Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept
Michael L. Weber and Michael J. Hine

“For evolution is not only substitution of independent
components; it is also integration of the components
to form adaptively coherent systems.”

Theodosius Dobzhansky (1900–1975)
Evolutionary biologist
In ”Mendelism, Darwinism, and Evolutionism” (1965)

Currently, many terms are used to describe business ecosystems and their inhabitants. These terms have meanings that can cause definitional confusion and an ambiguous level of analysis as to what constitutes a business ecosystem. To understand business ecosystem relationships, an unambiguous understanding of the ecosystem components is required. The importance of standardized terminology and clear definitions of these components has been recognized in the literature. From a managerial perspective, identifying the relationships a firm is situated in is valuable and useful information that can be practically applied. We propose a business ecosystem model anchored around interdependent technospecies similar to the biological model that many of the existing concepts are drawn from. Technospecies are unique entities based on their organizational routines, capabilities, and use of technology. This article will present an alternative formulation of the business ecosystem model with the aim of synthesizing the diverse terminology presently in use into a concise, common language.

Introduction

Natural ecosystems provide a powerful metaphor to aid in understanding business ecosystems given that both consist of inhabitants with different characteristics and interests, joined together by diverse mutual relationships (Corallo & Protopapa, 2007). Analogous to the supply chain concept, business ecosystems focus on the connections and interrelationships between firms (Moore, 1993; Bailetti, 2008; Carbone, 2009; Hurley, 2009; Adner, 2012; Muegge, 2013; Muegge & Haw, 2013) because organizations do not exist in isolation but depend upon the capabilities and resources of their ecosystem (Hakansson & Snehota, 1995). Unless a company is completely vertically integrated, it cannot successfully compete alone and thus requires relationships, interactions, and resources provided by the ecosystem (Rice & Hoppe, 2001).

Most previous research on business networks examines dyadic (or triadic) connections of network inhabitants and the consequences of particular network positions (Anderson et al., 1994). This focus does not identify or control for higher-order dependencies and influences that are typically present with inter-organizational systems (Moore, 1993, 2006; Peltoniemi & Vuori, 2005). Although research has made important contributions toward the understanding of business connections and structures (Hakansson & Ford, 2002; Iansiti & Levien, 2004a, 2004b; Kambil, 2008; Henneberg et al., 2010), a holistic understanding of business ecosystems is absent (Corallo & Protopapa, 2007; Li, 2009; Satsangi, 2012).

Business ecosystems have been conceptualized as platforms (Muegge, 2013), multi-sided platforms (Iyer & Davenport, 2008; Bailetti & Bot, 2013), communities (Carbone, 2009; Muegge, 2011), networks (Iansiti & Levien, 2004b; Corallo & Protopapa, 2007; Basole, 2009), value blueprints (Adner, 2012), and institutions and resource flows (Hearn & Pace, 2006; Muegge, 2011, 2013; Bailetti et al., 2013); these models are often viewed separately and studied independently even though a holistic view is required. Firms, government and regulatory agencies, non-governmental organizations, and open source platforms, among others, all in-
teract (Hurley, 2009) and create value (Basole, 2009). It is thus important to understand and chart these interrelationships as each firm engages in an ongoing exchange with its environment, including other ecosystem inhabitants (Marin et al., 2008). In order to interact and engage effectively, a firm must be able to identify the members of the ecosystem(s) with which it interacts. Where a firm is situated in the ecosystem and the connections within that ecosystem are of primary concern to each business ecosystem inhabitant (Chesbrough, 2006; Moller & Rajala, 2007; Basole, 2009) and hence are of practical relevance to the managers of those firms.

Although business ecosystem research has matured and proliferated, advancement has been limited by different terminology and nomenclature and inconsistent usage of said terminology. To move forward in both academia and industry, the field requires standardized terminology so academic literature can be synthesized, compared, and applied to real managerial situations. This standardization would allow managers to make improved decisions and apply research findings based on a common understanding of the structure and organization of the business ecosystem (Bardawil, 2011). In turn, this standardization would allow managerial situations to more tightly link and thus influence academic undertakings (Astley & Zammuto, 1992). Without common terminology, research progress is difficult or impossible (Astley & Zammuto, 1992; Shoemaker et al., 2004) and whatever results are derived are difficult to transmit to management as message content degrades as it is passed from the business to academic realms and vice versa (Ortenblad, 2005). This article proposes a new model of business ecosystems with the potential to unify the multiple current business ecosystem perspectives using standardized and consistent terminology.

The remainder of this article is organized as follows. First, current views of business ecosystems are presented. Next, we expand on the biological species metaphor to introduce the new technospecies construct that forms the foundation of our business ecosystem model presented in the third section. The description of the model is followed by conclusions, research and managerial implications, and future research directions.

Business Ecosystems

Moore (1996) defined a business ecosystem as: “...a foundation of interacting organizations and individuals – the organisms of the business world.” To date, there is no clear definition for these organisms with the literature focusing on dyadic, triadic, or limited network interactions when discussing business ecosystems. Although widespread interaction and resource sharing are recognized as existing in a business ecosystem (Bailletti, 2008), the terminology describing these interactions continues to be drawn, primarily, from the industrial and organizational behaviour literatures and resource-based views (Wernerfelt, 1984). A common theme in that literature is goal-directed behaviour, that a business ecosystem can be “organized” around a platform (keystone) and managed based on the limited interactions arising from the resulting connections (Holling, 2001; Gunderson & Holling, 2002). For example, keystones such as Microsoft, Apple, Wal-Mart, and Mozilla provide platforms to their ecosystems allowing value creation both for themselves and for other ecosystem members (Moore, 1993, 2006; Cusumano & Gower, 2002, Iansiti & Levien, 2004b, Tiwana et al., 2010).

Peltoniemi and Vuori (2005) state that a business ecosystem is a socioeconomic system where its population develops through coevolution with the environment resulting in self-organization and emergence (i.e., the ability and process to create new order), and adaptation to the environment. An ecosystem is therefore a complex adaptive system that is more than the sum of its parts and cannot be understood except by considering the entirety of the ecosystem rather than a limited number of connections. The concept of the Internet of Things represents a network of connections including people–people, people–things, and things–things via the Internet allowing virtually unlimited connections (Morgan, 2014; Westerlund et al., 2014) between all inhabitants of a business ecosystem, resulting in connections that may or may not be accessed.

Much of the business ecosystems literature is based on Moore’s (1993, 1996, 2006) ecosystem perspective and has advanced definitions and operationalizations for limited domains. There has been much in the literature concerning platform architecture (Cusumano & Gower, 2002; Milinkovich, 2008), keystones (Heikkilä & Kuivaniemi, 2012), networks (Iansiti & Levien, 2004b; Greve et al., 2014), communities (Moore, 2011; Muegge, 2013) and ecosystems (Moore, 2006; Carbone, 2009). However, these bodies of knowledge are not well integrated, tend to be studied in isolation, and often diverge in approach depending upon the level of analysis (Muegge, 2011). The focus is frequently on a single actor, feature, or platform that, while providing depth of coverage, does not adequately address holistic ecosystem complexity. For example, Bailletti (2008) applied
Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept
Michael L. Weber and Michael J. Hine

the ecosystem approach to the commercialization of technology products and services. Bailey & Hudson (2009) adapted Moore’s definition to include the use of a “community oriented out-of-the-box platform”, and describe the Lead To Win ecosystem designed to create technology jobs and attract technology investment in a similar manner as keystones described by Iansiti and Levien (2004). Bailey (2010a) recognized that any firm that is unable to envisage and understand the ecosystem in which it operates is at a significant disadvantage and uses the analogy of courtship to distinguish between a firm in an ecosystem as compared to a traditional setting (Bailey, 2010b). Muegge (2011) further advances the concept by defining business ecosystems and resolving various existing perspectives in the literature by applying an institutional theory frame of reference to describe distributed innovation. Although the aforementioned works have been insightful and important in moving forward the concept and application of business ecosystems, the scope of this literature is primarily oriented toward technology and entrepreneurs, and the platform (or keystone) in a business ecosystem. A more general perspective would benefit this area specifically and the blossoming field of business ecosystems in general. Toward this goal, we adopt a more general view of business ecosystems by further connecting the business and biological perspectives.

Other work in business ecosystems has focused on ecosystem leaders (Moore, 1993), platform leaders (Cusumano & Gawer, 2002), or keystones (Iansiti & Levien, 2004a, 2004b) coexisting with other communities and individuals (Milinkovich, 2008; Muegge, 2013). These views follow on the description of a business ecosystem oriented around a hub or keystone by Iansiti and Levien (2004a, 2004b). Using this perspective, a business ecosystem does not necessarily align with a particular industry but may span different industries (e.g., Apple encompasses computer technology, consumer electronics, and information and communication technologies). The crucial factor driving the success of each business ecosystem is the ability of the keystone to provide a platform (i.e., tools, technologies, manufacturing processes, services, etc.) that other members of that ecosystem can leverage to add value to their product or service in a co-evolutionary process. Interactions may be either competitive, competitive, or cooperative (Smith, 2013). In a business ecosystem, the capabilities of a firm co-evolve around innovations unique to that ecosystem.

Tian and colleagues (2008) define a business ecosystem as a “...configuration of people, technology, shared information, and value propositions connecting internal and external service systems”. This definition is closely related to the value chain and value network concept describing the tangible (e.g., goods, services, and revenue) and intangible (e.g., knowledge and intangible value) transactions between different organizations (Porter, 1980, 1985; Allee, 2000; Walters & Lancaster, 2000) and between organizations and customers (Prhalad & Ramaswamy, 2004). As such, there is reciprocal interdependence where “each node depends on adjoining nodes to perform its role...” (Hult et al., 2004). The implication of this statement is that each node (inhabitant) is connected to adjoining nodes in a network configuration, forming a business ecosystem. Currently, business ecosystems are considered to consist of platforms and communities having a multi-level, hierarchical system and an architecture of participation (Muegge, 2013). As ecosystems are considered to be self-organizing and scale-free, they consist of an interconnected, complex, assemblage of members having resource and information flows and some level of productivity where each ecosystem affects and is affected by the inhabitants of that ecosystem resulting in evolution or adaptation with emergence or emergent features.

However, the conceptualization of the ecosystem inhabitants varies with the area of research and individual researcher, especially concerning how the inhabitants are defined. This tendency is particularly apparent with the species concept borrowed from biology (Prendergast & Berthon, 2000), where the conceptualization within the business literature is quite different than the intention of the original and definitive intention of species. To date, most of the work on business ecosystems has resulted in definitions that vary by researcher, and thus there are differing levels of consistency with the biological definition. For example, multi-sided platforms are considered to bring together distinct but interdependent groups (Bailey, 2010b; Evans et al., 2011) although exactly where the platform exists remains undefined (Haigu & Wright, 2011).

The Technospecies Construct

Species is a biological term used in many areas of the business literature, including: platforms (Kang & Downing, 2014), keystones species (Iansiti & Levien, 2004a, 2004b), organizational species (Gundlach, 2006; Lemos, 2009; Pagano, 2013), non-profit organizational species (Potter & Crawford, 2008), organizational species barrier (Gaba & Meyer, 2008), flagship species (Kim et al., 2010), leading species (Knight & Cavugil, 2004), ecosys-
Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept
Michael L. Weber and Michael J. Hine

tem species (Guegen & Isckia, 2011), business owner species (Bruhn, 2013), business species diversity (Wright et al., 2009), and endangered (business) species ( Cooke, 2000). Although the word is used in the business literature with similar connotation to the biological term (Prendergast & Berthon, 2000) – that of a distinct population of organisms – business species and biological species are very different. In biology, species is the main natural taxonomic unit and is defined as a group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding (Lawrence, 2005), and is usually based on genetic (DNA) similarity (Mayr, 1963). For business ecosystem usage, the biological definition of species is restrictive because a species may only mate with members of its own species. Although firms and organizations do not have DNA or genes, it has been argued that organizational routines are the equivalent of genes (Nelson & Winter, 1982).

Nelson and Winter (1982) adopted Darwinian concepts (e.g., variation, replication, and selection) and proposed that evolution occurred at a higher level than individual genes and involved the replication and selection of routines. Organizational routines may be viewed from an evolutionary perspective based on these general Darwinian principles (Hodgson & Knudsen, 2004). This perspective implies that routines are collective-level (i.e., organization-level) constructs that embody prior learning and are selected for by some mechanism. In evolutionary economics, organizational routines and capabilities are of central importance (Felin & Foss, 2004) because they provide the fundamental unit of analysis (Becker, 2004) in the sense of their being the micro-unit of analysis and that they directly link with the evolutionary triad of variation (of routines across a population of firms), selection (based on routine fitness relative to the environment), and heredity (routines being the social equivalent of genes) (Nelson & Winter, 1982). However, routines have also been viewed as generative and as a source of continuous change (Feldman, 2000; Pentland et al., 2011). Feldman and Pentland (2003) suggest the generation of endogenous change as a result of carrying out the organizational routine. By definition, routines involve repetitive or recurrent patterns of action, although each repetition will have observable differences. This observation has been referred to as the “paradox of the (n)ever changing world” (Birnholtz et al., 2007). Each repetition of a routine varies due to improvisation or error; increasing numbers of repetitions create more variation and opportunity for change (Tsoukas & Chia, 2002) similar to the manner in which mutation occurs in DNA. Routines may be considered a particular firm’s way of doing things, for example the business model of a firm (West-erlund et al., 2014).

Routines and capabilities differ (Teece et al., 1997; Teece, 2011). Nelson and Winter (1982) see capabilities as at a higher level than routines, although there is some overlap (Dosi et al., 2000). A capability has a recognizable purpose expressed in terms of the outcome that capability enables due to conscious strategic deployment (Felin & Foss, 2004). Capabilities, or processes, are sets of actions that repeat over time and are used to accomplish some business purpose (e.g., product development, acquisition, marketing) (Pentland & Rueter, 1994; Teece et al., 1997; Miner et al., 2001; Ray et al., 2004; Teece, 2011). Organizational routines are a key independent variable in organizational performance research and are the foundation for organizational capabilities (Becker, 2004) bridging the economics and evolutionary literature for organizations (Felin & Foss, 2004; 2009). Organizational routines and capabilities therefore relate to strategic management performance and firm heterogeneity (Nelson & Winter, 1982; Barney, 1991), specifically the core competencies of the organization (Prahalad & Hamel, 1990; Helfat et al., 2007). Organizational routines can be considered as the equivalent of genes with the totality of capabilities representing the genome (Bruderer & Singh, 1996); ultimately, both characterize the phenotype (Figure 1).

![Figure 1. Comparison of biological and organizational entities](image-url)
Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept
Michael L. Weber and Michael J. Hine

Different organizations may have similar routines but unique interactions of routines, capabilities, and technology. Routines may be similar in outcome but expressed in a completely different way due to the facilitating technology. For example, consider the difference between a manual billing system using paper invoices mailed to the customer and the electronic billing system used by PayPal. Each routine enables a billing capability that has the same goal and outcome but is accomplished differently.

The nature of organizational evolution differs from that of biological organisms due to learning for routines (Nelson & Winter, 1982; Zollo & Winter, 2002). The attempt to adapt evolutionary theory as a metaphor for explaining the business perspective is limited by the lack of unit analysis for the evolutionary process, similar to the gene in biological evolution (Corallo & Protopapa, 2007). For biological organisms, evolution is fundamentally genealogical and based ultimately on the propagation of genes and, for a few species, social learning along lines of descent (Heyes, 1994; Whiten et al., 1999; Laland, 2004).

As with biological organisms, the appearance of novel organizational forms requires an innovation; for business organizations, this innovation is often technological, and disruptive, in nature (Christensen, 1997; Markides, 2005), affecting the routines and capabilities of the firm. However, organizations do not reproduce in the same manner as biological organisms; organizational evolution is thought to begin with the appearance of a new form and end with the disappearance, or transformation to another form, of that variant (Corallo & Protopapa, 2007). This view has created a problem in the application of evolutionary theory to business processes, and some confusion as to the usage of the word “species”. Given that there are significant differences between biological species and business species, a distinction would be helpful in order to distinguish between the two forms and to properly define species in the business context.

To distinguish the meaning of species between the biology and business domains, we suggest the addition of the prefix “techno” to differentiate a business species from a biological species. The prefix “techno” is from the Greek technē, meaning art, science, or skill and is related to the Greek technikos, meaning art, artifice and weave, build, or join. The most common form of this word is “technology”, meaning: “The purposeful application of information in the design, production, and utilization of goods and services, and in the organization of human activities” (Business Dictionary, 2015).

Given that “techno” relates to the use of technology by humans or social organizations, this prefix can be applied to the root word “species”, yielding technospecies, referring to an organizational, human construct rather than the biological species describing an extinct or extant biological organism. Only one use of the word technospecies occurs in the literature. Kurylowicz and Gyllenberg (1989) use the term in reference to a genetically engineered, man-made species of Streptomyces. Thus, there is unlikely to be any definitional confusion in the use of the word technospecies, unlike the current situation for species, which requires an adjective to indicate a business species.

Replacing the word species with technospecies for business usage would benefit two areas in business research. First, it will distinguish a business species from a biological species and hence reduce the current definitional confusion in the literature concerning the use of the word species. Second, given that the species definition in biology is restrictive in terms of reproductive and evolutionary processes, – a species may only mate with members of its own species – using technospecies will remove this constraint as it does not hold for business species able to recombine into diverse hybrid forms (Nelson, 2007; Reydon & Scholz, 2009). In a manner similar to biological species, technospecies could exchange routines resulting in genetically different offspring. This view would permit a unique evolutionary assessment of organizations following on the combination of organizational routines and capabilities (Nelson & Winter, 1982; Becker, 2004) and technology that would more resemble the gene-based Darwinian evolutionary model acting on populations of organisms.

Each technospecies is uniquely defined by its routines, which enable capabilities. A technospecies evolves in response to interactions with other technospecies, each of which is also affected by the set of technospecies they interact with. This process is known as diffuse co-evolution (Thompson, 1999) and is also expected to be true for social ecosystems such as a business ecosystem. Analogous to the natural unit of classification in biology (species), technospecies could form the unit of classification for business ecosystems. This would al-
low technospecies to be typed according to routines and capabilities in a similar manner to genome sequencing for biological organisms. In summary, we define technospecies as:

An organizational form consisting of a distinct combination of routines expressed as capabilities that combined with technology encompass the core competencies of that technospecies.

Technospecies would have the capability of exchanging (mating) the organizational equivalent of DNA (routines) with other technospecies. As with biological organisms, this exchange would result in a novel genome and a new (evolved) technospecies.

Technospecies in a Business Ecosystem

The prevailing view of business ecosystems is that they are dominated by one or more keystones (Iansiti & Levien, 2004a, 2004b; Bailetti, 2010c; Weiss, 2010) utilizing a unique technology or platform to create value in a connected network with distinct boundaries and based on a single product, service, or technology. However, ecosystem boundaries often transcend a single industry (Makin et al, Dedehayir, 2012). Examples of boundary spanning ecosystems are: the mobile phone ecosystem (Basole, 2009), the Internet ecosystem (Zacharakis et al, 2003, Nehf, 2007, Javalgi et al. 2005), the microprocessor ecosystem (Garnsey et al., 2008), the biopharmaceutical ecosystem (Garnsey & Leong, 2008), Amazon’s web service ecosystem (Isckia, 2009), Google’s ecosystem (Iyer & Davenport, 2008), Cisco’s business ecosystem (Li, 2009), and the rental car ecosystem (Pierce, 2009). Taking the mobile phone ecosystem as an example, current superphone products by Samsung, Sony, Apple, etc. now span multiple industries including cable, Internet, gaming, media, entertainment, photography, and fitness with integrated and complementary products and services. Value is created across boundaries that are increasingly indistinct but tied to a central platform in a business ecosystem.

With the escalating use of information technology (IT) forming a digital business ecosystem emphasizing technological connectedness (e.g., Alibaba.com) what constitutes a business ecosystem should be reconsidered (Tan et al., 2009; Bharadwaj et al., 2013). The current view is of a group of cooperating or competing firms; our conception is that a business ecosystem consists of an interconnected assemblage of technospecies and additional members (Helkkilä & Kuivaniemi, 2012; Makinen & Dedehayir, 2012). This view requires that the boundaries of a business ecosystem be reassessed because they are less distinct than is suggested by the current literature.

The boundaries of the firm cross a variety of industry boundaries (Moore, 1993, 2006) and extend into multiple ecosystems (Iansiti & Levien, 2004b). However, the common conception is that a firm exists in a single business ecosystem, a model that is poorly understood and conceptualized. What constitutes the boundaries of a business ecosystem should be extended in order to account for all technospecies and other inhabitants of that ecosystem. Synthesizing the features of such a system from Muegge (2013), and using the technospecies and business perspective, results in the proposed definition:

A business ecosystem is an adaptive system positioned around a platform encompassing the totality of co-evolved interactions between technospecies and other inhabitants, required to design, improve, produce, deliver, or market a product or service.

Although in most instances the processes required to produce, market, and deliver a product or service are similar, the interactions will be specific to each business ecosystem for that product or service. For example, the process differences between the manufacturing of a landline telephone and a cellular telephone are immediately evident. Thus, the ecosystem for these two firms would also be noticeably different. More similar products would be expected to have more similar ecosystems, although different firms manufacturing the same product would also be expected to have different relationships, resulting in different ecosystem boundaries even though they exist in a business ecosystem centred around the same platform or keystone.

We propose that a business ecosystem is predominantly comprised of a population of technospecies (with each having a unique combination of routines, capabilities, and access to resources). A technospecies may control (i.e., as a keystone) or utilize (i.e., as a complementor) a technology with value creation arising from a combination of the technology and the other resources available in the business ecosystem environment. The focal firm (keystone technospecies) controls the platform technology that is shared within that ecosystem supporting the value chain. Each uses this technology
Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept
Michael L. Weber and Michael J. Hine

in a complementary manner to create value across the ecosystem (Jansiti & Levien, 2004b; Adner, 2006; Muegge, 2013). An example instantiation of a business ecosystem model in the context of the Adobe Flash platform is presented in Figure 2. Although there may be more than one keystone in a business ecosystem (Weiss, 2010), only one is presented here for simplicity. In our example, we have listed some of the complementary technospecies for the Adobe Flash ecosystem but the list is not comprehensive.

Adobe is a keystone technospecies based on control of the Flash technology platform. Flash was originally developed by Macromedia using the routines and capabilities of that firm. Other technospecies in this ecosystem (e.g., Google, Mozilla) will assemble a unique set of routines, capabilities, and resources enabling those firms to leverage the platform technology in the ecosystem. External and internal resources, including other forms of technology, may be available to members of the ecosystem (Conner & Prahalad, 1996). Google and Mozilla incorporate Adobe Flash Player for web browsers to enable clients and customers to view content based on their business models and capabilities, search engine, and web browser, respectively. Ecosystem resources (e.g., wireless technology infrastructure, web services, cloud technology) enable interaction throughout this ecosystem. The unique combination of individual routines, capabilities, and the platform technology define each technospecies in the same way that DNA is unique to organismal species. This unique combination for each technospecies could be considered to be the internal platform of that technospecies that is comparable, and complementary, to the external (keystone) platform central to that ecosystem (Gawer & Cusumano, 2014).

A technospecies that is a keystone in one ecosystem may play a different role in a different ecosystem by simultaneously having multiple relationships within and between ecosystems (Bengtsson & Kock, 1999). For example, in Figure 3, Adobe is a complementary technospecies in the Microsoft Office technology business ecosystem via its Portable Document Format (PDF) technology that allows documents to be consistently rendered regardless of application software, operating system, or hardware. Microsoft Office is the most widely used suite of office/productivity software worldwide. In this ecosystem, Adobe is a complementor tied to the Microsoft platform. Therefore, Adobe exists sim-

Figure 2. Adobe Flash ecosystem with Abode Flash as the platform technology and examples of complementary technospecies leveraging this technology

www.timreview.ca
Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept
Michael L. Weber and Michael J. Hine

Figure 3. Microsoft Office ecosystem with Adobe acting as a complementor

ultaneously in multiple ecosystems, via the Flash platform in its own ecosystem where it acts as a hub and in the Microsoft ecosystem where it acts as a complementor (Weiss, 2010).

Business ecosystems also include, but are not limited to: suppliers, system integrators, distributors, advertisers, financiers (venture capitalists, corporate investors, investment bankers, angel investors), universities, research institutions, regulatory authorities, standard-setting bodies, the judiciary (Makinen & Dedehayir, 2012), individuals (e.g., customers, open source contributors) (Baldwin & von Hippel, 2011), crowdsourcing and crowdfunding participants (Vukovic, 2009; Kahtan, 2013; Kannangara & Ugucioni, 2013), and not-for-profit organizations such as Mozilla, the Apache Software Foundation, and the Eclipse Foundation (Hurley, 2009). We have not included these additional ecosystem members in the figures because the added detail would render the figures unreadable. These additional members may or may not be considered to be technospecies but are additional resource sources existing in the ecosystem. Thus, relationships between ecosystem members are more complex than simply between the technospecies providing the platform and complementors, and this complexity is not generally recognized (one exception being Heikklä & Kuivaniemi, 2012). Recognizing the full extent of these connections, and what constitutes a technospecies either controlling or exploiting the focal technology in that ecosystem, is important both in defining the boundaries of a business ecosystem and determining the different ecosystems a technospecies resides in. A firm may exist simultaneously in multiple business ecosystems; the ecosystem boundaries of a firm such as Adobe are not limited to a single ecosystem. Combining this knowledge with the defining features of each technospecies (i.e., routines, capabilities, and resources utilized to create value in that ecosystem) should provide both managers and academics with a much clearer picture of the complex interrelationships in a business ecosystem. For example, software vendors require insight into software ecosystems and relationships (Jansen et al., 2009), because a software enterprise may abolish some, or all, of the barriers surrounding its intellectual property by becoming a keystone or complementor in multiple ecosystems (e.g., the Eclipse Foundation or the Apache Foundation).
Conclusions and Future Research

Following from biology, we propose a business ecosystem model structured as a population of interacting technospecies. This perspective is in contrast to the current assortment of views including: platforms (Muegge, 2013), multi-sided platforms (Iyer & Davenport, 2008; Bailetti & Bot, 2013), communities (Muegge, 2011; Carbone, 2009), networks (Iansiti & Levien, 2004b; Corallo & Protopapa, 2007; Basole, 2009), value blueprints (Adner, 2012), and institutions and resource flows (Hearn & Pace, 2006; Muegge, 2011, 2013; Bailetti et al., 2013). Adopting this common terminology would allow communication about business ecosystems with reduced ambiguity, especially concerning the biological species concept used in business, and it would enable higher-level learning. These are necessary antecedents to the comprehensive study of business ecosystems involving mapping relationships between technospecies populating multiple, diverse business ecosystems and will allow progress toward describing a holistic view of the business environment.

A broader view of the ecosystem is required, encompassing the platform provider, complementary technospecies, and a variety of other participants. This view requires defining the technological capabilities and the ecosystem relationships for each technospecies. Recognizing technological capabilities would allow a technospecies to extend its connections beyond a single business ecosystem. Close monitoring of the capabilities of other technospecies in an ecosystem would also allow detection of threats and opportunities related to platforms that could displace the incumbent (Christensen, 1997) or could allow the technology to be assimilated and the possible competitor become a co-operator or cooperator (Zineldin, 2004; Gueguen & Isckia, 2011; Heikkilä & Kuivaniemi, 2012). This approach would extend the value creation confines of the business ecosystem beyond the current view of that created by the technospecies providing the ecosystem platform or a complementor (Bailetti, 2010c).

The business ecosystem conceptualization presented in this article provides several managerial insights. Our model facilitates managerial identification of business ecosystem inhabitants, their interrelationships, and associated boundaries using consistent and semantic terminology. A manager, and thus organization, that is able to more clearly envision and articulate their own business ecosystem, and others that they may interact with, could potentially have a competitive advantage within their industry. A clear understanding of one’s business ecosystem may allow an organization to move quicker and more fluidly than their competitors and also leverage resources from other technospecies and inhabitants that may be currently unrecognized. Additionally, understanding inter-ecosystem technology flows has implications for technological standards (Rohlls, 2001; Laakso & Nyman, 2014), industry consolidation (Puranam et al., 2006; Carbone, 2011) and the emergence of new technologies (Weiss et al., 2013). Given that the number of different entities in a business ecosystem is quite diverse, ranging from competitors to open source contributors, being able to identify and utilize these valuable resources would benefit both the focal firm and the health of the entire ecosystem. Business ecosystems are likely to have quite different populations of technospecies and other participants that vary with different value chains; therefore research in this area based on a common language and definitions would provide deep insight into better management of these ecosystems.

Future research should focus on determining technospecies relationships in a business ecosystem beyond the limited primary relationships currently described in the literature. Similar to the concept of a keystone technospecies providing the platform in a single ecosystem, it may be that the interrelationships of a single technospecies provide unique technology or capabilities that would, if unavailable, result in a trophic extinction cascade in that ecosystem (Eklof & Ebenman, 2006; Nichols et al., 2009). Species diversity is directly implicated in biological ecosystem health (Lundberg et al., 2000; Nichols et al., 2009; Naem et al., 2012); therefore, monitoring business ecosystem relationships and technospecies population numbers (i.e., if a dominator is present diminishing the critical mass of the ecosystem such that it becomes unsustainable) would seem equally important in terms of operationalizing the business ecosystem health concept of Iansiti and Levien (2004b).

Researchers in technology management and in business could contribute to this area of research by studying the multiple ecosystems technospecies are situated in, either as a keystone or a complementor. The interactions between business ecosystems in this regard is currently an unexplored area. Another research opportunity would be to consider business ecosystems from the perspective of the individual technospecies; this approach would also frame the research questions and results around managerially relevant problems that would be applicable for technology entrepreneurs. Additionally, the unexplored technospecies construct pro-
Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept

Michael L. Weber and Michael J. Hine

posed in this article requires further refinement and development. Specific areas include a better understanding as to the characteristics of this new form and the inter-relationships of technospecies themselves and with other inhabitants in a business ecosystem. The latter concept is a particularly neglected area in research (e.g., the interaction of technospecies with non-techno-species in a business ecosystem). How ecosystem relationships are modified through the lifecycle of the platform technology is a related area of research. As relationships and interactions become more important in value creation (Ritter et al., 2004), a holistic view of business ecosystems and relationships becomes more important.

Acknowledgement

The authors would like to thank the anonymous reviewer for their detailed comments and suggestions that greatly helped to improve this article.

References

Adner, R. 2006. Match Your Innovation Strategy to Your Innovation Ecosystem. Harvard Business Review, 84(4): 98–107.

Adner, R. 2012. The Wide Lens: A New Strategy for Innovation. New York, NY: Penguin.

Alldrich, H. 1979. Organizations and Environments. Englewood Cliffs, NJ: Prentice-Hall.

Allee, V. 2000. Reconfiguring the Value Network. Journal of Business Strategy, 21(4): 36–39. http://dx.doi.org/10.1108/eb040103

Anderson, J., Häkansson, H., & Johanson, J. 1994. Dyadic Business Relationships within a Business Network Context. Journal of Marketing, 58(4): 1-15. http://dx.doi.org/10.2307/1251912

Astley, W., & Zammuto, R. 1992. Organization Science, Managers, and Language Games. Organization Science, 3(4): 443-460. http://dx.doi.org/10.1287/orsc.3.4.443

Baillet, T., & Hudson, D. 2009. Value Co-creation: Lessons from Lead to Win Ecosystem. Open Source Business Resource, December 2009: 10–16. http://timreview.ca/article/308

Baillet, T. 2008. TIM Lecture Series: Ecosystem Approach to the Commercialization of Technology Products and Services. Open Source Business Resource, April 2008: 17–19. http://timreview.ca/article/138

Baillet, T. 2010a. Technical Entrepreneurs Benefit from Business Ecosystems. Open Source Business Resource, February 2010: 16–23. http://timreview.ca/article/325

Baillet, T. 2010b. Blueprint and Approach to Grow Revenue in Small Technology Companies. Open Source Business Resource, June 2010: 5–12. http://timreview.ca/article/355

Baillet, T. 2010c. Keystone Off-The-Shelf. Technology Innovation Management Review, September 2010: 9–15. http://timreview.ca/article/377

Baillet, T., & Bot, S. D. 2013. An Ecosystem-Based Job-Creation Engine Fuelled by Technology Entrepreneurs. Technology Innovation Management Review, 3(2): 31–40. http://timreview.ca/article/658

Baillet, T., Craigien, D., Hudson, D., Levesque, R., McKeen, S., & Walsh, D. 2013. Developing an Innovation Engine to Make Canada a Global Leader in Cybersecurity. Technology Innovation Management Review, 3(8): 5–14. http://timreview.ca/article/711

Baldwin, C., & von Hippel, E. 2011. Modeling a Paradigm Shift: From Producer Innovation to User and Open Collaborative Innovation. Organization Science, 22(6): 1399–1417. http://dx.doi.org/10.1287/orsc.1100.0618

Bardawil, M. 2011. Key Player Identification in the Mashup Ecosystem. Open Source Business Resource, February 2011: 9–13. http://timreview.ca/article/417

Barney, J. 1991. Firm Resources and Sustained Competitive Advantage. Journal of Management, 17(1): 99–120. http://dx.doi.org/10.1177/014920639101700108

About the Authors

Michael L. Weber is a PhD candidate in the Sprott School of Business at Carleton University in Ottawa, Canada, and he is the undergraduate lab coordinator in Carleton University’s Department of Biology. He holds a BScH degree in Biology and an MMS degree in Information Technology, also from Carleton University. His primary research interests are in food supply chain security, business ecosystems, and electronic communication and negotiation. He has published in journals including Group Decision and Negotiation and Electronic Markets.

Michael J. Hine is an Associate Professor of Information Systems in the Sprott School of Business at Carleton University in Ottawa, Canada. His primary research interests are in online services, online reviews, health informatics and how individual human differences play out in computer-mediated work environments. In addition to BCom and MSc degrees, he holds a PhD in Computer Information Systems from Arizona State University. He has published in journals including but not limited to, the Journal of Management Information Systems, Communications of the ACM, Group Decision and Negotiation, and Electronic Markets.
Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept
Michael L. Weber and Michael J. Hine

Basole, R. 2009. Visualizing of Interfirm Relations in a Converging Mobile Ecosystem. Journal of Information Technology, 24(2): 144–159. http://dx.doi.org/10.1057/jit.2008.34

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. 2013. Digital Business Strategy: Toward a Next Generation of Insights. MIS Quarterly, 37(2): 471–482.

Becker, M. 2004. Organizational Routines: A Review of the Literature. Industrial and Corporate Change, 13(4): 643–677. http://dx.doi.org/10.1093/icc/dth026

Bengtsson, M., & Kock, S. 1999. Cooperation and Competition in Relationships Between Competitors in Business Networks. Journal of Business and Industrial Marketing, 14(3): 178–194. http://dx.doi.org/10.1108/0885629910272184

Birnholtz, J. P., Cohen, M. D., & Hoch, S. V. 2007. Organizational Character: On the Regeneration of Camp Poplar Grove. Organization Science, 18(2): 315–332. http://dx.doi.org/10.1287/orsc.1070.0248

Boudreau, K. J., & Lakhani, K. R. 2009. How to Manage Outside Innovation. MIT Sloan Management Review, 50(4): 68–76.

Business Dictionary. 2015. Technology. BusinessDictionary.com. Accessed May 1, 2015: http://www.businessdictionary.com/definition/technology.html

Bruderer, E., & Singh, J. 1996. Organizational Evolution, Learning and Selection: A Genetic-Algorithm-Based Model. Academy of Management Journal, 39(5): 1322–1349. http://dx.doi.org/10.2307/257001

Bruhn, M. 2013. A Tale of Two Species: Revisiting the Effect of Registration Reform on Informal Business Owners in Mexico. Journal of Developmental Economics, 103: 275–283. http://dx.doi.org/10.1016/j.jdeveco.2013.03.013

Carbone, P. 2009. The Emerging Promise of Business Ecosystems. Open Source Business Resource, February 2009: 11–16. http://timreview.ca/article/227

Carbone, P. 2011. Acquisition Integration Models: How Large Companies Successfully Integrate Startups. Technology Innovation Management Review, 1(1): 26–31. http://timreview.ca/article/490

Chesbrough, H. 2006. Open Business Models: How to Thrive in the New Business Landscape. Boston, MA: Harvard Business School Press.

Christensen, C. 1997. The Innovator’s Dilemma. Cambridge, MA: Harvard Business School Press.

Cooke, J. 2000. Endangered Species. Logistics Management & Distribution Report, 1(May 2000): 82.

Conner, K. R., & Prahalad, C. K. 1996. A Resource-Based Theory of the Firm: Knowledge versus Opportunism. Organization Science, 7(5): 477–501. http://dx.doi.org/10.1287/orsc.7.5.477

Corallo, A., & Protopapa, S. 2007. Business Networks and Ecosystems: Rethinking the Biological Metaphor. In F. Nachira, A. Nicolai, P. Dini, L. Rivera Léon, & M. Le Louarn (Eds.), Digital Business Ecosystems: 60–64. Luxembourg: European Commission, Office for Official Publications of the European Communities.

Cusumano, M. A., & Gaver, A. 2002. The Elements of Platform Leadership. MIT Sloan Management Review, Spring: 51–58.

Dobzhansky, T. 1965. Mendelism, Darwinism, and Evolutionism. Proceedings of the American Philosophical Society, 109(4): 205–215. http://www.jstor.org/stable/985879

Dosi, G., Nelson, R., & Winter, S. G. 2000. The Nature and Dynamics of Organizational Capabilities. New York, NY: Oxford University Press.

Ekholm, A., & Ebenman, B. 2006. Species Loss and Secondary Extinctions in Simple and Complex Model Systems. Journal of Animal Ecology, 75(1): 239–246. http://dx.doi.org/10.1111/j.1365-2656.2006.01041.x

Evans, D. S., Schmalensee, R., Noel, M. D., Chang, H. H., & Garcia-Swartz, D. D. 2011. Platform Economics: Essays on Multi-Sided Businesses. Competition Policy International.

Feldman, M. S. 2000. Organizational Routines as a Source of Continuous Change. Organization Science, 11(6): 611–629. http://dx.doi.org/10.1287/orsc.11.6.611.12529

Feldman, M. S., & Pentland, B. T. 2003. Reconceptualizing Organizational Routines as a Source of Flexibility and Change. Administrative Science Quarterly, 48(1): 94–118. http://dx.doi.org/10.2307/3556620

Felin, T., & Foss, N. J. 2004. Organizational Routines: A Sceptical Look. In M. Becker (Ed.), Handbook of Organizational Routines. Northampton, MA: Edward Elgar.

Felin, T., & Foss, N. J. 2009. Organizational Routines and Capabilities: Historical Drift and a Course-Correction toward Microfoundations. Scandinavian Journal of Management, 25(2): 157–167. http://dx.doi.org/10.1016/j.scaman.2009.02.003

Gaba, V., & Meyer, A. D. 2008. Crossing the Organizational Species Barrier: How Venture Capital Practices Infiltrated the Information Technology Sector. Academy of Management Journal, 51(5): 976–998. http://dx.doi.org/10.5465/AMJ.2008.34789671

Garvey, E., & Leong, Y. Y. 2008. Combining Resource-Based and Evolutionary Theories to Explain the Genesis of Bio-networks. Industry and Innovation, 15(6): 669–686. http://dx.doi.org/10.1080/13662710802565271

Garvey, E., Lorenzoni, G., & Ferranti, S. 2008. Speciation through Entrepreneurial Spin-Off: The Acorn-ARM Story. Research Policy, 37(2): 210–224. http://dx.doi.org/10.1016/j.resopol.2007.11.006

Gawer, A., & Cusumano, M. A. 2014. Industry Platforms and Ecosystem Innovation. Journal of Product Innovation Management, 31(3): 417–433. http://dx.doi.org/10.1111/jpim.12105

Greve, H., Rowley, T., & Shipilov, A. 2014. Network Advantage: How to Unlock Value from Your Alliances and Partnerships. San Francisco, CA: Jossey-Bass.

Gundlach, G. T. 2006. Complexity Science and Antitrust? The Antitrust Bulletin, 51(1): 17–30.

Guéguen, G. & T. Isckia. 2011. The Borders of Mobile Handset Ecosystems: Is Coopetition Inevitable? Telematics and Informatics, 28(1): 5–11. http://dx.doi.org/10.1016/j.tele.2010.05.007

Gunderson, L., & Holling, C. 2002. Panarchy: Understanding Transformations in Human and Natural Systems. Washington, DC: Island Press.
Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept
Michael L. Weber and Michael J. Hine

Hagiu, A., & Wright, J. 2011. Multi-Sided Platforms. Harvard Business School Working Paper 12-024. Cambridge, MA: Harvard Business School.

Häkansson, H., & Snehota, I. 1995. Developing Relationships in Business Networks. New York, NY: Routledge.

Häkansson, H., & Ford, D. 2002. How Should Companies Interact in Business Networks? Journal of Business Research, 55(2): 133–139. http://dx.doi.org/10.1016/S0148-2963(00)0148-X

Hearn, G. & Pace, C. 2006. Value-Creating Ecologies: Understanding Next Generation Business Ecosystems. Foresight, 8(1): 55–65. http://dx.doi.org/10.1108/14636680610647147

Heikkilä, M., & Kuivaniemi, L. 2012. Ecosystem Under Construction: An Action Research Study on Entrepreneurship in a Business Ecosystem. Technology Innovation Management Review, 2(6): 18–24. http://timreview.ca/article/564

Helfat, C., Finkelstein, S., Mitchell, W., Peteraf, M., Singh, H., Teece, D., & Winter, S. G. 2009. Dynamic Capabilities: Understanding Strategic Change in Organizations. Malden, MA: Blackwell Publishing.

Henneberg, S. C., Naude, P. & Mouzas, S. 2010. Sense-Making and Management in Business Networks – Some Observations, Considerations, and a Research Agenda. Industrial Marketing Management, 39(3): 355–360. http://dx.doi.org/10.1016/j.indmarman.2009.03.011

Heyes, C. M. 1994. Social Learning in Animals: Categories and Mechanisms. Biological Reviews, 69(2): 207–231. http://dx.doi.org/10.1111/j.1469-185X.1994.tb01506.x

Hodgson, G. M., & Knudsen, T. 2004. The Firm as an Interactor: Firms as Vehicles for Habits and Routines. Journal of Evolutionary Economics, 14: 281–307. http://dx.doi.org/10.1007/s00191-004-0192-1

Holling, C. S. 2001. Understanding the Complexity of Economic, Ecological and Social System. Ecosystems. 4(5): 390–405. http://dx.doi.org/10.1007/s10021-001-0101-5

Hult, G. T. M., Ketchen, D. J., & Slater, S. F. 2004. Information Processing, Knowledge Development, and Strategic Supply Chain Performance. Academy of Management Journal, 47: 241–253. http://dx.doi.org/10.2307/2015975

Hurley, B. 2009. Enabling the Creative Entrepreneur: Business Ecosystems. Open Source Business Resource, August 2009: 5–10. http://timreview.ca/article/276

Iansiti, M., & Levien, R. 2004a. Strategy as Ecology. Harvard Business Review, 82(3): 68–80.

Iansiti, M., & Levien, R., 2004b. The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation and Sustainability. Harvard University Press, Harvard, MA.

Isckia, T. 2009. Amazon’s Evolving Ecosystem: A Cyber-Bookstore and Application Service Provider. Canadian Journal of Administrative Sciences, 26(4): 332–343. http://dx.doi.org/10.1002/cjas.119

Iyer, B., & Davenport, T. 2008. Reverse Engineering Google’s Innovation Machine. Harvard Business Review, 86(4): 1–11.

Jansen, S., Brinkkemper, S., & Finkelstein, A. 2009. Business Network Management as a Survival Strategy: A Tale of Two Software Ecosystems. In S. Jansen, S. Brinkkemper, A. Finkelstein, & J. Bosch (Eds.), Proceedings of the First International Workshop on Software Ecosystems (IWSECO-2009): 34–48. Falls Church, VA: CEUR.

Javalgi, R. G., Todd, P. R., & Scherer, R. F. 2005. The Dynamics of Global E-Commerce: An Organizational Ecology Perspective. International Marketing Review, 22(4): 420–435. http://dx.doi.org/10.1108/02651330510608442

Kahtan, M. 2013. Crowdfunding: The Disruptor’s Disruptor. Ivy Business Journal, July/August 2013.

Kambil, A. 2008. Purposeful Abstractions: Thoughts on Creating Business Network Models. Journal of Business Strategy, 29(1): 52–54. http://dx.doi.org/10.1002/jb.8275

Kang, J.-S., & Downing, S. 2014. Keystone Effects on Entry into Two-Sided Markets: An Analysis of the Market Entry of WiMAX. Technological Forecasting and Social Change, 94(May): 170–186. http://dx.doi.org/10.1016/j.techfore.2014.09.008

Kannangara, S. N., & Uguccioni, P. 2013. Risk Management in Crowdfunding-Based Business Ecosystems. Technology Innovation Management Review, 3(12): 32–38. http://timreview.ca/article/751

Kim, H., Lee, J.-N., & Han, J. 2010. The Role of IT in Business Ecosystems. Proceedings of the ACM, 53(5): 151–156. http://dx.doi.org/10.1145/1735223.1735260

Knight, G. A., & Cavusgil, S. T. 2004. Innovation, Organizational Capabilities and the Born-Again Global Firm. Journal of International Business Studies, 35(2): 124–141. http://www.jstor.org/stable/3673247

Kurylowicz, W., & Gyllenberg, H. G. 1989. Problems in Taxonomy of Streptomyces. Archivum Immunologicum et Therapiae Experimentalis, 37(1-2): 235–249.

Laakso, M., & Nyman, L. 2014. Innovation Opportunities: An Overview of Standards and Platforms in the Video Game Industry. Technology Innovation Management Review, 4(7): 15–21. http://timreview.ca/article/808

Laland, K. N. 2004. Social Learning Strategies. Learning and Behavior, 32(1): 4–14. http://dx.doi.org/10.3758/BF03196002

Lawrence, E. (Ed.) 2005. Henderson’s Dictionary of Biology. 13th edition. Toronto, ON: Pearson-Prentice Hall.

Lemos, J. 2009. In Defense of Organizational Evolution: A Reply to Reydon and Scholz. Philosophy of the Social Sciences, 39(3): 463–474. http://dx.doi.org/10.1177/0048393109334582

Li, Y-R. 2009. The Technological Roadmap of Cisco’s Business Ecosystem. Technovation, 29: 379–386. http://dx.doi.org/10.1016/j.technovation.2009.01.007

Lundberg, P., Ranta, E., & Kaitala, V. 2000. Species Loss Leads to Community Closure. Ecology Letters, 3(6): 465–468. http://dx.doi.org/10.1046/j.1461-0248.2000.00170.x
Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept
Michael L. Weber and Michael J. Hine

Makinen, S. J., & Dedehayir, O. 2012. Business Ecosystem Evolution and Strategic Considerations: A Literature Review. In B. Katzy, T. Holzmann, K. Sailer, & K. Thoben Eds.), Proceeding of the 2012 18th International Conference on Engineering, Technology and Innovation. http://dx.doi.org/10.1109/ICE.2012.6297653

Marin, C. A., Stalker, I., & Mehandji, N. 2008. Engineering Business Ecosystems Using Environment-Mediated Interactions. In D. Weyns, S. A. Bruecner, & Y. Demazeur (Eds.), Engineering Environment-Mediated Multi-Agent Systems: 240–258. Berlin: Springer-Verlag. http://dx.doi.org/10.1007/978-3-540-85029-8

Markides, C. 2005. Disruptive Innovation: In Need of Better Theory. Journal of Product Innovation Management, 23(1): 19–25. http://dx.doi.org/10.1111/j.1540-5885.2005.00177.x

Mayr, E. 1963. Populations, Species, and Evolution. Cambridge, MA: Belknap Press, Harvard University Press.

Milinkovich, M. 2008. TIM Lecture Series: A Practitioners Guide to Ecosystem Development. Open Source Business Resource, October 2008: 40–42. http://timreview.ca/article/200

Miner, A. S., Bassoff, P., & Moorman, C. 2001. Organizational Improvisation and Learning: A Field Study. Administrative Science Quarterly, 46: 304–337. http://dx.doi.org/10.2307/2667089

Moller, K., & Rajala, A. 2007. Rise of Strategic Nets: New Models of Value Creation. Industrial Marketing Management, 36(7): 895–908. http://dx.doi.org/10.1016/j.indmarman.2007.05.016

Moore, J. F. 1993. Predators and Prey: A New Ecology of Competition. Harvard Business Review, 71(3): 75–86.

Moore, J. F. 1996. The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems. New York, NY: Harper Business.

Moore, J. F. 2006. Business Ecosystems and the View from the Firm. The Antitrust Bulletin, 51(1): 31–75.

Moore, J. F. 2013. Shared Purpose: A Thousand Business Ecosystems, a Connected Community and the Future. Concord, MA: First Ecosystem.

Morgan, J. 2014. A Simple Explanation of The Internet of Things. Forbes, 13 May 2014. Accessed April 1, 2015: http://www.forbes.com/sites/jacobmorgan/2014/05/13/simple-explanation-internet-things-that-anyone-can-understand/

Muegge, S. 2011. Business Ecosystems as Institutions of Participation. Technology Innovation Management Review, 1(1): 4–13. http://timreview.ca/article/495

Muegge, S. 2013. Platforms, Communities, and Business Ecosystems: Lessons Learned about Technology Entrepreneurship in an Interconnected World. Technology Innovation Management Review, 3(2): 5–15. http://timreview.ca/article/655

Muegge, S., & Haw, C. (Eds.). 2013. Business Models for Entrepreneurs and Startups: Best of TIM Review. Ottawa, Canada: Talent First Network.

Naeem, S., Duffy, J. E., & Zavaleta, E. 2012. The Functions of Biological Diversity in an Age of Extinction. Science, 336(6087): 1401–1406. http://dx.doi.org/10.1126/science.1215855

Nehf, J. P., 2007. Shopping for Privacy on the Internet. The Journal of Consumer Affairs, 41 (2): 351–375. http://dx.doi.org/10.1111/j.1745-6606.2007.00085.x

Nelson, R. R. 2007. Universal Darwinism and Evolutionary Social Science. Biology and Philosophy, 22: 73–94. http://dx.doi.org/10.1007/s10539-005-9005-7

Nelson, R. R., & Winter, S. G. 1982. An Evolutionary Theory of Economic Change. Cambridge, MA: Belknap Press of Harvard University.

Nichols, E., Gardner, T. A., Peres, C. A., & Spector, S. 2009. Co-Declining Mammals and Dung Beetles: An Impending Ecological Cascade. OIKOS, 118(4): 481–487. http://dx.doi.org/10.1111/j.1600-0706.2009.17268.x

Ortenblad, A. 2005. Vague and Attractive: Five Explanations of the Use of Ambiguous Management Ideas. Philosophy of Management, 5(1): 45–54. http://dx.doi.org/10.5840/pom20055130

Pagano, U. 2013. The Origin of Organizational Species. In A. Nicita & U. Pagano (Eds.), The Evolution of Economic Diversity: 21–47. New York, NY: Routledge.

Peltoniemi, M., & Vuori, E. 2005. Business Ecosystem as the New Approach to Complex Adaptive Business Environments. In M. Seppä, M. Hannula, A-M. Järvelin, J. Kujala, M. Ruohon, & T. Tiainen, (Eds.), Conference Proceedings of Frontiers of e-Business Research 2004 (eBRF) 2004: 267–280. Tampere, Finland: Tampere University of Technology and University of Tampere.

Pentland, B. T., & Rueter, H. H. 1994. Organizational Routines as Grammars of Action. Administrative Science Quarterly, 39(3): 484–510. http://dx.doi.org/10.2307/2393300

Pentland, B. T., Haerem, T., & Hillison, D. 2011. The (N)Ever-Changing World: Stability and Change in Organizational Routines. Organization Science, 22(6): 1369–1383. http://dx.doi.org/10.1287/orsc.1110.0624

Pierce, L., 2009. Big Losses in Ecosystem Niches: How Core Firm Decisions Drive Complementary Product Shakeouts. Strategic Management Journal, 30: 323–347. http://dx.doi.org/10.1002/smj.736

Porter, M. 1980. Competitive Strategy. New York, NY: Free Press.

Porter, M. 1985. Competitive Advantage: Creating and Sustaining Superior Performance. New York, NY: Free Press.

Potter, J., & Crawford, S. 2008. Organizational Ecology and the Movement of Non-Profit Organizations. State and Local Government Review, 40(2): 92–100. http://www.jstor.org/stable/25469781

Prahalad, C. K., & Ramaswamy, V. 2004. Co-Creation Experiences: The Next Practice in Value Creation. Journal of Interactive Marketing, 18(3): 5–14. http://dx.doi.org/10.1002/dir.20015

Prendergast, G., & Berthon, P. 2000. Insights from Ecology: An Ecotone Perspective of Marketing. European Management Journal, 18(2): 223–231. http://dx.doi.org/10.1016/S0263-2373(99)00094-8

Puranam, P., Singh, H., & Zollo, M. 2006. Organizing for Innovation: Managing the Coordination-Autonomy Dilemma in Technology Acquisitions. Academy of Management Journal, 49(2): 263–280. http://dx.doi.org/10.5465/AMJ.2006.20786062
Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept
Michael L. Weber and Michael J. Hine

Ray, G., Barney, J. B., & Muhanna, W. A. 2004. Capabilities, Business Processes, and Competitive Advantage: Choosing the Dependent Variable in Empirical Tests of the Resource-Based View. Strategic Management Journal, 25(1): 23–37. http://dx.doi.org/10.1002/smj.366

Reydon, T. A. C., & Scholz, M. 2009. Why Organizational Ecology Is Not a Darwinian Research Program. Philosophy of the Social Sciences, 39(3): 408–439. http://dx.doi.org/10.1177/0048393108325331

Rice, J. B., & Hoppe, R. M. 2001. Supply Chain vs. Supply Chain: The Hype and the Reality. Supply Chain Management Review, 5(5): 46–54.

Ritter, T., Wilkinson, I. F., & Johnston, W. J. 2004. Managing in Complex Business Networks. Industrial Marketing Management, 33(3): 175–183. http://dx.doi.org/10.1016/j.indmarman.2003.10.016

Rohls, J. H. 2001. Bandwagon Effects in High-Technology Industries. MIT Press, Cambridge, MA.

Satsangi, S. 2012. Predicting Ecosystem Alliances Using Landscape Theory. Technology Innovation Management Review, 2(8): 31–38. http://timreview.ca/article/597

Shoemaker, P. J., Tankard, J. W., & Lasorsa, D. L. 2004. How to Build Social Science Theories. Thousand Oaks, CA: Sage Publications.

Smith, D. 2013. Navigating Risk When Entering and Participating in a Business Ecosystem. Technology Innovation Management Review, 3(5): 25–33. http://timreview.ca/article/685

Tan, B., Pan, S., Lu, X., & Huang, L. 2009. Leveraging Digital Business Ecosystems for Enterprise Agility: The Tri-Logic Development Strategy of Alibaba.com. ICIS 2009 Proceedings. Paper 171.

Teece, D. J., Pisano, G., & Shuen, A. 1997. Dynamic Capabilities and Strategic Management. Strategic Management Journal, 18(7): 509–534. http://dx.doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Teece, D. J. 2011. Dynamic Capabilities: A Guide for Managers. Ivey Business Journal, March/April.

Thompson, J. N. 1999. The Evolution of Species Interactions. Science, 284(5423): 2116–2118. http://dx.doi.org/10.1126/science.284.5423.2116

Tian, C. H., Ray, B. K., Lee, J., Cao, R., & Ding, W. 2008. BEAM: A Framework for Business Ecosystem Analysis and Modeling. IBM Systems Journal, 47(1): 101–114. http://dx.doi.org/10.1147/sj.47.1.0101

Tiwana, A., Konstynski, B., & Bush, A. A. 2010. Platform Evolution: Co-evolution of Platform Architecture, Governance, and Environmental Dynamics. Information Systems Research, 21(4): 675–687. http://dx.doi.org/10.1287/isre.1100.0323

Tsoukas, H., & Chia, R. 2002. On Organizational Becoming: Rethinking Organizational Change. Organization Science, 13(5): 567–582. http://dx.doi.org/10.1287/orsc.13.5.567.7810

Vukovic, M. 2009. Crowdsourcing for Enterprises. In Proceedings of the 2009 Congress on Services – I: 686–692 Washington, DC: IEEE Computer Society. http://dx.doi.org/10.1109/SERVICES-1.2009.56

Walters, D., & Lancaster, G. 2000. Implementing Value Strategy through the Value Chain. Management Decision, 38(3): 160–178. http://dx.doi.org/10.1108/0025174001035434

Weiss, M. 2009. Mapping Mashup Ecosystems. Open Source Business Resource, April 2009: 8–12. http://timreview.ca/article/242

Weiss, M. 2010. Keystone: Adjective or Noun? Open Source Business Resource, September 2010: 6–8. http://timreview.ca/article/376

Weiss, M., Sari, S., & Noori, N. 2013. Niche Formation in the Mashup Ecosystem. Technology Innovation Management Review, 3(5): 13–17. http://timreview.ca/article/683

Wernerfelt, B. 1984. A Resource-Based View of the Firm. Strategic Management Journal, 5(2): 171–180. http://dx.doi.org/10.1002/smj.4250050207

Westerlund, M., Leminen, S., & Rajahonka, M. 2014. Designing Business Models for the Internet of Things. Technology Innovation Management Review, 4(7): 5–14. http://timreview.ca/article/807

Whiten, A., Goodall, J., McGrew, W. C., Nishida, T., Reynolds, V., Sugiyama, Y., Tutin, C. E. G., Wrangham, R. W., & Boesch, C. 1999. Cultures in Chimpanzees. Nature, 399(6737): 682–685. http://dx.doi.org/10.1038/21415

Wright, R. A., Côté, R. P., Duffy, J., & Brazner, J. 2009. Diversity and Connectance in an Industrial Context: The Case of Burnside Industrial Park. Journal of Industrial Ecology, 13(4): 551–564. http://dx.doi.org/10.1111/j.1530-9290.2009.00411.x

Zacharakis, A. L., Shepherd, D. A., & Coombs, J. E. 2003. The Development of Venture-Capital-Backed Internet Companies: An Ecosystem Perspective. Journal of Business Venturing, 18(2): 217–231. http://dx.doi.org/10.1016/S0883-9026(02)00084-8

Zineldin, M. 2004. Co-opetition: The Organisation of the Future. Marketing Intelligence & Planning, 22(7): 780–789. http://dx.doi.org/10.1108/02634500410656800

Zollo, M., & Winter, S. G. 2002. Deliberate Learning and the Evolution of Dynamic Capabilities. Organization Science, 13(3): 339–351. http://dx.doi.org/10.1287/orsc.13.3.339.2780

Citation: Weber, M. L., & Hine, M. J. 2015. Who Inhabits a Business Ecosystem? The Technospecies as a Unifying Concept. Technology Innovation Management Review, 5(5): 31–44. http://timreview.ca/article/896

Keywords: technospecies, business ecosystem, business environment, complex adaptive systems