). This simplifies transactions further and with regard to transaction cost theory, it makes transaction costs even lower than before, to the consumers' and also producers' advantage. Content producers become autonomous in their collaboration and are able to control their products themselves. This leads to the basic triangle of collaboration – autonomy – control (Keidel. 2010). The Schumpeterian Wind of Creative Destruction is now also blowing against all established organisational structures (Oestreicher et al. 2011[1]).

Considering the aforementioned context and model there are obvious parallels which indicate a similar shift and threat of obsolescence but this time in the book market involving another party of 'the gang of four', namely Amazon. Again it is the book as a product requiring a specific format for Amazon's kindle (its infrastructure), which makes the whole construct viable. As Amazon recently reported, it is selling far more Kindle-versions than physical books (Walton et al. 2011). Of particular interest will be whether this repetition is extended. Will book authors and to which extent, like music producers' circumvent publishers (and maybe even Amazon) and sell directly to consumers? It happens already on a certain level. This will mean another shift and renewed ecosystem in another sector of the Home Entertainment Industry.

As the established theoretical frameworks have already been challenged in this paper it is now time to seriously ask the extent to which these models still cover the changed ecosystems and allow managers to gain the necessary insights relating to both corporate and marketing strategies? For example, how does the Marketing Mix enable organisations to create a sound analysis when (or if) they are excluded by the organisms of the new ecosystem (Oestreicher et al. 2011[2])?

Disruptive innovations threatening previously viable ecosystems can also be found outside the pure Internet-based structures. These offline trends may produce similar effects as the example of the energy market demonstrates. The following example focuses once more on the poisonous effect of a new entrant threatening the prior viable ecosystem.

The new entrant here is the car manufacturer Volkswagen which has created a poisonous strategic alliance with a comparatively small alternative German energy supplier, called Lichtblick. The product is electricity, the infrastructure comprises VW's (usual) gas-driven car motor belonging its Caddy and Fox models and a device, which creates a combination of those components, a block-unit cell. This home-based energy production can be installed in a normal family home and produces sufficient electricity for the home and additional needs. However, it is not just the technology-driven innovation that is important but also the innovation in the business model. The fact that superfluous energy can be delivered to the national grid at a family earning level of 2.5 ct per kw/h is also possible from these energy models. The strategic alliance by VW / Lichtblick also adds another perspective. The homeowner pays just € 8,000 for the block unit cell and a small fee for maintenance (Oestreicher, K. 2011[2]). In comparison to a normal system, this is an extremely cheap investment. The consequences for the two sides of the triangle (product and infrastructure) and for the third tangent (ecosystem) are therefore extremely toxic. The established part of the ecosystem consisting of an oligopoly of multinational energy suppliers is immediately threatened by obsolescence to a great extent. They might become distribution agents in the future but with regards to their billion Euro investments in power stations, this is not likely to be more than a fraction of the revenues. This is evidenced in the form of published reports that verify a huge demand (Oestreicher. 2011[2]). Again, radical innovation shifts the ecosystem and established business models therefore become endangered:

- Old ecosystem: Energy producers – Energy suppliers (frequently producers at the same time) – consumers
- New ecosystem: Car manufacturer (which will find likely imitators) + small independent alternative energy supplier – consumers

The new entrant changes the rules of the game. Once again it may be argued that this new form of energy production is aligned with the democratisation of innovation approach proposed by von Hippel (2005). This is both technological and business model innovation.

Based on the two earlier examples, attention is drawn to a component which has an ambiguous position:

- IPod, the product (but a product needing the products of music and movies)
- Kindle, the product (but a product needing the product of book content)
- A car motor, a product (but needing the additional product to create the block-unit cell)

This makes the differentiation between product and infrastructure more complicated and requires more than a single perspective and understanding of what the product finally is and which is then unambiguously the infrastructure. The organisational analysis of where finally the real toxic power can be found becomes more complicated.

It might be argued that Amazon was not a new entrant and therefore not unknown in the market before whereas Apple and Volkswagen were new players in a new environment. To refer back to the new Internet-based ecosystems, the first two examples were dependent on the Internet. However, despite this, the new energy model does not need the Internet. It is nevertheless suggested that the Internet is of considerable use as a facilitator in the understanding of ICT.

A final analysis of an emerging new ecosystem using this triangular geometry takes the form of 3-D laser printers. 3-D laser printers are a product and their infrastructure consists of the major component of 3-D designs, which allow the printing of the relevant product and requires IT. These 3-D matrices are increasingly delivered via the Internet. With regard to (future) consumer applications, a toy and a salad bowl are just two products to which thousands of others can be added. Today these 3-D laser printers are still expensive but prices are falling rapidly. There is little doubt that these products with their infrastructure will decline in price and will become available for mass consumption at home. The consumer's home will undoubtedly soon become a convenient manufacturing work unit similar to the 'home' office. This new ecosystem may then threaten corporations like Lego, Tupperware and the like (Oestreicher et al. 2011[2]). The market will shift along with consumption patterns alike. What will the threatened industry do when this type of manufacturing becomes democratised as well?

Considering marketing's frequently cited origin – bring to market – it becomes evident that the ways to bring to market are significantly changing and that the concept of permanent change is extremely relevant. The organisation's hyper-competitive environment may also explain the difficulties managements have when coping with the new Internet-based ecosystems. Managers who are used to B2B competition will find it extremely difficult since these consumer-centred developments add a further facet to organisational lives, the competition against user- and/or consumer-based structures, for which managers are much less adept and experienced. It is proposed that in these changing times, the 'new' competitors are more erratic and volatile

adding to the complexities of management in the competitive marketplace. To use a quotation from Kelly "[a]ll is flux, no harmony (1979, cited in Oestreicher et al. 2011[2]).

The (New) Triangular Perspective

With regard to management's strategic, thinking Keidel rightly complains that managers simplify too much, they prefer to think in point, black or white – here comfortable (the old ways) / not comfortable (the new ways) – or linear, by shades of grey (how can the present ecosystem be continued with as little change as possible) (cited in Oestreicher et al. 2011, Oestreicher. 2011[1]). The toxic power and the influence which the emergence of new ecosystems provide, contradict such simplicity and are pleading for more complex considerations.

As marketing and other relevant research shows, product orientation is a frequent focus in organisations. This may be interpreted as a support for Keidel's argument of simplification [point or linear] (2010, Oestreicher. 2011[1]). Management has concentrated too much in the past on one side of the triangle (a tangent or line), which may have drawn some of their attention to the second line, the infrastructure. This second consideration may be driven by questions of compatibility (e.g. Kindle needing a specific format to display the content), the shades of grey. This forms angular thinking, which Keidel's geometric explanation also covers (2010). With regard to the criticism on marketing frameworks this two-sided thinking creates a matrix. Matrices are very famous in management science, whether it is Porter's Generic Strategies or the Ansoff matrix, the marketing literature is full of such linear thinking in matrices and Keidel reinforces this criticism (cited in Wilson et al. 2008, 2010). Matrices consist of two variables (here product and infrastructure) but as Keidel argues, these variables A and B neglect the critical third variable C (here the ecosystem). This variable C may be – and the argumentation presented here is considered as being quite conclusive by its logic – the decisive trigger for instability and in many cases the responsible actor or change agent for discontinuous collapse. Oestreicher's in-depth research presents much evidence for this argumentation (2011[1]). The general conclusion is that two-dimensional thinking is frequently not appropriate since putting the triangle at the centre of the analysis is essential. Hence the conclusion proposes that only two-dimensional analytical frameworks are not sufficient anymore for such an environment of complexities. At least the decisive variable C is essential.

The afore-mentioned triangular geometry of product – infrastructure – ecosystem needs to be set in a wider framework. If it is accepted that the triangle is a geometry of extreme stability, then the proposition is that this counts only if all sides of the triangle are stable (Keidel. 2010). For example, as soon as one side – here the (old) ecosystem – is weakened, then the whole geometry is endangered. Such 'endangering' has been experienced by the Home Entertainment Industry with serious consequences:

- MP3s can be played on many devices but they do not need a DVD or CD player, the concept of convergent technologies makes its inroads beyond the product (content) to the infrastructure.
- The product (content) is threatened, since revenue models presently fall apart more and more; the driving question is, how can good content be produced? To refer to a recent blockbuster film, how can a movie like Avatar be financed (which is a product), when consumers exclude the industrial participants from revenues?
- With regard to the infrastructure, this particular industry expects significant potential regarding the use of the new 3-D development to revive or cure the established ecosystem with an improved

convergent infrastructure but the toxic factor of Internet-developments (due to smart phones) catches up quickly. This will most likely lead to a renewed status quo in this battle.

Thus, after Keidel, geometrical instability might lead to the collapse of the whole system in the last instance and to be precise, the long-term research undertaken supports this assumption (2010, Oestreicher. 2011[1]).

Adding the biological component, living organisms also have to fight against parasites. It could be argued that these are represented by the illegal P2P file-sharing or by piracy causing damage to the value of billions but it is not the intention to compare the democratised consumers with parasites, especially after the misbehaviour of industrial exploitation for more than a century (Oestreicher. 2011[1]). The problem needs to be analysed more closely. Specific parasites extract from their host as long as he/she is alive. When he/she dies, the parasite frequently dies also, unless it finds another host in time.

Bringing this reflection back to the economic side of the movie example, consumers are attracted by blockbusters like Avatar. But if the budgets for such an expensive product are not guaranteed anymore (since democratised file-sharing – even if legal – deprives organisational players from the necessary streams of revenues) then the subsequent question is how and which type and quality of product can be produced? Therefore the exclusion of industrial participants may finally damage the consumers' own interests. This is considered as an evidence of the dependence on both sides:

- The industry needs consumers and their product acceptance to produce good content that they are (really) interested in.
- The consumers need to return tangible values if they expect to have high quality content in the long-term.

It may be possible with today's technology to produce good music and to write excellent books but it is unlikely to produce the same high quality in the movie sector. A housewife may use a 3-D laser printer to manufacture a plastic salad bowl but it needs very specific skills and rare capabilities to construct and build a device being able to produce energy.

Such interdependence changes the picture. It is not (as said before) biologically about a parasite – host relationship but a symbiosis. However, to consider and respect a symbiotic relationship, it has advantages on both sides: No industrial exploitation of consumers and no illegal behaviour or support of piracy by consumers. This biological equation may be applied to economic ecosystem considerations and to make ecosystems more viable and predictive. This example is specific but as nature knows many forms and expressions of symbioses similar parallels can be formed for other industries. It may be argued by application of the chaos theory that life always finds a way.

As a summary, the triangle must be stabilised and it is in the interest of an ecosystem that by such biological consideration the triangle's stability is not undermined leading to the consumers' own disadvantage. As a result of this added biological component it is suggested that:

- The new ecosystems and their democratic structures and behavioural methods and patterns of consumption have other and different limitations;
- These limitations cannot be generalised as a one for all assumption since type, use and ways of consumption differ;

- The triangle of product – infrastructure – ecosystem has degrees of interdependence; a weakness of one side (tangent) may cause a domino effect, whereby it cannot be guaranteed that new additions, which may replace the weakened part, can endlessly guarantee the survival of the triangle as a geometric figure of stability.

- Comparable to biological recognition, a symbiotic form is expected to extend the viability of an ecosystem by the implicit and explicit advantages for all parties involved.

As a result it is suggested that these considerations, to which further ones can be added, limit freedom, democracy and models of interaction (such as P2P) depending on the type of triangle involved but also blurring industry and product boundaries.

This argumentation refers back to one of Keidel's fundamental triangles focusing on autonomy – control – collaboration (2010, Oestreicher. 2011[1]). This perspective relates to the discussion of additional advantage. For example, when the music industry accepts platforms like iTunes, it starts a modern (MP3, Internet-based) collaboration with the new entrant (Apple). In terms of its potential the iPod plus iTunes has a lot of toxic power for the established system of incumbents. By their acceptance, incumbents adopt change, they shift and reorganise their business model by forming a new collaboration with the new entrant in possession of the poisonous power. The incumbents' advantage is that they maintain their control of the product this way, since they are dealing with a serious industrial player. At the same time they do not only stabilise the triangle's sides of collaboration and control, they are also acting favourably with regard to the third side, autonomy. The result is that components have been exchanged (single track sales, effects on the distribution and value chain, effects for the prior infrastructure, etc.) but there is then a different but still a solid triangle. Unfortunately the reality for this specific industry is very different (Walton et al. 2011, Oestreicher et al. 2011[2], Oestreicher. 2011[1]).

By adding another biological component here, the addition of new blood means the new ecosystem is viable and with a specific view on Christensen et al's. disruptive innovation theory, incumbents on the product side (content) may attract non-consumers, too (2004). More (and perhaps different) consumers may find the new model of buying single tracks more favourable and attractive now since they are not being forced to purchase the industrially predefined content of an album which the majority of consumers have no interest in (Christensen et al. 2004, Oestreicher et al. 2011[1]). For example, a potential extension of the factor collaboration could have finally led to new blood in the veins of the relevant struggling industry thereby improving its autonomy and at the same time, despite the loss of their distribution chain, extending their value chain by increased collaboration with (prior non-)consumers. However, it is this reluctance to orient the established business models to the new realities of a different Internet-based ecosystem, which has seriously poisoned the viability of this whole industry.

Another marketing perspective, which seems to be of influence are values of sympathy. Both the Home Entertainment Industry and energy suppliers are oligopolies, which have and still exploit their customers. Both have low values of sympathy in the eyes of their customers. For example, Dunt states that it is time to finish off the record companies (2011). The very comparable situation for energy suppliers can be taken as common ground. These examples may raise the question, whether there is a relation between an oligopoly structure, values of sympathy and the consumers' preparedness to change the ecosystem. Taking this into consideration, a further triangle is constructed: Organisational structure (control of markets, products, prices, etc.) – values of sympathy (preparedness and voluntariness of and for collaboration) – autonomy (the freedom to change the rules of the game and to leave the ecosystem). The assumption is that there are

indicators for such an interdependence. However, the book industry and its and publishers do not fit well into it, since few complaints are known here. In the first instance this argument contradicts such a hypothetical conclusion but taking this further also seems to offer some confirmation, since the book market with its various sectors is much less formed and dominated by an oligopoly. Regardless of this, many independent publishers are owned by bigger corporations.

Nevertheless, there is a phenomenon needing further research, since it cannot be evaluated by three rather obvious examples without empirical valid and reliable studies on wider elements of different industries. This requires substantial additional empirical data.

Autopoiesis

Using a biological perspective, the concept of the New Internet-based Ecosystem can find an extended consideration in autopoiesis. In its biological understanding, autopoiesis characterises living systems as a process, which realises these. It is a functional collaboration of the systems' components, which produces these components. For example, the product of their organisation is themselves without the separation between producer and product. Action and being of an autopoietic system are a specific form of organisation and producer and product are inseparably interconnected.

One further triangle emerges: (1) the Internet – (2) the major providers, which includes the 'gang of four' with their fast growing dominance, which may lead to a new oligopoly with different kinds of threats (to consumers) – (3) consumers. The hypothesis is that none of these can live without the other. If there is no Internet, the 'gang of four' loses its platform and consumers lose the recently gained advantages. However, without the interaction, the Internet would also lose its purpose.

Going further, industries nowadays depend heavily on the outcome of what the 'gang of four' delivers. The differentiation of what the product is and whether the ecosystem produces a product or recreates, renews or (re-)produces itself, has become extremely difficult.

Google is presently a centre of Internet-based activities. From a marketing perspective, there is no difference between B2B and B2C. From corporations to private persons nearly everyone uses Google as a first choice. There are competitors to Google but the Internet-based ecosystem 'googles'. But what is the product? It is suggested that the product is the result which this search engine produces. Finally, Google does not produce the product, it is this specific organisation, which produces the product. Search engine marketing and search engine optimisation have become a permanent effort to achieve an improved ranking. Hence, the ecosystem itself enables Google to improve the major product(s) it delivers. With regard to Google's competitors, the primary focus for research engine results is the place on and in Google's ranking, not that of secondary competitors. Producers and product cannot be simply separated and the viability of this close relationship is dependent on the permanent interaction.

Another example of not being part of the 'gang of four' is Wikipedia. The product is an encyclopaedia which has achieved an acknowledged status of accuracy for most of its entries. However the producers and the product are inseparably connected, interconnected. The significance of this is that it affects the traditional old system, the formerly established ecosystem of producers, publishers and buyers of lexicons, which also influences their printed versions as well as the online presentation. Social communities (here the 'gang of four' is back, like Facebook) are in a similar position. The community creates the content and the content is the community.

Should this highly dynamic relationship of producers and product be interrupted e.g. by a disruption of its decisive linkage, the Internet, then the whole organism is interrupted and its viability endangered. A long interruption can finally be expected as the death of this specific organism is inflicted by the New Internet-based Ecosystem in which institutional and organisational structures have become little more than peers.

The limitations of this research paper do not allow us to delve more deeply into a such a complex phenomenon such as autopoiesis but in our eyes it cannot be neglected with reference to the explanatory research ahead.

The Corollary Sustaining Innovation Classification-scheme

This theory by Christensen et al. helps to explain much of the accompanying elements having decisive impacts for organisations if they want to escape potentially disruptive or discontinuous environments (2004):

- The Internet and its new, formerly unknown ways of collaboration and interaction are changing the demand from just-in-time to more real-time processes.
- The Internet is a sustainable innovation with a dominant factor and the hotbed of many toxic elements for existing ecosystems.
- It defines through many perspectives the pathway for improvements of products and infrastructures.
- Through this classification-scheme the Internet creates, as a consequence, many disruptive innovations.

This theory subsequently delivers a foundation which leads back to new entrants like Apple in the music and mobile phone market or Amazon in the book market possessing the toxic power of interruption and/or replacement of established incumbents. As this theory tends to hold, incumbents must be visionary, more visionary than the invader, who may suggest that the existing ecosystem establishes a new and different form by the replacement of existing structures and an improved value network. The rules of the new game are frequently very different and are unlikely to allow incumbents the application or the use of a thinking in point (white: welcomed / black: not welcomed), linear (the shades of grey, somehow this situation will be resolved by just a better product) or by angular thinking (a new product with an improved infrastructure, such as 3-D movies), since according to Keidel there is the frequently vicious variable C (2010). This variable C can be the decisive trigger for the collapse of the existing ecosystem if it is neglected. It requires holistic, triangular strategic thinking to ensure survival. A review of collapsed firms is also recommended including companies such as the British retail chain HMV which is presently struggling for survival. Through this theoretical assessment a specific focus on the missing crucial variable C can be achieved.

If the new approach is radical enough it will require the re-attribution of all critical factors which have constituted the former ecosystem. A new allocation of resources and capabilities and the development of new capabilities are expected to be the necessary consequence for survival [emphasis is put on Christensen et al.'s resources, process and values theory and the resource-based view] (2004). According to the corollary sustaining innovation classification-scheme, a visionary industrial leader needs to accept and internalise the challenge (Christensen et al. 2004). The rules of competition have changed and what Kim et al. have defined as conventional organisational thinking will not be sufficient anymore (cited in Oestreicher. 2011[1]).

Critical mass is also important which may constitute a variable C. From an industrial perspective there may be two different ecosystems competing for dominance. The question is whether the existing ecosystem will receive sufficient and highly attractive new impulses from its two other sides, product and infrastructure. To avoid this the present ecosystem's participants will need attractive new value propositions or they will move to the new ecosystem and the critical mass for the new dominant ecosystem may be achieved leading to the collapse (or at its best a niche survival) of the older ecosystem.

A weakened organism feeding another organism using too many of its own vital resources will reach a critical moment when it has no more power to live or suppress the toxic influences of the invader; then it will no longer be fit for survival. Organisms, which think in terms of simplicity and create their strategies around conventional thinking, (Kim et al.) by using angular thinking as a maximum (Keidel), lose momentum and control over the developments (cited in Oestreicher. 2011[1], Walton et al. 2011). This has inevitable consequences for their control and autonomy.

Such cause and effect logic leads finally back to Darwinism (1859).

Conclusion

This conceptual paper is the start of the in-depth research which attempts to understand the phenomenon of the ecosystem from an additional perspective. Natural sciences and biology know that ecosystems are a fragile structure of give and take between living organisms. It is suggested that this is considered as a value network of collaboration (one tangent of the triangle). However, the second tangent, autonomy is also present. Each individual organism remains responsible for an improved or at least sufficiently independent outcome. However, the ecosystem as such produces and is itself a product in its own right i.e. it represents a system of autopoiesis.

The concept of the survival of the fittest can be applied to many of these natural ecosystems and especially their individual participants (Darwin. 1859).

Meanwhile, the third tangent, control, is of essential importance, too. Sometimes even a small influence, shift or change within the system can have substantial impacts. In this biological environment a small portion of toxic material may destroy such fragile conditions of harmony. A harmony which is nevertheless not without competition for the best resources and in which superior capabilities count. This may be caused by an external intruder which may have superior capabilities. Their power may destroy the equilibrium of the existing network of values and create a new and different ecosystem with a different centre of value proposition therefore appearing more attractive to individual organisms.

As the institutional theory suggests, organisations do not work in a vacuum i.e. they control products and they may need additional components supplied by and fitting into the surrounding infrastructure. However, it is the ecosystem which makes the system viable. Important collaboration is necessary but also autonomous decisions of the parties involved to find their best outcome. This maximised outcome may be delivered by a new entrant with superior value propositions causing the shift of network participants. Chesbrough et al. (2006) refer to Christensen et al. and Iansiti et al., when they state that collaboration is frequently referred to as a value network or ecosystem. Adomavicius et al. suggest a

"[d]esign science research involves the construction and evaluation of IT artifacts, constructs, models, methods, and instantiations, by which important organizational IT problems can be addressed. Our proposed set of artifacts includes constructs and a model

for representing relationships between IT components, products, and infrastructure, and a new method for identifying and representing patterns of technology evolution" (2008).

This includes a variety of triangular strategic thinking of increasing importance. The proposition is that this approach can be extended to a more general meaning when the notion of IT is replaced by the Internet.

There is the famous 'gang of four' which has initiated a good number of shifts in various ecosystems. However, it cannot be forgotten that there are many smaller, less popular initiators of such shifts in- and outside Internet-based ecosystems, which have presented disruptive value propositions for a variety of industries. There is no doubt that many more such shifts of value networks are ahead.

It is now time to abandon the paradigm of the Internet as a *new* technology but to present new theoretical frameworks which are more than simple amendments or adaptations. The macro-facilitator Internet is still in the early growth stages of its life cycle and it has still to reach the final point whereby it can no longer trigger new ecosystems that cause toxic elements which affect previously stable environments. It must be assumed that the contrary will happen and that more and more industries will face the 'gale of creative destruction' (Schumpeter. 1942).

This preliminary research paper therefore asks a major question for further study: 'After two decades of Internet growth and millions of years of biological ecosystem development, what can be learned from the concept of the Internet as a New Technology-based Ecosytem and how can this support and inform managerial thinking and decision-making processes for sustainable survival in the future?'.

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