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Assessing the Health of a Business Ecosystem: The Contribution of the Anchoring Actor in the Formation Phase

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Business ecosystem concept takes ideas from ecological ecosystems into analysis of complex networks. Business ecosystems emerge either as managed initiatives or organically, impacted by internal or external stimuluses. Ecosystem formation is unpredictable and challenging to control transferring project front-end into an operational ecosystem. The theme of this research is how to form a healthy business ecosystem. If defines a framework for formation analysis and introduces the concept of the anchoring actor as a role leading the formation. Ecosystem health assessment through actors and relationships provides information to support ecosystem formation. Through a case study in Taiwanese health and wellbeing domain, this research presents how the anchoring actors can be identified and how they contribute to ecosystem formation. Building on the anchoring actors' contribution, the research defines a model for ecosystem health assessment. Practitioners can use the findings to facilitate the ecosystem formation and to monitor the ecosystem health. This research contributes to the business ecosystem and business network literatures by introducing the anchoring actor as an important role for ecosystem formation and by presenting how ecosystem health can be assessed.

Keywords: Business ecosystem, ecosystem formation, anchoring actor, ecosystem health, business network formation

Introduction

Business ecosystem is not an own organizational form as such. It takes ecological ecosystem concepts like food web, co-evolution and self-organized development to approach dynamics of business networks (Snehota & Håkansson, 1995; Möller & Rajala, 2007; Powell, 1990) and complex adaptive systems (Choi, Dooley, & Rungutusanatham, 2001; Ritter & Gemu-

nden, 2006). Complexity logic from the strategy research (Lengnick-Hall & Wolff, 1999) can be used to explain the business ecosystem core logic, behavior of relationships and applicable strategies to operate in it. The main advantages of using business ecosystem to approach contemporary business networks is that it emphasizes elements like coevolution, interdependency of actors, multidimensional transactions and self-organizing as the key characteristics (Provan & Kenis, 2008; Anggraeni, den Hartigh, & Zegveld, 2007).

Business ecosystems consist of multiple actors and their relationships (Gossain & Kandiah, 1998; Anggraeni et al., 2007). The total value of a business ecosystem resides in the capabilities of actors to co-operate, compete and complement each other to create value they could not achieve as independent actors (Iansiti & Levien, 2004; Moore, 1998). Multidimensional relationships and tangible and intangible asset transactions (Baldwin, 2007) determine the ecosystem scope and purpose (Anggraeni et al., 2007). Ecosystem success is the result of its robustness, productivity and ability to create new business opportunities (Iansiti & Levien, 2004). Ecosystem success can be evaluated through its health. Actor roles and the relationships between the actors are the key components for the health of the ecosystem measurable through resilience, sustainability, innovativeness and renewal capabilities (den Hartigh, Tol, & Visscher, 2006; Iansiti & Levien, 2004).

The management of business ecosystem is challenging due to multidimensional relationships, infrequent changes, lack of formal hierarchy and unpredictable changes (Capaldo, 2014; Jones, Hesterly, & Borgatti, 1997; Baldwin, 2007). Through understanding the behavioral patterns of actors and relationships in the context of the core logic, the actors can define governance actions supporting the ecosystem health (Baldwin, 2007; Borgatti & Foster, 2003). The governance actions conducted in the formation phase have a strong impact to the health of operational ecosystem.

Ecosystem evolution is impacted by governmental, social, technological and economical forces that create shocks and regulations to the ecosystem (Adomavicius, Bockstedt, Gupta, & Kauffman, 2006). Business ecosystem evolution can be summarized as formation, operational and renewal or death phases based on literature descriptions (Iansiti & Levien, 2004; Moore, 1998; Lu, Rong, You, & Shi, 2014). Ecosystem formation and health has not been widely addressed in academic literature (Kortelainen & Järvi, 2014). Emergence, as described in the earlier literature, focuses on the early unstructured phase, and the operational phase focusses on the developed entity. To complement the lifecycle view of business ecosystem, we introduce formation as a transition from project-type front-end towards an operational entity.

Based on the reviewed literature on business ecosystems, business networks and project front-end we identified research foundation elements: ecosystem characteristics and core logic, actors and relationships, health and performance, governance and evolution. From this baseline, we formulated the research theme and main research problem as 'How to form a healthy business ecosystem' and set the following research questions to guide an empirical case study on Taiwanese health and wellbeing domain:

RQ1 *How to analyze business ecosystem formation?*

RQ2 *How to describe the role of the anchoring actor in the formation of a healthy ecosystem?*

RQ3 *How to assess business ecosystem health?*

To answer the RQ1, we defined an analysis framework from literature that presents the ecosystem formation elements. We utilized the framework in a single case study on Taiwanese health and wellbeing domain to gather practical understanding about the formation process. We combined a business ecosystem from eight interrelated business networks that we positioned as ecosystem network modules. To respond to RQ2, we defined the contribution of the network module's lead actors, the size of the network module and the time of presence in the ecosystem into a description of the anchoring actor and how the anchoring actors drive the ecosystem formation. The anchoring actor as a novel role description in the business ecosystem context represents a conceptual contribution to the business ecosystem literature.

Anchoring actors contribute to the ecosystem health through relationships they create. They are the actors who have been present for the longest time and whose direct business network is the biggest. As a response to RQ3, we consolidated a model of ecosystem health assessment through a number of anchoring actors, a number of moderator actors and a number of strong and weak relationships. The model of ecosystem health assessment can be used by practitioners to guide the ecosystem governance.

The research process is described in Figure 1 and presents in a logical format how the research theme is derived from the theoretical foundations. The analysis framework synthesizes the literature review and serves as a baseline to address the research questions through an empirical case study conducted in the Taiwanese health and wellbeing area.

This research broadens the understanding of early phases of business ecosystems. The findings contribute to the business ecosystem literature and business network research by defining how to analyze formation and how to identify the role of anchoring actors. The model of ecosystem health assessment introduces a new concept that complements the success evaluation perspectives for complex systems.

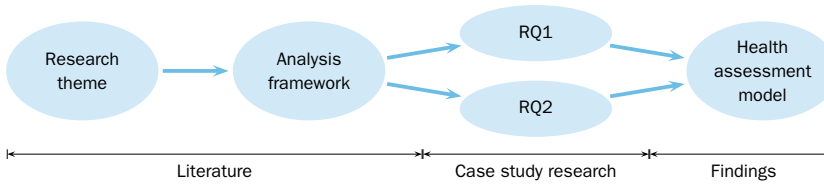

Figure 1 Research Process

Literature Review

Ecosystem Characteristics and Core Logic

The paradigm of individual isolated companies competing against each other is becoming less applicable in today's networked environment (Baldwin, 2007; Adomavicious et al., 2006). The environment is impacted by the actors decreasing the applicability of current business network doctrine promoted by, for example, Håkansson & Snehota (2006). The study of the strategic management is moving towards network perspective (Powell, 1990). For instance, a number of studies on social networks perspective on business is showing an exponential increase (Borgatti & Foster, 2003). Different backgrounds of the studies, methods and objectives make the field fragmented and create conceptualization and empirical investigation challenges (Ritter & Gemunden, 2003).

The concept of business ecosystem takes ecological ecosystem as a metaphor (Moore, 1993, 1998) to approach multi-organizational networks and relationships. The foundations for business ecosystems as a network analysis perspective originate from strategic research (Porter, 1985), business network research (Snehota & Håkansson, 1995; Möller & Rajala, 2007; Ford & Håkansson, 2013; Powell, 1990) and complex adaptive system theory (Choi et al., 2001; Ritter & Gemunden, 2003; Gulati, Nohria, & Zaheer, 2000; Gundlach & Foer, 2006). The formation of business ecosystem in a complex environment has similarities with project front-end phase making project management applicable perspective (Williams & Samset, 2010; Flyvbjerg, 2014) to analyze ecosystem formation.

Business ecosystems develop through self-organization and co-evolution enabling them to acquire adaptability (Hu, Rong, Shi, & Yu, 2014). According to Moore (1993; 1998), including non-directly involved actors, 'species' such as governmental bodies, associations or standardization bodies, expands a business network to a business ecosystem. Approaching the compilation of business networks as an ecosystem (Campagnolo & Camuffo, 2010) opens up new perspectives for organizational structures, technologies, customers and products. On the system level, actors can have multiple roles and the focus of the analysis will be on relationships and their

dynamics combined with networked value (Peltoniemi, 2005; Campagnolo & Camuffo, 2010).

Network core logic describes a set of strategic principles that define goals, operating principles, competences and success measures (Anggraeni et al., 2007; Häkansson & Snehota, 2006). Business ecosystems follow a complexity logic (Lengnick-Hall & Wolff, 1999) as the core logic meaning that the success of the ecosystem and its actors is a function of the actors' capabilities to drive dynamic non-linear systems that rely on network feedback and emergent relationships (Anggraeni et al., 2007). Effective strategies in a complexity logic need to address both competition and co-operation in multidimensional transactions (Lengnick-Hall & Wolff, 1999).

Complexity logics bring an interesting perspective to analyze relations between ecosystem actors and their networks (Lengnick-Hall & Wolff, 1999). They can provide a wider perspective to relationships and business environment research and strategy making in practice (Ritter & Gemunden, 2003; Gulati et al., 2000).

The key premises of complexity logics (Lengnick-Hall & Wolff, 1999) adapted to business ecosystems are:

1. The success of actors and the whole system requires a healthy ecosystem.
2. Unpredictable, nonlinear and natural consequences of actions are significant drivers.
3. Influence is achieved through managing initial conditions and underlying capabilities.
4. The system is in constant, undirected change where coevolution is a result of interdependency in relationships.
5. Self-organization triggers transformation.
6. Cultural integrity, like shared values and common purposes, defines the scope of the ecosystem and the scope changes while the ecosystem evolves.

Complexity logics promote connections and enduring relationships in the same way as business ecosystems (Iansiti & Levien, 2004). They strive the actors to rethink their fundamental targets of engagement into surrounding business ecosystems (Choi et al., 2001).

Roles and Relationships of Ecosystem Actors

The concept of business ecosystem identifies multiple actor roles in different life cycle phases (Iansiti & Levien, 2004). Different authors (Moore, 1993, 1998; Iansiti & Levien, 2004: Gossain & Kandiah, 1998) use differ-

ent role descriptions. The central actor role is a common nominator, also referred as keystone player, focal company or key architect. The central actor controls the access to the ecosystem critical capabilities and drives the system level value creation process and success of the ecosystem (Gossain & Kandiah, 1998; Anggraeni et al., 2007).

Other roles in business ecosystems have multiple definitions. Iansiti and Levien (2004) present landlord, dominator, niche and commodity as other roles, whereas, for example, Lu et al. (2014) consider only participant and opportunist in addition to the central actor. In their recent study, Lappi and Lee (2017) complement the discussion about ecosystem roles by introducing the role of 'moderator actor.' Moderator actors operate strong relationships that are critical interfaces between actors for the creation of ecosystem joint value. The business model concept can sharpen the role description (Kinnunen, Sahlman, Harkonen, & Haapasalo, 2013). The role description is a subjective attribute and needs to be set into context of the ecosystem scope (Tsvetkova & Gustafsson, 2012; Lappi & Haapasalo, 2016).

Diversity of roles has been identified as a key characteristic of a healthy ecosystem (Anggraeni et al., 2007) as it provides the ecosystem with a portfolio of innovations and capabilities that can be combined in different ways via relationships. Diversity makes ecosystems less vulnerable to external shocks but is challenging to manage. Diversity comes as a result of self-organization and flexible boundaries (Gossain & Kandiah, 1998; Anggraeni et al., 2007).

Relationships between actors build the ecosystem structure (Borgatti & Foster, 2003) and define the value creation. All actors involved into the creation of ecosystem value are in internal or external customer relationship with each other (Lappi & Haapasalo, 2016). Customer relationships can also be be defined between modular network units (Borgatti & Foster, 2003; Campagnolo & Camuffo, 2010). Key relationships in business ecosystems are driven by actors that connect the network modules and host system level processes (Lengnick-Hall & Wolff, 1999).

Ecosystem Evolution

As evolving entities the business ecosystems follow the biological ecosystem lifecycle (Moore, 1998: Iansiti & Levien, 2004). There are several descriptions also for ecosystem lifecycle phases (Moore, 1993; Iansiti & Levien, 2004; Lu et al., 2014; Hu et al., 2014) but in general the ecosystem lifecycle includes formation (birth, emergence), operational (current, consolidating) and renewal or death phases. Moore (1993) defines ecosystem formation as the ecosystem's transition from a random collection of elements to a more structured community. Formation includes activities

where actors develop co-operation strategies to adapt to a new ecosystem mode of operation (Gulati et al., 2000).

Complexity in business ecosystems implies that everything is interconnected and more information does not lead into more accurate decisions as the impact of the planning actions is nonlinear (Hearn & Pace, 2006). To manage in an evolving ecosystem actors need to revisit the internal and external relationships that served to protect and isolate core competences and capabilities in favor of relationships directed by sharing and cooperation (Lengnick-Hall & Wolff, 1999).

Business ecosystems have common elements with complex projects. A project can be seen as a temporary value proposal embedded in a more permanent business ecosystem (DeFilippi & Sydow, 2016), making projects vehicles of ecosystem formation (Lappi & Haapasalo, 2016). The purpose of ecosystem formation planning is to establish a system that addresses both technical and organizational design (Lundrigan & Gil, 2015). As the design must meet the preferences of actors with needed resources, the central actor cannot specify the requirements before the core actors of the ecosystem are involved into the ecosystem formation (Lappi & Haapasalo, 2016; Gossain & Kandiah, 1998). On the other hand, these actors are unlikely to support the ecosystem targets unless they are specified in relevant details. The central actor needs to balance in the development of a detailed design to convince the core actors but simultaneously is flexible enough to accommodate emergent preferences (Lundrigan & Gil, 2015; Gossain & Kandiah, 1998).

The formation of business ecosystems has similarities with project front-end (Lundrigan & Gil, 2015; Williams & Samset, 2010). Project front-end includes all activities from the time the idea is conceived until the final decision to finance the project is made (Williams & Samset, 2010). It includes concept definition but not detailed planning. Front-end phase governance need to focus on stakeholder requirements, frequent changes and managing the concept definition in a turbulent environment (Aapaoja, Haapasalo, & Söderström, 2013). Similar challenges apply also in the formation of business ecosystems, where relationships are unstructured, value proposals are immature and actors seek alignment with the ecosystem targets (Iansiti & Levien, 2004; Gossain & Kandiah, 1998).

Ecosystem Success and Health

Following the key premises of complexity logic (Lengnick-Hall & Wolff, 1999), the success of all ecosystem actors depends on the success of the ecosystem as a whole. Iansiti & Levien (2004) define ecosystem success through robustness, productivity and the ability to create new business opportunities. The success of business ecosystem follows also the organizational

network success definition (Provan & Kenis, 2008), where success is defined as the attainment of positive ecosystem level outcomes that could not be achieved by individual actors independently (Gossain & Kandiah, 1998).

The ecosystem success can be evaluated through ecosystem health. The ecosystem health dimensions and related capabilities are sustainability (capability for long-term success), resilience (capability to adapt to changes), innovativeness (capability to explore new value opportunities) and renewal (capability to modify roles, practices and relationships) (den Hartigh et al., 2006). Stability as an enabler for the ecosystem health refers to the capability to build long-term trust based relationships where the actors understand each other's strengths and weaknesses and are willing to act to maximize the network outcomes (Provan & Kenis, 2008). Measuring the health status can provide the central actor of the ecosystem a 'compass' to guide the ecosystem governance (den Hartigh et al., 2006). Ecosystem health is the result of efficient formation (Gossain & Kandiah, 1998).

Ecosystem Governance

Governance of business ecosystems has not been widely discussed. Partly the reason might be that the organizational scholars are focusing on organizations, not multi-organizational entities (Provan & Kenis, 2008). Furthermore, developing a deep understanding of business ecosystems is time and effort consuming, requiring the collection of data of multiple interconnected network modules (Borgatti & Foster, 2003; Campagnolo & Camuffo, 2010). As the ecosystems are self-organized entities, managerial mechanisms, including hierarchy and control, do not apply (Jones et al., 1997) and, as they are not legal entities, the legal governance imperatives are only partially present (Provan & Kenis, 2008).

Business ecosystems use social networks to stimulate access to knowledge, increasing the potential of the actors to achieve strategically significant outcomes (Capaldo, 2014; Gulati & Foer, 2006). Social relationships create mechanisms for shared governance. Social relationship mechanisms consist of relational (interpersonal relationships, trust, etc.) mechanisms and network structural (macroculture, norms, reciprocity etc.) mechanisms (Capaldo, 2014). Both of these mechanisms affect the behavior of the ecosystem actors but the processes that impact the ecosystem governance are different (Adner & Kapoor, 2010).

Governance of ecosystem formation should have flexibility from the beginning (Williams & Samset, 2010). Central actors should focus on sensemaking rather than detailed planning (Aapaoja et al., 2013). In the early phase, the lack of detailed information can actually benefit rather than be a negative item in providing focus and flexibility for the decision maker (Choi et

al., 2001; Williams & Samset, 2010). The formation cannot be directly managed due to complex interactions and unpredictability of events (Anggraeni et al., 2007).

However, some archetypal behavior patterns can be recognized based on the relationships between ecosystem network modules. Ecosystem formation can thus be operationalized when these behavioral patterns are observed.

The nature of relationships determine the level of control an actor has over another (Adomavicius et al., 2006). Reducing relationship dimensionality and negative feedback can increase control in the ecosystem. Positive empowerment of actors and the involvement of new relationship dimensions can increase self-organization and diversity (Moore, 1998). Following a complexity logic (Lengnick-Hall & Wolff, 1999), influence in ecosystems relies on shaping the ecosystem structure and relationships, as they serve as catalysts to increase or reduce system regularity.

As the number of actors in ecosystems grows, the number of relationships increases exponentially making governance extremely challenging (DeFilippi & Sydow, 2016). A mode of shared governance can become inefficient in large ecosystems when actors either ignore critical network issues, or spend a lot of effort trying to coordinate the relationships across several organizations (Provan & Kenis, 2008; Gundlach & Foer, 2006). Centralized governance around a lead organization or external facilitator can provide a structural solution to this problem as direct involvement of all actors is no longer required (Jones et al., 1997). There is no strict number of actors for a correct governance form but shared governance seems to be effective with fewer than six to eight actors or network modules (Provan & Kenis, 2008).

Social network theories emphasize behavior of ecosystem actors as their position in the network is influenced by it (Borgatti & Foster, 2003). Centrally-positioned actors hold considerable power access to the ecosystem because other actors are dependent on them. According to Moore (1998) the most important governance methods are community governance systems and quasi-democratic mechanisms. Anggraeni et al. (2007) list the following governance activities for centrally-positioned actors:

1. Provide incentives and vision of shared goals to the members.
2. Empower the members to strive for the goals with their own incentives.
3. Apply steering mechanisms to ensure that activities are aligned with the shared goals.
4. Improve ecosystem internal innovativeness and capabilities to cope with external changes.

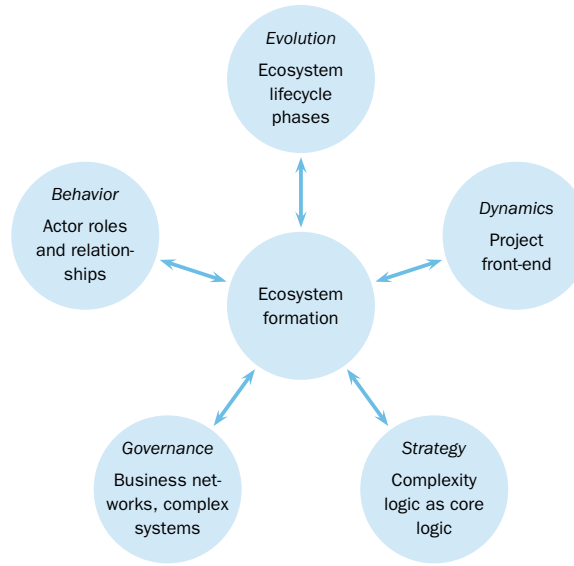

Figure 2
Ecosystem Formation Analysis Framework

Summary: Ecosystem Formation

We use term 'ecosystem formation' in this research to discuss about how unstructured business networks are joined as operational ecosystems. The merging of different definitions as ecosystem formation enables a wider analysis of the role of actors in the transition, in the establishment of important relationships and in the governance mechanisms during the formation. The formation phase defines whether the ecosystem becomes healthy or not.

Based on the reviewed literature we defined 'How to form a healthy business ecosystem' as the research theme. To structure the research and as a response to RQ1 (How to analyze business ecosystem formation?), we formulated the analysis framework for ecosystem formation described in Figure 2. The framework elements evolution, dynamics, strategy, governance and behavior derived from literature review bring inputs from different sources ranging from project front-end (dynamics) to complex systems theory (governance) and ecosystem literature (evolution, behavior). The inputs from various literature streams enable comprehensive analysis of ecosystem formation as a phenomenon. In Figure 2 the five elements of the ecosystem formation are discussed in the previous chapters but the consolidation of the picture was done by identifying the most relevant elements in conducted research and theoretical foundations that contribute to the business ecosystem formation.

Figure 2 presents the elements to approach healthy ecosystem forma-

tion. As a turbulent, complex, and unpredictable phase, the *dynamics* in the formation of business ecosystems can be adapted from literature discussing project front-end characteristics (Williams & Samset, 2010). Forces impacting project front-end combined with complexity logic (Lengnick-Hall & Wolff, 1999) as the ecosystem core logic provides important elements to define the *strategy* for ecosystem formation.

Governance mechanisms of business ecosystem formation are not studied extensively (Kortelainen & Järvi, 2014). The central actor can set governance actions for the formation phase of the ecosystem by applying insights from complex adaptive theory (Choi et al., 2001), a complexity logic as the ecosystem core logic (Lengnick-Hall & Wolff, 1999) and project front-end governance activities (Williams & Samset, 2010).

The roles and responsibilities of the actors define the formation process of the ecosystem. Their *behavioral* patterns set baseline for the ecosystem health during *evolution*. The role of the central actor and the key actors who define the process of ecosystem value need to involve the ecosystem customers into the ecosystem planning. Due to criticality of relationships and roles for a healthy ecosystem (Iansiti & Levien, 2004; Moore, 1993; Gossain & Kandiah, 1998), we set as the target of this research the following: to clarify who are the actors driving ecosystem formation and how the health of ecosystems can be assessed.

Case Set-up

Lappi and Haapasalo (2016) and Lappi, Aaltonen, and Haapasalo (in press) presented that a project-type front-end phase precedes the operational ecosystem. Based on the reviewed literature, we position ecosystem formation as the phenomenon that transfers the front-end or the project phase-depending on the context- ecosystem into an operational ecosystem. We applied the analysis framework of ecosystem formation in Figure 2 into empirical setting to investigate further the ecosystem formation. Based on this analysis framework, we visualize how the front-end and operational ecosystems are linked as a formation process in Figure 3. The actor roles follow the description from Lappi and Haapasalo (2016). Figure 3 serves as research methodology framework to guide the empirical research. Identification of the actors that drive the formation improves the success opportunities of the ecosystem and supports the governance. We present for this research that the actors driving the formation are called anchoring actors. The analysis framework presented in Figure 2 is used to identify those anchoring actors. The anchoring actor is a novel role description not previously discussed in business ecosystem literature.

We conducted a single case study in the Taiwan health and wellbeing domain to investigate the formation mechanisms and how to describe the role

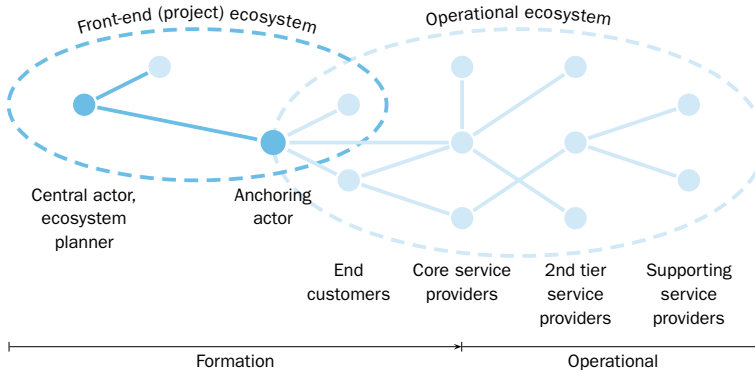

Figure 3 Business Ecosystem Formation from Front-End to Operational

of the predicted anchoring actor. The ecosystem perspective as described in literature review is applicable to the Taiwanese business context, as it emphasizes cross-industrial social networks as value creation and delivery channels (Hsieh, Yeh, & Chen, 2010; Chang & Lu, 2007). We selected the case study subject based on data access and as it was considered to reflect a self-organized business ecosystem with Taiwanese business culture characteristics as described by Hsieh et al. (2010). The case study ecosystem was in operational phase. The research set-up included interviews of the present actors to understand what their roles and relationships were in the ecosystem formation.

The case study was qualitative, like many studies related to business ecosystems (Kortelainen & Järvi, 2014). A qualitative research approach for a single case study provides in detail access to data (Yin, 1994) that was considered essential to address the research theme. Due to missing exact theoretical frameworks, we selected inductive research method (Eisenhardt, 1989) and applied the formation analysis framework from Figure 2. We interviewed 28 actors from private and public sectors as semi-structured interviews (Eisenhardt, 1989) to get insights on the business networks of the actors and how the ecosystem was formed. The interviews focused on describing the business networks, actors and relationships and how the business network evolved into the current status. In average the interview sessions lasted 1.5 hours. Based on the interviews, we mapped the actors' business networks following the relationship description from Lappi and Haapasalo (2016) and defined how the actors contributed to ecosystem formation.

Eight networks from the interviewed 28 were selected as business ecosystem modules following Baldwin (2007). We combined the networks as modules of business ecosystem in three separate 4 hour specialist work-

shops. The combined ecosystem described was self-organized but each of the network modules had their own lead actor. Eight network modules represent the ecosystem size. Following Provan & Kenis (2008), shared governance is an applicable governance mode in an ecosystem of this size. Based on the interviews, we defined the strong relationships that keep the ecosystem structure in place and moderator actors who hosted them. The role of the moderator actor was presented by Lappi and Lee (2017). The ecosystem was analyzed to clarify how the network module lead actors were linked to the moderator actors. The more connections the lead actor of the module has with moderators, and thus for strong relationships, the bigger the role the lead actor has had in the formation. Simultaneously, we identified weak relationships as temporal transaction specific connections. They are important for the ecosystem renewal and innovativeness as gates for actors to enter or exit the ecosystem (Adomavicius et al., 2006; Gossain & Kandiah, 1998). Weak relationships drive operational ecosystem renewal and adaptability capabilities.

Each network module is essential for the ecosystem health (den Hartigh et al., 2006). The level of contribution of a network module can be evaluated by calculating the number or connection points of moderator actors to the module (Baldwin, 2007). This parameter presents the significance of the network module lead actor to the ecosystem health.

The number of involved actors determine the impact of the network module in the ecosystem (Baldwin, 2007; Campagnolo & Camuffo, 2010). Therefore we selected network size as another parameter to estimate the impact of a module's lead actor in the ecosystem formation. Big networks are more developed and their contribution to the formation is higher following the ecological ecosystem analogy from Moore (1993).

How long an actor has been operating in the environment determines the longevity of the contribution (Kinnunen et al., 2013; Peltoniemi, 2005). We clarified when the interviewed lead actors had started their business in the ecosystem. Actors that had been present for longer time have been through and contributed into the ecosystem formation.

Results

We used Figure 2 framework to gather understanding about the Taiwan health and wellbeing ecosystem formation. We approached behavior and strategy elements by multiplying the number of involved moderator actors (doctors, nurses, hospital management and government) with the network module size to assess the level of importance of the lead actor. Involvement to the evolution can be evaluated from the establishment year of the business.

Results presented in Table 1 show that private nursing home and Chung

Table 1 Actors and Network Size in Taiwanese Health and Wellbeing Ecosystem

Business network module	Involved moder. actors				(1)	(2)	(3)	(4)
Hospital nursing home	D	N	H	G	4	12	48	2013
Private nursing home	D	N	H	G	4	18	72	1986
Chung Teng medical instrument (CTMI)	D	N	H	G	4	14	56	1995
iHealth	D		H	G	3	16	48	2010
Yong Wei Security			H*		2	13	26	2005
Jen Ai hospital long term care (JALTC)		N	H**		2	17	34	2007
Changhua Christian hospital logistics	D	N	H		3	15	45	2014
IMC Taichung				G	1	19	19	2015

Notes Column headings are as follows: (1) total, (2) size, (3) score (total × size), (4) established (year). D – doctor, N – nurse, H – hospital management, G – government; * other institutions, ** JALTC.

Teng Medical Instrument (CTMI) are the lead actors with the biggest role in ecosystem formation. We identified those actors as the ecosystem anchoring actors as presented in the ecosystem formation process (Figure 3). Ecosystem formation was self-organized as there was no single actor purposefully setting up the ecosystem from separate networks. Forming relationships between network modules and joining them as an unified business ecosystem involved multiple actors and transactions such as sharing of medical equipment and patient information. These dynamics of the ecosystem formation are common elements with project front-end characteristics (Williams & Samset, 2010) where actors are focused on creation of necessary enablers and relationships for the operational ecosystem (Defilippi & Sydow, 2016). Private nursing home and CTMI had also the strongest connection with the moderator actors (Lappi & Lee, 2017), as presented in Table 1.

The private nursing home established in 1986 has long customer and partner relationships and over 180 inhabitants. Due to long operation time, there is a constant flow of new inhabitants keeping the business profitable. Recreational events and sound therapy are examples of new service concepts that the private nursing home develops via involving new actors through weak relationships and deploys them through the ecosystem via strong relationships. Novel services and solid reputation enable the private nursing home to respond to megatrends such as aging population and the need for physical exercise. Deep co-operation with hospital management units and doctors as the moderator actors connect the private nursing home with other modules through strong relationships.

CTMI's significant role in the case study ecosystem comes from efficient network management both locally and globally. CTMI was established in 1995. Services such as clinics with US medical institutions enrich CTMI's

position and invite new activities into the ecosystem. CTMI offers not only medical instruments but solutions with services and consultancy, making it an important value integrator. The integrated value delivery has strengthened their position and increased the ecosystem's capability to respond to external global competition. CTMI's engagement with doctors and nurses and the deployment of their needs across the ecosystem have contributed to strong relationship formation. CTMI also drives the ecosystem evolution through new technologies like robotics. The CTMI's business model seeks for a win-win-win business model (company-customer-network) fitting the strategy with a complexity logic (Lengnick-Hall & Wolff, 1999).

The results have elements, such as large entities formed when resources and knowledge flow through social connections, supporting modular network formation mechanisms (Borgatti & Foster, 2003). Applying the elements from Figure 2, we conclude that the lead actors of the module with the widest contribution to strong relationships and the biggest size of connected actors are the anchoring actors for healthy ecosystem formation (Capaldo, 2014; Powell, 1990), and that the contribution to ecosystem health comes from the establishment of strong relationships. Supporting this conclusion, the identified anchoring actors have been operating for the longest time in the domain. Long history has built up their anchoring actor role and developed wide and sustainable modules that have contributed most to the formation and health status of the ecosystem, as it stands today.

The case study of the ecosystem evolved in a self-organized manner with a shared governance mode (DeFilippi & Sydow, 1016). The formation has been triggered by external inputs such as changes in government regulations and technology innovations. The evolution of the ecosystem has taken over fifteen years and the first anchoring actors have been present for over thirty years. Over time the ecosystem has gone through changes that have formed the current structure and health status. The organic formation of the ecosystem reflects the Taiwanese amorphous business culture, where social relationships and trust build business networks (Hsieh et al., 2010; Chang & Lu, 2007).

Discussion

To form the ecosystem from the front end to operational phase as described in Figure 3, it requires careful facilitation. Lappi et al. (in press) discuss about how to identify and involve the key customers and core service providers into the formation planning of a health and wellbeing campus ecosystem. That research had a nominated central actor, whose strategic goal was to set up a business ecosystem. That case study can be considered as a managed business network establishment (Capaldo, 2014) with

purposeful governance activities described by Anggraeni et al. (2007), such as building in flexibility for the stakeholder requests.

We identified that in this research case the ecosystem formation was self-organized, not purposefully managed and that the ecosystem formed when the business network modules joined via strong relationships set up by anchoring actors. The formation of the ecosystem in this case was driven by the actors' intent for joint value creation, by network benefits following the ecosystem formation mechanisms (Adner & Kapoor, 2010) and by network formation conditions (Jones et al., 1997). These mechanisms and conditions developed over time from triggers from internal stakeholders and external inputs.

We present, based on the reviewed literature and the case study results, that the role of anchoring actors can be identified in both managed and self-organized business ecosystems. We propose that the answer to the RQ2 (How to describe role of anchoring actor in healthy ecosystem formation) can be obtained from the operational ecosystem through identifying network module lead actor links to moderators, to the size of direct business network and to the presence longevity in the ecosystem. Describing the actors who contribute most to ecosystem formation as anchoring actors enable a practical focus of the network governance activities (Capaldo, 2014). As a novel concept, the role of anchoring actor complements the discussion about the importance of role diversity in a healthy business ecosystem (Iansiti & Levien, 2004; Kinnunen et al., 2013; Lappi & Lee, 2017).

Anchoring actors contributed to the ecosystem formation by building trust based on strong relationships between network modules and by developing new value through initial actors and their capabilities. For example, CTMI enhanced new technology deployment amongst the network modules by training doctors. Such contributions represent that, in this case study, the anchoring actors' strategies follow a complexity logic (Lengnick-Hall & Wolff, 1999).

Ecosystem formation can be supported with project front-end governance activities like sense-making, scope control and flexible communication (Williams & Samset, 2010) with a complexity logic aligned strategy (Lengnick-Hall & Wolff, 1999). Based on Jones et al. (1997) and Williams and Samset (2010), the governance framework in ecosystem formation should recognize the realities of uncertain environments and should be sufficiently flexible to enable adaptation to changes and to avoid pre-mature concept lock-in. The mode of shared governance in the case study ecosystem includes simultaneously somewhat conflicting capabilities (Capaldo, 2014), such as capabilities to share resources and information between the actors but under government regulations. The mode of shared governance

in ecosystem formation requires a structure that will maintain a strategic alignment of involved actors (Provan & Kenis, 2008).

The size of the business network module presents how much the actor contributes to the value creation of the business ecosystem and how many interfaces the actor has, including both strong and weak relationships. As the anchoring actors establish strong relationships, they define the structure of the operational ecosystem and set baseline for the ecosystem health. This contribution to the ecosystem's strong relationships makes the ecosystem resilient against internal and external changes (den Hartigh et al., 2006). The more diverse and frequent the transactions in the strong relationships are, the more sustainable the ecosystem is.

Anchoring actors' contribution to the ecosystem comes from the establishment of strong relationships and from building an impactful size of direct business networks. These contributions are interrelated to the moderator actors described by Lappi and Lee (2017) that keep strong relationships active and to weak relationships that represent external interfaces. Therefore, we present that the anchoring actors' contribution to the health of the ecosystem needs to be complemented with moderator actors and strong and weak relationships to assess the ecosystem health status.

Through weak relationships in their business networks, the anchoring actors bring in new innovations and renewal capabilities to the ecosystem making it to evolve. The number of weak relationships determine the health of the ecosystem as opportunities to develop the ecosystem by involving new service providers into the ecosystem scope.

Based on the number of strong and weak relationships and roles of anchoring actors and moderators, we present that the ecosystem health status can be assessed in dimensions of resilience, sustainability, innovativeness and renewal. We propose the following parameters as an answer to RQ3 (How to assess business ecosystem health?):

1. Size of anchoring actor's business networks (sustainability).
2. Number of moderator actors in the ecosystem (renewal).
3. Number of strong relationships in the ecosystem (resilience).
4. Number of weak relationships in the ecosystem (innovativeness).

The parameters are derived from the empirical results when the available data was analyzed to identify what are the ways to define the contribution levels for ecosystem formation using the ecosystem formation analysis framework (Figure 2) as a guideline. Parameters and health dimensions are illustrated as a health status assessment model in Figure 4. The parameters are interconnected, and the health assessment outcome needs to be evaluated in the context of the ecosystem size. The size of anchoring

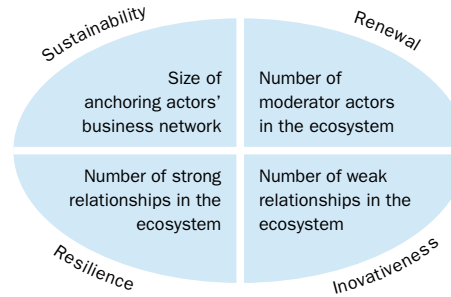

Figure 4

Business Ecosystem Health Status Assessment Model

actors' business networks and the number of moderator actors need to be divided by the total number of actors in the ecosystem. The number of strong and weak relationships need to be divided by the total number of relationships in the ecosystem.

The health status assessment model in Figure 4 gives an indication on where the ecosystem is at the current state. The health assessment model is a conceptual model where easy to calculate parameters from a business ecosystem is multiplied to as weighed scores per actor to prioritize them in terms of their contribution to the ecosystem formation. The size of the anchoring actors' business network present the impact of the actors contributed most to the formation of ecosystem following Powell (1990) networks as forms of organization. If the network size is large, then their contribution is likely to continue making the ecosystem sustainable. Moderator actors coordinate value creation (Lappi & Lee, 2017). The more moderator actors in the ecosystem are connected with the network modules, the more diverse and renewing capable the ecosystem is. The number of strong relationships define how adaptive and resilient the ecosystem is when facing changes. The number of weak relationships stipulate how many interfaces the ecosystem provides for new actors and services, reflecting the ecosystem innovativeness (Lappi & Lee, 2017).

These health assessment dimensions complement the Iansiti and Levien (2004) description on how business ecosystem success is evaluated. Renewal and innovativeness capabilities, for example, add more details about the process of ecosystem formation and operating routines that give indication about ecosystems' ability to react to either internal or external shocks, as described by DeFillippi and Sydow (2016) as one of the tensions related to project network governance.

This research builds on Kinnunen et al. (2013) in that the business models of the actors can be used to map the business ecosystem, and applies Baldwin (2007) insights on how a large ecosystem can be viewed as network of modules. The activities leading to ecosystem's formation cannot be

managed in a controlled manner following network governance challenges (Jones et al., 1997). Formation processes as two overlapping phases of front-end and operational ecosystem (Figure 3) provides a visual support for planning of the ecosystem formation before the process begins. It can be used to identify where the anchoring actors would reside and what would be the connections between actors that need managerial attention to develop strong relationships. Understanding the behavioral patterns of the anchoring actors can be used as a guide to the ecosystem towards intended direction. The behavioral patterns (Choi et al., 2001) can be defined through the business models (Kinnunen et al., 2013) and core logics of the actors (Lengnick-Hall & Wolff, 1999).

This case study results present that the anchoring actors have a critical role in ecosystem formation also when the ecosystem does not have a central actor (Provan & Kenis, 2008). In a planned set-up, such as megaprojects (Flyvbjerg, 2014), the central actor or project manager can utilize our answer proposal for RQ2 in the project front-end to identify the anchoring actors for a healthy ecosystem to be formed based on the project.

The health status assessment model (Figure 4) responds to the ecosystem health and success measurement challenges presented by den Hartigh et al. (2006). The assessment brings indications about resilience, sustainability, innovativeness and renewal capabilities that can be reflected against the ecosystem targets derived from customer requirements (Lappi et al., in press). The health assessment should always be done with detailed information coming from the actors themselves as, presented by Capaldo (2014), databases for financial transactions, etc. do not contain all the information relevant for a dynamic, trust-based networked organization analysis. Business ecosystems whose strong relationships are social with structural and relational shared governance mechanisms (Capaldo, 2014) benefit from in-depth insights of relationship nature for adequate health assessment. This applies especially to the Taiwanese business context (Hsieh et al., 2010).

The answers we propose for RQ3 can be used to evaluate ecosystem formation success. Combining the health assessment with strong and weak relationship content analysis provides comprehensive information of the ecosystem dynamics to the actors who are willing to lead the evolution. For the ecosystem central actor these tools are essential methods to define suitable governance actions.

Conclusions and Further Research

We present in this research the analysis framework in Figure 2 as a response to RQ1 (How to analyze business ecosystem formation?). As a response to RQ2 (How to the describe role of anchoring actors in healthy

ecosystem formation?), we propose that the longest present actors with biggest direct business networks and strongest contribution ecosystem formation are the anchoring actors. The anchoring actors with moderator actors and strong and weak relationships define ecosystem health assessment model as a response to RQ3 (How to assess business ecosystem health?). The case study findings from the Taiwanese health and wellbeing ecosystem support the ecosystem life cycle concept from Moore (1993), Iansiti and Levien (2004) and Lu et al. (2014) and complement the description of different roles in the ecosystem (Moore, 1993; Iansiti & Levien, 2004; Lappi & Lee, 2017). Furthermore, the answers to RQ2 and RQ3 bring novel insights into ecosystem characteristics, evolution and health assessment (Kortelainen & Järvi, 2014; Iansiti & Levien, 2004; den Hartigh et al., 2006; Lappi & Lee, 2017) and into how business ecosystem perspectives can be used to analyze complex network systems based on social relationships (Choi et al., 2001; Borgatti & Foster, 2003; Capaldo, 2014).

The health status assessment model (Figure 4) introduces a new concept to complement the academic knowledge on ecosystem success factors, development mechanisms and governance models (Capaldo, 2014). It serves as an example of how to define the 'ecosystem health compass' concept presented by den Hartigh et al. (2006), and deepens the applicability of the ecosystem success parameters defined by Iansiti and Levien (2004). Applying the health assessment model in different business ecosystems and in different life-cycle stages would provide an interesting source of information to compare ecosystems as further application of this research. Further research would also be beneficial in order to validate and develop further contributions of the conceptual health assessment model.

Mapping business ecosystems presents them as multidimensional entities that go beyond a dyadic organization mode as traditionally discussed in organizational theory and strategic management literatures (Provan & Kenis, 2008). Business ecosystems need to be governed without benefit of hierarchy and ownership (Borgatti & Foster, 2003). In addition, the actors have limited formal accountability for the ecosystem level goals, especially in self-organized ecosystems (DeFilippi & Sydow, 2016). Conformity to rules and agreed operational practices is voluntary. Identification of the anchoring actors and continuous health assessment provide tools for ecosystem governance that do not rely on formal authority. The findings of this research introduce concepts in order to approach the managerial complexity challenges identified by Provan and Kenis (2008) and Williams and Samset (2010) both in operational ecosystems and in the early phases of networks and projects.

This case study research presents how anchoring actors build strong relationships in ecosystems. The weak formal relationships present ecosys-

tem interfaces for external innovations and renewal capabilities. The role of external interfaces in the evolution of a business ecosystem would provide an interesting topic for further research. Furthermore, analyzing the behavioral patterns of the actors (Anggraeni et al., 2007) would build knowledge about specifics of the governance actions that could be applied in ecosystem formation planning.

In our case study. we identified that in self-organized ecosystems trust is an essential enabler for a healthy ecosystem. Distribution of trust amongst the ecosystem members is a critical component for the ecosystem relationships and the structure of the ecosystem as a whole (Provan & Kenis, 2008; DeFilippi & Sydow, 2016). How the trust is defined, how anchoring actors build trust as part of the strong relationship and how trust is distributed in a business ecosystem would complement the health assessment model.

This research presents how formation of business ecosystem can be facilitated through anchoring actors and through an health assessment model. In a networked economy the findings can be used to guide managerial actions towards networked value as globally the transition of value is from traditional linear process towards multidimensional networked value (Hearn & Pace, 2006). This research builds knowledge on how to address this megatrend using business ecosystems as the research approach. The findings also increase understanding on how to learn to utilize an operational ecosystem to model an emerging one.

The Taiwanese health and wellbeing ecosystem represents a self-organized business ecosystem with diverse actors and deep social relationships. As a single and unique case study, the generalization opportunities are limited. Though the results are obtained from a single case study in Taiwan, the implications can be seen as globally applicable to facilitate evolution of business ecosystems. The events leading to formation of self-organized ecosystems would benefit from further research, as those events can explain how the anchoring actors establish their role. The actors willing to impact operational ecosystems would benefit from the understanding of change events to predict better the possible disruptions in the ecosystem. Using the analysis framework and applying it in cases where the ecosystem has dissolved could bring up characteristics of actors that have had a biggest impact to the discontinuation.

For practitioners, this research provides methods to describe the role of anchoring actors and focus on the ecosystem governance to guide the formation towards resilient and sustainable ecosystems with relevant innovation and renewal capabilities. Understanding how the anchoring actors contribute to the health of the ecosystem and assessing ecosystem health on a continuous basis enables for a definition of strategies that would increase the network value of the ecosystem.

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