Chapter 10
Re-imagining the Forest: Entrepreneurial Ecosystem Development for Finnish Cellulosic Materials

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Abstract This case narrates the story of the creation of a Finnish Cellulose Entrepreneurial Ecosystem and its emergence through a series of community-based phase transitions during the years 2013–2017.

The case is explained by participants in the process who conducted and took part in a combination of more than 100 interviews and meetings. In the case, we explain the transition through phases of community: from a community of dreams through a community of inquiry towards a community of commerce, as the ecosystem emerges. The phases and transitions are characterised and driven by actors playing critical roles. These roles are identified in the phases along with the key processes that the actors lead and participate in.

The implications of the case are that entrepreneurial ecosystems can be created and driven through a bottom-up, community-based approach, driven by forms of public finance, as opposed to the creation of a hub-centred, more top-down model of development, and further that an understanding of roles and microprocesses can contribute to the building, organising and coordinating of ecosystem development.

Keywords Entrepreneurial ecosystem • Communities • Actor roles • Phase transitions

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10.1 Introduction

Entrepreneurial ecosystems are formed by a diverse set of interdependent actors and are characterised by 'high rates of entrepreneurship in a local region' (Spigel 2015) and 'rapid job creation, GDP growth, and long-term productivity' (Isenberg 2010). But how might such an ecosystem be planned or designed by policymakers or other national or local authorities? It is clearly a major challenge requiring a conducive culture, enabling policies and leadership, availability of appropriate finance, quality human capital, venture-friendly markets for products and a range of institutional support (Isenberg 2010). The context is also important, as each ecosystem emerges under a unique set of conditions and circumstances.

The setting or geographical region needs to have a certain set of resources to facilitate entrepreneurial success (Zacharakis et al. 2003), and it is 'the interaction between them which determines the success of the ecosystem' (Stam 2015, p.9), and that interaction builds 'one holistic system which turbocharges venture creation and growth' (Isenberg 2010, p. 43). Such holistic interaction activities develop networks, align priorities, build network capabilities (Vesalainen and Hakala 2014) and foster synergies between different stakeholders (Rodríguez-Pose 2013).

An ecosystem is marked by a mutual dependence between actors (den Hartigh and van Asseldonk 2004) and the co-evolution between, or shared fate of, organisations (Iansiti and Levien 2004). In the entrepreneurship literature, most studies adopt the perspective that opportunities are either discovered or created by an innovative individual, a process often described as a *eureka* (Gaglio and Taub 1992) or a *light bulb* (Fletcher 2006) moment. Shepherd (2015) suggests that more social perspectives, such as looking at ecosystem interactions, could advance our understanding of the formation of new opportunities. Such an approach would consider potential opportunities in terms of a process of social interaction (between a community and the entrepreneur) and therefore as a social construction, rather than solely as an outcome of thinking (in the mind of the entrepreneur) (Shepherd 2015). Furthermore, Autio and Thomas (2014) have called for research on the creation process of an ecosystem. The process of working inside the community is critical to the overall emergence of the ecosystem and to negotiating the development phase transitions. The ecosystem emerges through co-creative, microprocesses of interaction, through critical learning and reflection events, and is orchestrated by key actors as key role players. This kind of interaction perspective focuses on the process of activities and events involved in the emergence of a new opportunity within a community (Delmar and Shane 2004), which metamorphoses into an ecosystem.

To further the understanding of ecosystem development, this study elaborates the development phases and identifies the key actor roles of a Finnish project for creating a cellulose entrepreneurship ecosystem (CEE). Finland has a long tradition in highly sustainable forest resource management, and the forest-based industry has a major impact on Finnish society as a whole. The industry is, however, facing threats arising from global competition and other trends such as a reduction in the global demand for paper.

Novel methods of using cellulose have become an active research topic due to its abundance in nature, biodegradability and chemical formability and tunability. The development of high-value adding and sustainable entrepreneurial ecosystems using cellulose as their raw material therefore appears to offer an interesting opportunity for a country like Finland that derives much of its welfare from forests. This study is based on longitudinal research in which the authors have followed the development of this Finnish CEE through archival records, active participation in the project and over 100 research meetings and interviews. In Finland, 86% of the land is covered by forests, and the goal of the CEE is to accelerate the transformation of the current large-scale Finnish forest industry into a dynamic ecosystem for the bioeconomy, containing both large- and small-scale businesses, producing more products with added value.

We outline how the CEE has undergone several phases of development. The ecosystem transitions from a community of dreams (Koenig 2012) to a scientific research-focused community of inquiry (Shepherd 2015) and finally to a go-to-market-focused community of commerce. This emergence process could also be perceived as a form of self-organisation. During the phase transitions, the community has stakeholders that provide feedback on the feasibility of the potential opportunity (Autio et al. 2013), and within the community, potential opportunities are suggested by individuals (Swedberg 2009) who can test that opportunity with other people and organisations with the expertise and experience to revise and improve their ideas (Pardales and Girod 2006). Another missing dimension in existing research into ecosystems and community as a form of ecosystem is micro-social interactions. The focus on geographical variables within the well-known Isenberg (2010) framework, while important, needs to be informed by an understanding of these concrete interactions between actors, the roles they play, and what they do together (Heikkinen et al. 2007; Gemünden et al. 2007). Hence, our study also contributes by identifying different actors and their roles in an emerging cellulose ecosystem. Finally, we provide a working model of a multidisciplinary approach to the emergence of a bio-economy-based entrepreneurial ecosystem and an analytical framework for understanding the context and the process of this emergence through actors and ecosystem phases.

10.2 Literature

The concept of ecosystems in the business literature describes cross-industrial interactions between companies with certain characteristics. It refers to a network of companies that evolve together both co-operatively and competitively, around a core innovation, to fulfil their goals (Moore 1993). Iansiti and Levien (2004) recognised that ecosystems could include sub-contractors, outsourcing partners, financiers, technology providers, and even customers and – to a lesser extent – regulatory agencies and media. Peltoniemi and Vuori (2004) defined a business ecosystem as a

dynamic structure composed of interconnected populations of different types of organisations, including corporations, universities, research centres, public sector organisations, and other actors influencing the system.

The ecosystem analogy allows the study of the interconnectedness of organisations, the resulting dynamics, and possible explanations for the phenomena (Anggraeni et al. 2007). A closely related concept is an innovation ecosystem, which shares similar characteristics to the business ecosystem, and the two terms are often used interchangeably. Adner (2006) explains innovation ecosystems as collaborative arrangements firms use to combine their offerings into a mutual, customer-based solution.

Moore (1993, 2006) claimed that business ecosystems have the following economic model at their core: core capabilities become the basis for providing value to end customers that generate sales volumes, which in turn enable economies of scale and the total experience, which comprises both the core product or service and the complementary offering, and are then delivered to the end customers. Nambisan and Baron (2013) refer to this kind of structure as a hub-based innovation ecosystem. The central company holding the ecosystem leadership – which can also be called the keystone or hub company – usually has need of niche expertise, which causes new, smaller companies to spawn, ultimately leading to more entrepreneurial activity (Iansiti and Levien 2004; Nambisan and Baron 2013).

Entrepreneurship or entrepreneurial ecosystems were highlighted by Valdez (1988), who recognised certain dynamic elements in the formation of new businesses: the entrepreneur and the entrepreneurial environment. Entrepreneurship is said to be a process by which opportunities to create novel goods and services are discovered, evaluated, and exploited (Shane and Venkataraman 2000). More broadly defined, it is the process by which individuals pursue opportunities for innovation. Innovation involves creating new value in society. This innovation can be oriented towards exploration (i.e. pursuing opportunities that are radically new) or towards exploitation, in that the orientation focuses on refining existing opportunities (Lester and Piore 2004).

Cohen (2006, p.2) defined an entrepreneurial ecosystem as ‘a diverse set of interdependent actors within a geographic region that influence the formation and eventual trajectory of the entire group of actors and potentially the economy as a whole’. The entrepreneurial ecosystem is also then seen as a local, geographical construct (Spigel 2015). The entrepreneurial ecosystem may be geographically bounded but not confined to a specific geographical scale (e.g. campus area, city, or a region) and could be seen as a specialised type of organisational-industrial cluster, which develops over time within a specific geographical region and is replenished or expanded by new ventures (Cohen 2006). This form of cluster embodies the co-evolution of firms around particular innovations, technologies, or markets. The ecosystem generates incentives for entrepreneurial activity, linking potentially surplus resources to extant ecosystem participants and other opportunity-oriented individuals outside of the system (Spilling 1996). Storper and Venables (2004) and Bathelt et al. (2004) have emphasised the importance of locality and what the latter research terms ‘*local buzz* – an information and communication ecology created by face-to-face contacts,

co-presence and co-location of people and firms within the same place or region' (Bathelt et al. 2004,p.9).

The entrepreneurial ecosystem concept stresses how entrepreneurship is enabled by a comprehensive set of resources and actors that play an important role in enabling entrepreneurial action. Most of these are present locally, often requiring face-to-face contact or local mobility. The entrepreneurial ecosystem literature particularly focuses on the role of the (social) context in enabling or constraining entrepreneurship, the interdependencies between actors within the system, or a community of interdependent actors.

A community or a type of business ecosystem only emerges and holds together if its members are in agreement about the development of a common project. Our study focuses on the process of activities and events involved in the emergence of a new opportunity within a local, Finnish ecosystem which begins and emerges as a form of community (Delmar and Shane 2004). Koenig (2012) proposed a typology based on the type of reciprocity and control of key resources. The model includes four types of business ecosystems: supply systems; platforms; critically for our case, communities of destiny; and expanding communities. Both supply and platform systems feature centralised control or resources. Supply systems (similar to the model presented by Iansiti and Levien (2004)) are a centralised network in which a hub company controls key resources and surrounding companies take the role of a sub-contractor. Platform ecosystems are also centralised, but in contrast to supply systems, the hub company does not define the actions of smaller contributors but essentially provides the rules for the platform that other contributors must follow. In these centralised networks, the strategic centre gathers a small number of important partners together to engage in mobilising, designing, and controlling, to make a competitive offer to its customers.

The third and fourth types of design have non-centralised forms of control. For example, communities of destiny are organised around an existential solidarity which unites a heterogeneous group of actors. The system is not centralised, even if certain actors contribute more than others to its leadership. The final type of design groups a large number of members around an essential resource perceived to be a common good. This is an *expanding community*, and its design differs from that of the platform design in its non-proprietary character regarding the key resource, while it comes closer to the platform design in its member interdependence, while the contribution of each is distinct and isolable. The type of development for this design is expansion, which distinguishes it from a community of destiny. In such expanding communities, stakeholders cooperate without locking themselves into rigid contracts. Value creation is the product of a joint effort in a context of open participation. A number of empirical studies offer significant results on the importance of these ecosystems to fostering the dynamics of innovation (Adner 2006; Gawer and Cusumano 2014; Iansiti and Levien 2004; Maniak et al. 2014). These contributions demonstrate that the more interactions between stakeholders are open but organised within given platforms, the more likely their contributions are to be a source of value for the largest possible number.

In recent years, there has been a growing momentum behind the process view (Steyaert 2007; Van de Ven and Engleman 2004). The process literature is rich in explanations of non-linear pathways of emergence (Lichtenstein and Plowman 2009) as well as conceptualisations of the entrepreneurial journey as an emergent process in which abstract ideas are converted into tangible ventures (Dimov 2007; Lichtenstein and Kurjanowicz 2010; Venkataraman et al. 2012). As Shepherd (2015) suggests, this kind of more social perspective could advance our understanding of the formation of opportunities. The process explanation is usually developed by first eliciting sequences of events from narrative accounts (Van de Ven and Engleman 2004) and then operationalising explanatory mechanisms to explain the contingent pathway of an entrepreneurial journey (Lichtenstein et al. 2006).

A critical role in the functioning of entrepreneurial ecosystems appears to be fulfilled by forms of governance that combine sufficient structure and stability in their connections to enable investment but are also flexible enough to permit recombination and innovation. The form of governance and the process of deciding and agreeing, according to Moore, are important, and therefore an understanding of the processes being used is important. Moore himself saw a place for the use of the theory of complex adaptive systems (2006), while Peltoniemi (2006) saw a business ecosystem as fundamentally an evolving and developing structure. Business ecosystem discourse can be seen as part of larger complex systems research in social sciences which looks at complex adaptive systems characterised by distributed control, emergence, and self-organisation (Peltoniemi and Vuori 2004). Emergence here means that properties, qualities, patterns, and structures of a system rise out of interactions between actors (Peltoniemi and Vuori 2004). In the case of an entrepreneurial ecosystem, these actors are individuals, and emergence is a bottom-up process, starting from local micro-level interactions, which take place over time between interconnected actors.

The entrepreneurial creation process has constituent activities, processes, conditions and roles and can also be seen as one of the generating and refining potential opportunities through constituent activities, processes, conditions and roles. Despite the proposition that business ecosystems emerge from local interactions and negotiations between organisations (Peltoniemi and Vuori 2004), there has been no analysis of the tools and the processes that cause such ecosystems to emerge that would enable researchers to truly benefit from the ecosystem analogy (Adomavicius et al. 2006). A framework that establishes the elements and boundaries of the journey within a community has not yet been developed by process theorists (McMullen and Dimov 2013). Peltoniemi (2006) distinguishes a mutualistic form of business ecosystem, in which organisations cooperate and develop complementary capabilities in order to tackle a common enemy. In our case, mutual collaboration and agent level interactions, involving co-creation and sense-making actions taken by key actors playing key roles, lead to the emergence of, first, a community based on a compelling vision or dream (similar to Koenig's (2012) destiny) and then a community based on a need for enquiry (Shepherd 2015) and then to a community of commerce.

It is this series of microprocesses and actor roles that we seek to understand. Accordingly, we will borrow concepts taken from actor roles in innovation projects (Gemünden 2007), actor roles in innovation networks (Heikkinen et al. 2007), the facilitating of innovation networks (Kristiansen 2014) and the processes proposed in collective forms of sense-making (Nahi and Halme 2015).

10.3 Research Methodology

Our research involved a multistage and longitudinal study that spanned several Finnish organisations and a broad range of individual experiences in a project seeking to create a new entrepreneurial ecosystem. The research was conducted in several steps: preliminary investigation, in-depth interviews and data gathering, coding and analysis and finally validation.

First, exploratory interviews were conducted with five key participants within the project to understand the nature of their ecosystem development efforts and to map the community in which they work. Second, we conducted 44 semi-structured interviews with 20 members of the project working in the science and design fields, covering different locations, job roles and units. These interviews were conducted between December 2015 and May 2017.

We interviewed five people several times to gather additional evidence and discuss our interpretation of the information gained from previous interviews. Our interviews focused on individuals' direct experience with the processes in the project. We asked interviewees to describe how the community worked; what kept it together, to outline its success factors; and how entrepreneurial ideas and opportunities were developed. We also asked the interviewees to reflect on which aspects they saw as key to effective community-style ecosystem development. The interviews lasted between 45 and 60 min and were recorded and transcribed.

These preliminary and second round interviews were part of an in-depth case study of the ecosystem creation project of which the authors are part. Our role as business specialists in the project was to develop the conditions for a fully-fledged ecosystem around the new cellulosic materials. We were therefore present at all project meetings and seminars, internal and external, and helped to suggest what technologies might become commercial propositions and how new venture ideas could become opportunities. To this end we have attended more than 50 internal meetings.

The transcripts and notes comprise almost 200 pages of data. In the first-order analysis, we made little attempt to distil categories, so the number of categories was large. Fundamentally, we were looking for all forms of enablers that advanced the development of the ecosystem. As the research progressed, we started to see similarities and differences among the many categories and were able to group categories into labels or phrasal descriptors. By the time of the third-order analysis, we were asking whether the emerging themes suggested concepts that might help us

describe and explain the phenomena we were observing. Once we had these third-order themes, we could then configure our data into a visual aid, which also provided a graphic representation of how we progressed from raw data to terms and themes in conducting the analyses, a key component of demonstrating rigour in qualitative research (Pratt 2009; Tracy 2010). The fourth stage of the study involved discussing our findings with a range of stakeholders in the project to validate our thinking. A steering group of the project's most accomplished technologists provided detailed feedback in meetings. We then participated in informal meetings with other senior technologists from the project, where we presented our findings, and engaged in discussions to test the generalisability of the challenges identified and the feasibility of the solutions documented in this chapter.

10.4 The Finnish Cellulose Entrepreneurship Ecosystem

10.4.1 Context of the CEE

The central goal for the CEE project is to actively and consciously combine new wood-based technology, materials design and new business creation using state innovation funding as an initial resource to kick-start the emergence of a new entrepreneurial ecosystem. The project officially began in the spring of 2013 and will run until spring 2018. The project brings together businesses and researchers from different fields including engineering, chemistry, materials science, design and business studies. The project has already developed a number of promising technologies (see Table 10.1) that may catalyse or form a backbone for a new sustainable and innovative ecosystem around cellulosic products.

Finland has a long tradition in sustainable forest resource management, and also in the design and research of forest-based products, and well-developed supply networks for handling wood materials. The chemical treatment of cellulose, called pulping, was invented in the nineteenth century. Traditionally, pulp and all products made from it – mainly paper and board – have been major exports from Finland, and the forest-based industry has had a major impact on Finnish society as a whole. The long history of the wood-based economy has left Finland with high-technology plants and an extensive knowledge of wood processing, which have in turn contributed to a willingness to utilise wood resources in a sustainable manner. The Finnish forest industry can be characterised as a mature industry, in which innovation has not previously been seen as a high priority (Peltoniemi 2013) and where the focus has been on efficient and effective systems for harvesting the wood from the forests, transporting it to cellulose mills and turning the wood into pulp suitable for producing paper, cardboard and other products. Demand for the most important products, paper and board, has been relatively stable, and the products themselves are bulk, low-value and offer limited opportunity for innovation (Järvinen and Linnakangas

Table 10.1 New technologies and materials in focus in the CEE

Ioncell-F is a process for producing man-made cellulosic fibres. These are synthetic polymers made from natural resources. Yarns produced by dissolving birch and eucalyptus pulp have been used to create pieces of clothing for demonstration purposes.
Foam forming is an enabling technology that can be applied in several application fields for example: specialty papers, filter materials, and technical textiles.
Swelling fibre yarn is a cellulose filament preparation process using fibrous cellulose I particles (i.e. pulp fibres and potentially other cellulosic materials such as (nano-fibrillated cellulose).
Nano-cellulose is cellulose that has been hydrolysed to form very small fragments. Nano-cellulose exhibits many unusual physical and chemical properties in terms of stiffness and ability to bind water, in addition to being biocompatible and biodegradable (Lin and Dufresne 2014).

2012). The need for these traditional wood and paper products is not going to disappear any day soon, but the emergence of an electronic media has reduced the global demand for printing paper. The historical capabilities developed in the forestry industry are no longer sufficient to guarantee a competitive advantage, which leaves the Finnish forestry sector with two choices: to capitalise on the existing capabilities in new ways and to develop totally new ones (Järvinen and Linnakangas 2012), and an awareness of the need for strategic change and the exploration of additional sustainable ways to derive wealth from the forests has begun.

In the largest Finnish forest corporations there is growing interest in the high-technology, high-value use of nano-cellulose in biomedical applications (e.g. using a cell culture matrix made from nano-cellulose for growing tissue from stem cells), but in terms of revenue, this kind of business is still in its infancy. However, firms are currently investing in new production capacity that could be flexibly used to produce new cellulose applications, an example being the construction of the new bio product factory in Äänekoski, Central Finland, which is the biggest ever single investment in the industry (von Weymarn 2015).

Such large-scale projects also present opportunities for small companies with novel business models built around cellulose, and there are start-up companies developing products based on unconventional uses of cellulose. At the political level, the current Finnish government is also emphasising the role of the bio-economy and clean solutions in building the future competitiveness of the nation (Anon, Finnish Prime Minister's Office 2015). The future-oriented Finnish Innovation Fund, Sitra, published a vision of a distributed bio-based economy in 2011, and the National Bio-economy Strategy was launched in May 2014 as an initiative by the Ministry of Employment. Hence, there appears to be strong political support for developing new cellulose-based businesses.

The foremost new cellulose-based materials and technologies are described in Table 10.1.

10.4.2 Emergence of the CEE: Phases of Community, Transitions, Roles and Processes

10.4.2.1 Phases of Community

The German sociologist Tönnies highlighted the distinction between *Gemeinschaft* and *Gesellschaft* communities (Community and Society) as early as 1887 (Waters 2016). In a *Gemeinschaft*, relationships emerge out of social interactions of a personal nature, and personal emotional attachments are maintained through private sentiment and loyalty, rather than through a connection involving concepts of productivity or the marketplace. In contrast, in *Gesellschaft* societies, interactions are more rational and reflect impersonal relationships, explained through the medium of money. Tönnies saw *Gemeinschaft* relations as being absorbed into a more modern rational *Gesellschaft* society.

More recently, Shepherd, in the context of entrepreneurship research (2015), has called for investigations into communities capable of developing entrepreneurial opportunities (entrepreneurial communities) and has also suggested that communities may morph in different directions. Essentially, this type of strategic learning, leading to a transition of the community, is not a straightforward process (Sirén et al. 2017), and hence our study of the CEE aligns with these ideas and proposes that there is not one form of community that emerges (as a specific type of ecosystem), but a series of emergent forms or phases of a community that transition and eventually become the entrepreneurial ecosystem. Our observations suggest that the CEE transitions from a *community of dreams* to a *community of inquiry* and finally to a *community of commerce*.

This emergence process that we see as transitioning or morphing within the entrepreneurial ecosystem is a form of self-organisation or a spontaneous coming together of a group for a purpose. A helpful precondition for self-organisation would be a symbiotic relationship between the participants such that they each provide a particular input that makes up the system, and that are complementary, and can coevolve sympathetically (Thomas and Autio 2012) through generating and sharing new knowledge. This systemic learning process is based on the interaction of individuals creating new patterns of thought at the macro and micro levels. Mitleton-Kelly (2003) suggests that this generation and sharing of knowledge must be facilitated by providing the appropriate sociocultural and technical conditions to support connectivity and interdependence and to catalyse self-organisation (and emergence).

One such condition that we see clearly in the CEE is governance based on a horizontal as opposed to a hierarchical structure, which facilitates the phase transitions by fostering multiple local and cross collaborations between actors belonging to partner organisations (Donada and Attias 2015).

Other previous research also identifies a number of roles that are crucial for innovation, for example, gatekeepers (Allen 1970) and champions (Markham and Griffin 1998). By *roles* we mean behaviours displayed and actions taken by actors in particular positions and in particular contexts and in particular on the critical roles in the ecosystem development.

Such types of actor roles have been widely discussed in the social sciences for several decades, with a particular emphasis on role theory, which traditionally places individuals as the primary unit of analysis. In the case of the CEE, we also include dyads (two persons acting together) and triads (three persons acting together) alongside organisations as key actors performing in the ecosystem. The roles played in the case are only occasionally determined by actors' formal positions; in other words, the actor is adopting an expected and established position and then behaves accordingly. In this case, the majority of roles are not consequences of a formal position in a social structure, but must be claimed. Consequently, certain individuals change roles and might even play multiple roles. The roles are therefore a situation-specific construct and are dynamic and processual, describing what actors are doing within the overall process of the emergence of the ecosystem via phase transitions of community.

Research with partners in the CEE has shown that individuals pushing the emergence of the ecosystem recognise certain key promoter-style roles (Hauschildt and Schewe 2000) and, further, that different forms of key promoter-style roles are required for phase transitions to occur from the initial *dream* of an entrepreneurial ecosystem through the more detailed investigation of such possible opportunities in an *inquiry-focused* community through to the rational economic focus of the community of commerce. Each phase has certain characteristics in terms of these key roles, key actions and key processes.

10.4.2.2 Dream Phase

In the *dream phase*, a *Gemeinschaft*-type community of small collectives containing just a few people that know each other well (Waters 2016) shares a common understanding of what needs to be done. As in Koenig's community examples (2012), this community of dreams is a decentralised, heterogeneous group of actors bound together by a desire or a dream, an emotional and compelling common purpose. This phase has some similarities with forms of social movement, in that it is a collective process that looks to remedy perceived social and ecological problems by mobilising networks of individuals, groups and organisations bound by a shared collective identity (Hargrave and Van de Ven 2006). The dream phase in the case of the CEE began during a university summer project where technology students, art students and staff from Aalto University in Helsinki created concepts they called *World of Cellulose* and *Luxurious Cellulose Finland*. The teams were exploring a dream within the field of cellulosic materials, that a real paradigm change could

occur in cellulose-based product portfolios by combining the fresh approach of art and design students with experts in advanced and non-conventional technological approaches and concepts, which were not being used by the Finnish forest industry at that time. The dream community was therefore based on an engaging and compelling vision to transform the current large-scale forest bio-economy into a vibrant ecosystem that would make Finland a source of novel and sustainable value-added cellulosic products.

The first and perhaps most important of the key roles in this phase is that of the **visionary,** played by the original senior research scientists. At this point the few individuals in the community envision the need for some form of large-scale institutional change to address future opportunities that will arise as part of their vision being enacted. Without such a driving and future-oriented role, new entrepreneurial opportunities would not have been imagined and funding would not have been acquired to push the phase transition towards the community of inquiry manifestation. A fundamental challenge at this stage is that these individuals do not have the resources, power or legitimacy to introduce such change by themselves. They therefore investigate what resources and networks are available and start to organise coalitions and to ally themselves with complementary interests and resources.

As a result, more diverse actors became engaged and embedded in the process where they can contribute to the larger dream by recombining existing practices, technologies and institutions. This collection and organisation of existing resources is done by a **resource explorer** who organises the exchange of information, seeking appropriate actors to come together, and looks for external sources of funding to transition towards and through the community of inquiry phase.

The **diplomat** is required in this phase to show political awareness in understanding the interests of the other actors in the expanding community, as well as the ability to frame the dream agenda in ways that appeal to the interests and identities of those other actors, and, critically, of the funding body or bodies that will allow the following inquiry phase to take place. The diplomat and the resource explorer together encourage the mutual understanding of new knowledge and technologies and continually contribute to the diffusion of information.

For the community to generate even greater commitment and a *local buzz* requires the creation of meaningful stories on the importance of the vision and the need to make institutional changes and actions that interested parties and actors can take to help promote such a change. **Missionaries** then act to tell these stories. Missionaries believe that the committed community can be a powerful agent of change in society and engage in trying to create a base from which they can pursue the community vision and advance the cause.

For this dream phase to succeed and transition to a more formal inquiry phase required key structures to be available for the (small) network of actors to mobilise and together engage in a form of collective action. The critical opportunity structure turned out to be the state innovation fund (the Finnish Funding Agency for Innovation or TEKES) which provided resources to take the dream forward based on a persuasive framing process delivered by the community and an altruistic form of

leadership, acting without reward, in the belief that their dream of an ecosystem could be publicly promoted without major involvement from large companies or entrepreneurs at this point.

10.4.2.3 Transition from Dream to Inquiry Phase

The community of inquiry is fundamentally a place of learning, sharing and motivation. In this phase, the community focuses on more resource gathering and initial materials technology and conceptualising (product/service) development. Achieving the vision and developing the potential opportunities within a fully functioning entrepreneurial ecosystem require an extended number of community members to group around the essential forestry and technology resources in a process of social interaction and as a community to investigate the viability of the potential opportunity (Autio et al. 2013). Consistent with this interactive view of opportunity identification and refinement, the notion of potential opportunity is not in the mind of an individual, the initial creator, but is grounded in the community and in the way that actors act together to co-create and explore that opportunity.

Also in this phase, the ecosystem participants cooperate to define a collective purpose (a collective purpose being less clear for community ecosystems in which collaboration problems are more likely to arise), a refined collective identity to encompass the added members and then to co-opt key customers and partners to define value logics. Actors interact dynamically with each other to realise the purpose of the collective (i.e. the dream to be fulfilled) and to help individuals identify mutual opportunity ideas, by enabling a similar interpretation of data and employing similar vocabulary to express their emerging understanding.

At the beginning of the phase of inquiry a fundamental challenge is to bridge the various languages and thought processes that exist within the community, between designers, scientists, engineers, funders and business actors. A main aim is to enhance the networking and collaboration of the community, so that actors from different fields understand each other's roles and ways of working. Such work starts and continues at key events with networking and meetings to develop collaborative processes and functions. The leadership has a central role during the inquiry phase involving nurturing membership by building on everyday conversations and agreeing how to ensure transparent decision-making processes (Kristiansen 2014).

As the community becomes more formalised, a **conductor** becomes very important, as that person nurtures membership and helps the structuring necessary for effective self-organizing. An element critical to the productive coordination of interactions is the underlying structure of processes that connect all the participants together. One such collaborative process is the choice of governance mechanism to foster the adherence of actors to the community and to coordinate and control the actions of stakeholders. An example would be the introduction of procedures for regular monthly meetings to support networking and the building of trust. In these monthly meetings, all members or actor representatives should be present to discuss their part of the project in a language that is accessible to the all other attendees.

Once inhibitors are removed and enablers put in place, new behaviours and ways of working emerge, which enable a form of agent interaction that is not centrally or hierarchically controlled. The various actor stakeholders involved in the project begin to identify cross-dependencies in the community relationships, which lead to new ideas for opportunity development and for ways of working. Individuals self-organise to decide upon and take appropriate actions to take opportunities forward.

This mutuality and self-organising is a form of collective sense-making. Sense-making refers to a process whereby people attempt to make sense of unfamiliar contexts and unexpected events (Weick 1995). Individuals construct common mental frameworks that offer explanations for an event (Nahi and Halme 2015), turning emerging understandings into words (Weick et al. 2005). In order to do this successfully, certain ground rules or norms must be adhered to. Beinhocker (2007) formulates a list of norms that offer a specification of the internal culture elements that are required (for collective sense-making), and these include a desire for continuous and improving excellence as well as a commitment to honesty and a meritocracy. Several community actors mention the fundamental role of openness in the cross-disciplinary relationships and also of a feeling of trust and equality that encourages all participants to speak freely.

In order to keep the diverse and cross-disciplined group together, certain other actors work as **interpreters**. The interpreter role mediates the dialogue between the domains of expertise represented at the meetings, workshops and during conversations. The interpreter facilitates the communication process by helping diverse actors to understand each other by applying a knowledge of different sets of cultural norms and values. Interpreters can therefore be described as bilingual in the field of knowledge areas and institutional practices and routines. This enables them to act as negotiators if there are conflicting value systems, by providing explanations and synthesising conversations to help parties arrive at a meaningful set of shared understandings and actions.

One of the challenges in collective sense-making is the perceived fuzziness of work and interaction at the individual actor level. This inquiry phase of the community's development is characterised by fuzzy goals and relatively few signposts. Actors can often envision a future state but have great difficulty in portraying how to get there (Nahi and Halme 2015). Therefore, road mapping work to predict and enact the future is a significant part of the phase and helps with the general, collective and prospective sense-making process. The **sense helper** is an actor who creates and presents frameworks and roadmaps to help with the mutual and individual sense-making processes that are necessary to give individuals within the community some clarity of direction in the medium to longer term. These roadmaps help to conceptualise what Kristiansen (2014) calls *the problem space* and to visually summarise the work of the community and its progress. This is particularly important, as in this phase the community has evolved into a multidisciplinary, multi-actor network and this collective sense-making helps to identify the correlations and interactions between actors, factors and events, thus supporting the implementation of the roadmap.

Towards the end of this inquiry phase, the community starts another phase transition towards becoming a community of commerce, which involves a stronger focus on opportunities created. Technology readiness assessments are conducted in order to integrate various streams of technology and materials development and to prepare to converge on specific opportunities identified within the technologies and materials. Internal and external co-creation workshops are used to ideate and develop new concept opportunities, often using fortunate accident scenarios, where certain individuals take something considered mundane in one discipline across a boundary into their own discipline, where a different value proposition then becomes apparent.

Such **boundary crossers** recognise, gather, interpret and disseminate nonredundant information across boundaries (Allen 1977; Tushman 1977) by entering into unfamiliar territory and negotiating and combining ingredients from different contexts to achieve hybrid solutions (Engeström et al. 1995). A compatible role which operates at a more macro-level to drive the transition from the community of inquiry to one of commerce is that of the **helicopter pilot**. This is someone who stands apart from the local actor interactions and is aware of the greater strategic and national-regional possibilities and of the opportunities that the community is producing that have the potential to become concrete business opportunities that might trigger the creation of new companies. The helicopter pilot looks across formal organisational and technology boundaries to reduce barriers to the flow of information between other like-minded communities and networks that are also looking to transform the greater bio-economy and promote higher-level opportunity identification at the level of a technology paradigm.

10.4.2.4 Transition from Inquiry to Commerce Phase

In the dream phase, there are a small number of active participants. There is now a need in this later phase for richer interactions with more market-based external actors to co-create functionalities of services and product, and to further define the logics that drive the co-creation of value. This series of interactions now helps the community to produce and then sustain a more entrepreneurial culture.

The absorption of new knowledge and new ideologies from these external actors is the process through which community members eventually find the motivation to act entrepreneurially (Marti et al. 2013), to become ‘entrepreneurised’. This process, which is here described as ‘entrepreneurisation’, helps actors within the community to develop a collective entrepreneurial culture, being progressively equipped with ideas and values coming originally from inside and latterly from outside of their community. There is now the combination of *Gemeinschaft* and *Gesellschaft* elements of an entrepreneurial culture and at the same time communitarian ties of mutuality.

The community has now transitioned beyond multidisciplinary co-creation into multi-organisational and multidisciplinary co-creation, creating a highly experimental and fuzzy environment, which is demanding for all actors involved. Organic structures have been found to be more favourable to the success and emergence of entrepreneurial initiatives (Hakala et al. 2016), but this fuzziness again requires a common language, a curious and respectful attitude towards different disciplines and an understanding of diverse working methods. The co-creation process requires articulation of emerging understandings by each of the actors and group level elaboration that can yield new and congruent understandings as a basis for joint action. This requires a specialist **co-creator** to facilitate an open and equal innovation approach, where internal actors and more recent external newcomers can interact to make key decisions together (Lee et al. 2012).

In this phase of the CEE, co-creation is used to develop and commercialise technological innovations through collectively constructing an industrial infrastructure. The collective constructions must then be implemented through negotiation and persuasion, and this requires an **architect** role. A more proprietary and business focus requires more understanding and action to construct critical institutional arrangements such as clarity on property rights, materials standards and certification, supply chain flows and future financing arrangements.

Joint venture and partnering expertise are also required to lead collaboration with larger partners, SMEs or possible in-house start-ups or spin-offs that would evolve from technology pilots. Former entrepreneurs within the community who have previously built successful companies and intrapreneurs with previous corporate entrepreneurship expertise who reinvest their experience in the community during this phase in order to build a bridge between community intrapreneurs and possible funders or consortium actors can be described as adopting a **bridger** role. The role also involves creating and supporting activities that enhance the entrepreneurial environment, for example, by lobbying government and establishing new organisations that support entrepreneurial activity. Similarly, a **mentor** contributes directorial experience acquired through positions on start-up or spin-off boards of directors and in the CEE also engages in teaching entrepreneurship, acting as a mentor in student start-up competitions connected to future commercial development of the cellulosic materials opportunities.

The involvement of a critical mass of experienced entrepreneurs who have contributed time, energy and wisdom to support the ecosystem is particularly helpful to **intrapreneurs**. Intrapreneurship within the CEE describes entrepreneurial behaviours within an existing organisation in terms of the creation of new ventures. They develop business models built on market knowledge of consumption patterns, pricing, market structure and supply chain structure.

The key roles and phase transitions are summarised in Table 10.2.

A visual representation of the community transitions and the emergence of the ecosystem through the community phase transitions can be seen in Fig. 10.1.

Table 10.2 Key roles and role descriptions in the phase transitions

Phase	Key roles	Description
Dream	Visionary	A driving and future-oriented role, imagines and clarifies new entrepreneurial opportunities and large-scale institutional change to address future opportunities
Dream	Resource explorer	Collects and organises existing resources and networks, influences external actors and helps in the process of recombining existing practices, technologies and institutions as a resource
Dream	Diplomat	Shows political awareness in understanding the interests of the other actors in the expanding community, helps frame the dream agenda to appeal to the interests and identities of actors outside of the initial community and liaises closely with the funding body and local and national government
Dream	Missionary	Helps create and then convey meaning and meaningful stories on the importance of the entrepreneurial ecosystem vision, on the need to make institutional changes and actions that actors and others can take to help promote such a change
Inquiry	Conductor	Nurtures membership by building on everyday conversations, creates agreement on how to ensure transparency in decision-making processes, helps the structuring needed for effective self-organising
Inquiry	Interpreter	Keeps the diverse and multidisciplined group together, mediates the dialogue between the domains of expertise, facilitates the open communication process
Inquiry	Sense helper	Creates and presents frameworks to help with the mutual and individual sense-making processes that are needed to give individuals within the community some clarity of direction in the medium to longer term
Inquiry	Boundary crosser	Takes the mundane from one discipline across a boundary into their own discipline, recognises, gathers, interprets and disseminates relevant information across boundaries to create new opportunity ideas
Inquiry	Helicopter pilot	Operates at a macro-level to drive the transition from the community of inquiry to commerce, stands apart from the local actor interactions and is aware of the greater strategic and national-regional possibilities and opportunities that the community is producing
Commerce	Co-creator	Facilitates, helps articulate and support emerging understandings and opportunity ideas of the partners and of the group level collaboration needed as a basis for joint action, facilitates an open and equal innovation approach
Commerce	Architect	Leads the construction process of an industrial infrastructure for commercialisation, implements through negotiation and persuasion and helps design critical institutional arrangements such as clarity on property rights, materials standards and certification, supply chain construction and future financing arrangements
Commerce	Bridger	Has joint venture and partnering expertise to lead collaboration with larger partners, SMEs or possible in-house start-ups or spin-offs that evolve from pilots; creates and supports activities that enhance the entrepreneurial environment, for example, lobbying government and establishing organisations that support entrepreneurial activity

(continued)

Table 10.2 (continued)

Phase	Key roles	Description
Commerce	Mentor	Contributes director-level experience through positions on start-up or spin-off boards of directors. Acts as a teacher and judge for new student start-up competitions
Commerce	Intrapreneur	Exhibits entrepreneurial behaviours within an existing organisation and within the community, in terms of the creation of new ventures; develops business models built on acquired market knowledge of consumption patterns, pricing, market structure and supply chain structure

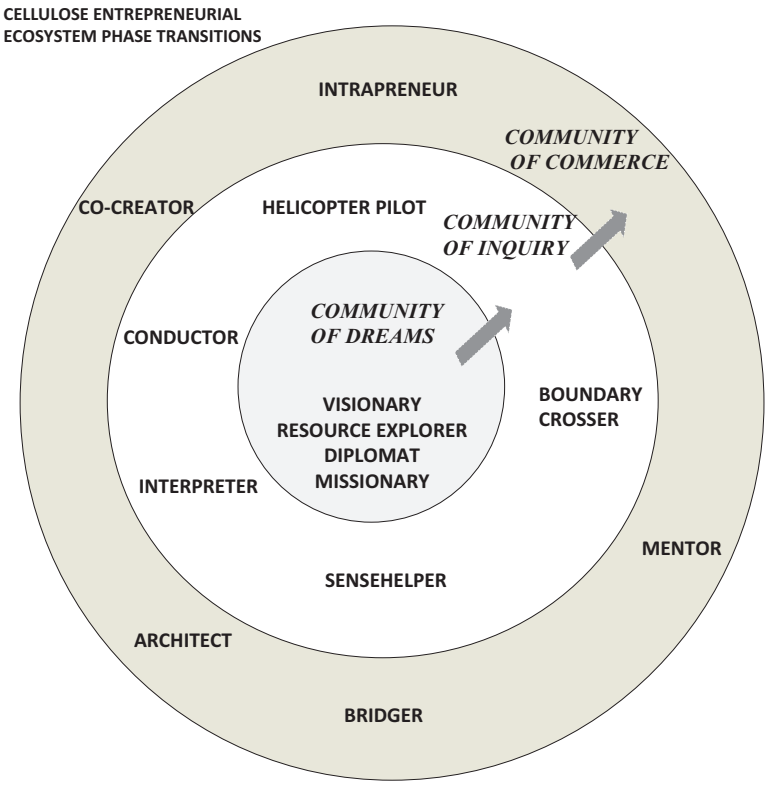

Fig. 10.1 Phase transitions

10.5 Conclusions and Implications

The *Finnish Road Map to a Circular Economy* published in 2016 (Sitra 2016) highlights the determination of the Finnish state to work with key public, private and third-sector organisations to pioneer a circular economy aiming to decouple economic development from environmental degradation. The road map sets Finland

a target to be a global leader in the circular economy by 2025. This vision of Finland succeeding as a pioneer in sustainable wellbeing sees cellulose-based biomaterials as playing a significant role in the future of the planet. Fossil oil-based materials such as plastics and resource-intensive materials such as cotton or aluminium can be increasingly replaced by cellulose-based materials as technologies develop and markets become more favourable.

The forest element of the road map aims to promote economic growth and create new jobs in Finland by supporting the development of new products and services derived from the country's forests that can add high levels of value (Sitra 2016). New forest-based entrepreneurial ecosystems can have a great impact on the creation of a future Finnish economy. In the case of cellulose, the opportunity can be seen alongside the development of the circular economy. Nano-cellulose, fibres from lignin and biochemicals from hemicelluloses have a multitude of future applications ranging from bionics materials to superconductors to growth substrates for synthetic biology. These future applications and specialised high-value products will add value to cellulose and the current value chains.

A dynamic model of entrepreneurial ecosystem development represents an important step forward in our understanding of ecosystems that emerge based on technology transfer (Autio et al. 2014; Autio and Thomas 2014). This dynamic model includes an enabling environment or context in which actors play key roles using critical processes that cause phase transitions and the emergence of the Finnish cellulose entrepreneurial ecosystem (the CEE). The systemic conditions are the foundation for the ecosystem: networks of large and small companies, community leadership, sources of finance, local talent, knowledge and sophisticated support services. The presence of these elements and the interaction between them help to ground the success of the ecosystem. Leadership, through its actions in the community phases, provides direction and role models for the entrepreneurial ecosystem. This leadership is critical in building and maintaining the ecosystem. This involves a set of visible visionary leaders who are committed to the creation of the Finnish CEE. Access to financing, preferably provided by actors with knowledge of entrepreneurship, is crucial for investments in such technology-driven entrepreneurial projects with a longer-term horizon where market returns may be quite distant (Kerr and Nanda 2009).

An important source of opportunities for entrepreneurship can be found in knowledge from both public and private organisations (Audretsch et al. 2005), and perhaps the most important element of the CEE is the presence of a diverse and highly skilled group of committed actors. These actors have different goals, expectations and attitudes, and many authors have called for more research on this topic in entrepreneurial ecosystems. In this case we highlight 14 roles that actors adopt and show how the roles work during phase transitions and the emergence of the ecosystem. These roles help understand how ecosystems characterised by openness and the coexistence of mutually shared and diverse individual motives can be built.

From a practitioner perspective, the study contributes to managerial knowledge by providing a framework tool to identify the prerequisites for open and bottom-up ecosystem emergence in terms of actor roles. The CEE is fundamentally built on

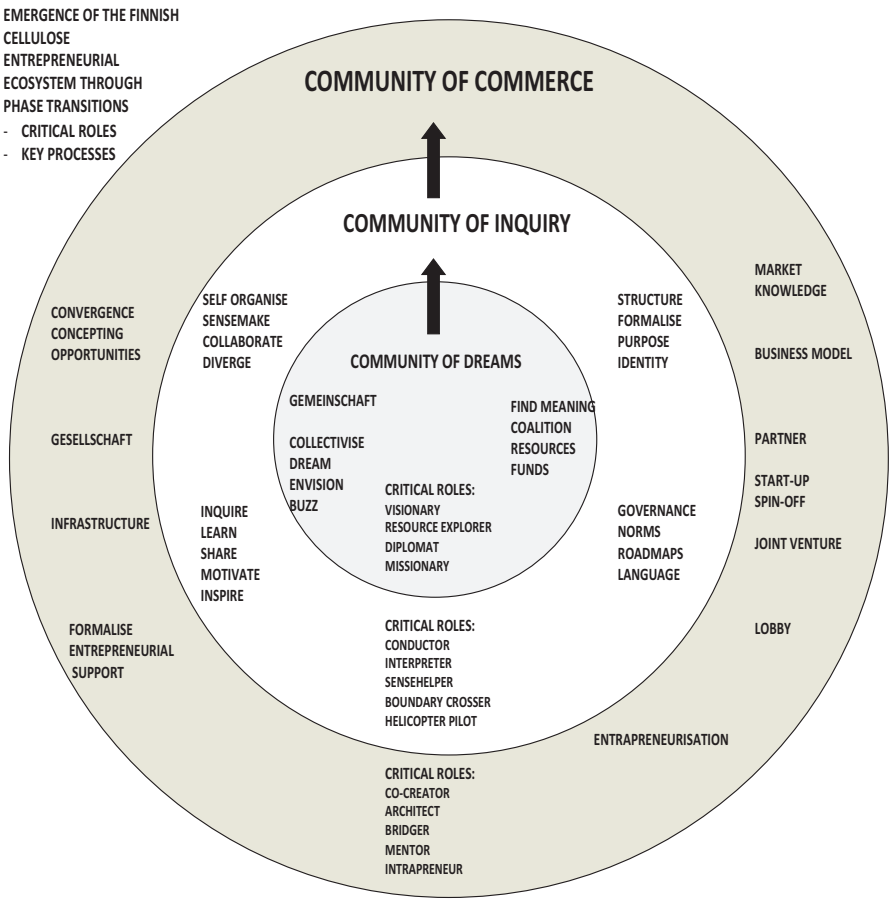

Fig. 10.2 Emergence of the entrepreneurial ecosystem

innovation discovery, but the idea of innovation should not only be applied to products; it also should be applied to ecosystem people practices (Birkinshaw et al. 2008), ecosystem structures and governance models. In this context, the key success factors are those that relate to the ability to mutually orchestrate, conduct and structure the creation of innovations within an open-innovation style system designed to foster collaboration between actors who may not typically have communicated openly with one another, for example, in a centralised ecosystem controlled by a hub-type organisation (Chesbrough et al. 2006; Damanpour and Aravind 2012).

A visual representation of the roles, processes and transitions is shown in Fig. 10.2.

There is a need for a detailed understanding of the processes by which ecosystems are created. In our case, new knowledge on cellulosic materials should be shared to generate further new learning and opportunities, and the process is about

understanding connectivity, interdependence, emergence and self-organisation. We extend research linking collective sense-making to ecosystem development, and, specifically, our findings help identify the specific mechanisms that drive sense-making, including the conditions that facilitate learning and the generation and sharing of knowledge.

This case offers further reflection on the governance model, which is suitable for community-based ecosystems, based on decentralised control. To successfully develop community-based ecosystems, leaders will need to manage new operating models and learn new ways of collaborating and of creating and capturing value and a process for co-creation encompassing various actors. That last process will also have to allow for the chance emergence of breakthrough ideas in the areas of products, services and business models. Policymakers have primarily supported the creation of knowledge ecosystems assuming that these ecosystems will automatically trigger the development of business ecosystems. However, the value creation processes in the bottom-up, emergent, knowledge-driven ecosystem and those in the traditional hub-based business ecosystem are fundamentally different, and policies to support each type will have to be designed accordingly.

New cellulose-based products will provide Finland with a significant competitive advantage arising from the country's sustainable source of the biomass and the infrastructure to export products around the world. The renewability, climate friendliness and biodegradability of cellulose-based biomaterials allow for a more positive vision of the future.

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