Ecotones: The complex transitional zones of service (eco) systems.

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Purpose – This paper introduces ecotones to the service (eco) system literature as a conceptual extension to the ecosystem framework, arguing that the boundaries and the relations between complex systems hold particular explicatory value as complex zones of stability and change. We further utilise the remarkable properties of ecosystems to address the complexity found in the intersections of multiple service systems and the actors who inhabit them.

Design/Methodology/approach – This conceptual paper lays out the ecotone concept before reconciling its explanatory and conceptual linkages with complex systems and recent developments in institutional and field theories and the service (eco) system concept to explore the relations between linked service (eco) systems.

Findings – The open and fluid nature of complex systems means boundaries do not separate but intimately connect systems with their environment, meaning the nature and complexity of a system is necessarily influenced by its relationships and interaction with other complex systems. Ecotones provide a useful concept as they represent the zones of transition between adjacent systems. These transitional areas support comparatively large amounts of diversity, resources and activity, creating emergent phenomena, while supporting the inhabitants (actors) of the overlapping systems and commonly inhabitants that are characteristic of and often restricted to the ecotone. Ecotones can be understood through the effects they have on their constituting systems, the feedback effects they generate, their mediation of resource flows between systems and their constituting roles in helping define the structure of systems.

We utilise the ecotone concept from natural ecosystems to build a conception of the service ecotone as complex interactional and transitional zones formed by intersections of informational, relational, technological and institutional boundaries. These intersections serve as dynamic spaces of complexity created by tensions and diversities in roles, resources and practices between resource integrating actors and value creating systems. We argue that by synthesizing the functions and dynamics of the ecotone concept we can contribute to the recent focus on institutional complexity, the limited understanding of the relations and interactions between institutional fields and different types of ecosystems and address the interactions and roles of actors within these transition zones.

Originality/value – We introduce the ecotone concept and integrate it with emerging literature influencing service theory and the general ‘zooming out’ of social-economic activity. This paper suggests service ecotones provide a conceptual tool for understanding the complex interplay between different systems that affect their emergence, composition, stability, and co-evolution. Thus, ecotones suggest new avenues for understanding the diversity and roles of actors, and how new structural properties, resources and practices come to be through the tensions, interactions and flows facilitated in these complex zones of intersection linking complex systems.

Paper type – Conceptual paper

Introduction

Understanding service ecosystems requires us to understand complex and adaptive systems created by the interrelations and resource integration between multiple actors. These systems develop and change through the nonlinear and dynamic feedback, resource flows and learning that emerge within, and are imposed by the environment of the system (Meynhardt, Chandler, & Strathoff, 2016). This paper addresses the relationship between these systems and their environment, focussing on what can be thought of as the systems boundaries and their explicatory value in understanding how systems develop and change. The continuing work on complex systems and the ecosystems metaphor/model/concept, in service research, has rightly concerned itself with the central components and functioning of these systems. However, this focus, often implicitly, obscures system boundaries as constitutive forces serving to mediate the system's relationship with its environment (Cilliers, 2001). Subsequently, it is important that we do not limit our understanding by construing these systems as self-contained, autonomous worlds, an issue recognised in both institutional and strategic action field studies (Fligstein & McAdam, 2012; Furnari, 2016). As Institutional theory becomes an important framework for understanding service ecosystems, it is important we acknowledge the calls in this literature for better understandings of how institutional fields are affected 'by the myriad ties they share to other fields' (Fligstein & McAdam, 2012, p. 19; Furnari, 2016, p. 573). Consequently, we intend to extend the ecosystem concept, further utilising their remarkable properties as explanatory devices (Barile et al., 2016; Mars, Bronstein, & Lusch, 2012) to understand the complexity found in the intersections of multiple service systems, and the value and the activities of the actors who inhabit them. We introduce the notion of ecotones, those zones of transition or edges between ecosystems (Holland 1988; Gosz 1991; Bowersox and Brown 2001), as important elements of intersystem dynamics, providing a basis for understanding the boundary zones of service ecosystems.

Philosophically, theoretically and analytically boundaries are important in understanding complex systems (Byrne & Callaghan, 2013; Cilliers, 2001; Gabbay, Thagard, Woods, & Hooker, 2011). Boulding and Khalil (2002) argue that all systems are involved in the creation, maintenance and change of their own boundaries, which intimately connect systems with their environment, rather than separating them from it. Therefore, as we recognise that complex service systems are interdependent in the exchange of resources and coevolve with the complex systems of their environments, we should come to see boundaries not as "perimeters but

functional constitutive components of systems", serving as dynamic areas of change (Zeleny, 1996, p. 133).

We propose ecotones as a conceptual tool which will simultaneously allow us to build stronger conceptions of the nature of systems and the interactions of their actors, while allowing us to broaden our analysis of the interdependence and interaction of coupled systems. We consider service ecotones as the complex interactional and transitional zones formed by the intersection of relational, technological and institutional boundaries that separate functioning and coherent service ecosystems. Ecotones provide an alternate view of boundaries, rather than as stable and separating, we see these as localities of dynamic interaction and connection. In the effort to build a relevant conception we use the ecotone concept as a foundation on which to build a service based concept, by translating current work from the literature on boundary organisations, institutions, fields and service systems. We conclude with a set of implications resulting from the implementation of the ecotone concept. We begin by setting a foundation for our theoretical underpinnings, by examining boundaries in complex systems.

The Problem of Boundaries and their relevance to Service Systems

Generally, a system can be defined as an assemblage of mutually-related elements that constitute a whole, having properties as an entity created by the parts regular interaction or interdependence (Checkland & Scholes, 1990). A Service ecosystem (SE) is a social system, emerging from sets of relations between actors that give rise to their functioning properties such as institutions and practices (Taillard, Peters, Pels, & Mele, 2016). SE are considered self-adjusting systems of largely loosely coupled social and economic resource integrating actors connected by shared institutional logics, technology, and language (Lusch & Vargo, 2014).

More specifically, we think of SE as complex adaptive systems (CAS) (Barile et al., 2016), open systems, that as a matter of necessity exchange information and energy with their external environment (Holland, 2012). Therefore it is not only the complex interdependencies and feedback loops of their constituting actors, but as open systems, also the constant interactions with the environment that define the nature of the system. These exchanges push us to understand how the pressures of the external environment cause internal adjustments and developments in the system in order to meet the tensions of their changing environment (Condorelli, 2016; Waldrop, 1992). Central principles of systems theory, the law of requisite

variety' (Ashby, 1964) and the principle of adaptation (Hitchins, 1992), tell us the internal flexibility, change and capability of the system must match those in the external environment in order for the system to remain cohesive and viable. This interconnected and interdependent nature of systems requires us to identify the other relevant systems which serve as the relational environment and the influence they can exert on the focal system in order to understand the behaviour and nature of a focal system (Barile et al., 2016). An individual complex system, therefore is, at any time, partly constituted by interactions which are part of the dynamic structures of other, different systems.

Openness means that systems, although bounded, interact with other open systems in their environment. This interaction results in changes to the systems as environmental influences become part of the system's structure. The process of self-organisation, a core process that defines a CAS, draws on the fact that systems learn from their environment by adapting to perturbations to ensure successful behaviour in the new environmental conditions (Holland, 2000). Similarly, the concept of co-evolution, another central process of CAS, refers to a mutual process of change between a system and its environment as result of their interaction (Kauffman, 1993). This interrelated, open and dynamic conceptualisation defeats a traditional perspective of rigid, distinguishing boundaries, and muddies the questions we ask of, and assertions we relate to, boundaries (Bickhard, 2011; Cilliers, 2001). As Reynolds and Ng (2015) suggest, open systems and the necessary exchange of resources mean it can be difficult to identify what is actually part of the service system and what is just part of the wider environment. Indeed the idea of boundaries has been hard to define or implement as conceptions move from a static/structural to dynamic/systems perspective, and raises the question whether or not their conceptualisation is necessary (Barile & Saviano, 2011; Ng, Maull, & Yip, 2009).

As a number of authors have suggested, systems are hierarchical - composed of and included in other systems while also enclosed by a boundary so that their are "internally discernible" processes (Pickel, 2006, 2011; Yarrow & Salthe, 2008). Although we recognise the dynamic and transitionary nature of systems, as Morcal (2012) notes, systems need to have some degree of stability in order to be recognized as such since ''a collection of elements that are in a state of eternal and ultimate flux cannot be considered a system'' (p. 55). Although the understanding of complex system boundaries has been hard to define (Quick & Feldman, 2014), there is still continued recognition that boundaries of social systems are key complex subsystems of social and socioeconomic dynamics (Ludu, 2016). The relations between systems, and the boundaries

that allow this relation to exist (Abbott, 1995; Donati, 2014), are important as it is these points or zones of exchange that contribute a central source of complexity to these systems (Sternlieb, Bixler, & Huber-Stearns, 2013). Similarly, the change and disturbances in the environment are not magically transferred to the system (Gerrits & Verweij, 2015), nor does a system's environment simply impact on the system (Kauffman, 1993). Rather the boundary, the point of interaction or relation, is seen as an interface, mediating the transactions, and mechanisms of interaction, consequently participating in constituting the system.

It is easy to fall into the trap of thinking of a boundary as something that simply separates one thing from another (Cilliers, 2001). Concepts of boundaries can overemphasize the static or descriptive aspects (Cadenasso, Pickett, Weathers, & Jones, 2003), indeed a more classical or Newtonian, mechanical science built on closed systems has trivialised the nature of boundaries, focussing on them as inherent separations and as easily identifiable (Richardson, 2005; Richardson & Lissack, 2001). As Cilliers (2001) argues, system boundaries are complex and therefore we require a critical appraisal in their use since it affects our understanding of such systems, and influences the way in which we deal with them. As a number of theorists suggest we should rather think of a boundary as something that constitutes that which is bounded. This shift will help us to see the boundary as something enabling, rather than as confining (Cilliers, 2001; Zeleny, 1996). As Richardson (2005) notes, the field of complexity studies, suggests that there may be no real boundaries, but rather there are distributions of boundary stabilities, that give rise to the structural and functional dispositions and process of systems and their components (their internal discernibility). Boundaries can simply be seen as sites of difference neither closed or static (Abbott, 1995).

Fields of study from which current service research and theory is drawing from, also suggest that the conceptualisation and understanding of boundaries are important in advancing research. As Valkokari (2015) argues, the management field requires an understanding of the different types of ecosystems and how they interrelated, as the interaction between different types of ecosystem is an unexplored area. Similarly, Furnari (2016) suggests that within the institutional theory literature, theories of institutional change have paid limited attention to the ways in which relations between institutional fields might facilitate or hinder institutional change (Furnari, 2016). Fligstein and McAdam (2012) likewise argue that the questions "how do we understand field boundaries and the ways in which they change?" And, "how do the relationships between fields (systems) affect stability and change?" Are central to furthering

our understanding of fields in the social world. Fligstein and McAdam (2012) go as far as to suggest that the ties between fields, constitute one of the main sources of change and stability in all fields.

This discussion leads to the purpose of this paper, to provide a theoretical tool that helps us conceptualise systems boundaries in order to allow us to build stronger conceptions of the nature of service systems and the interactions of their actors, while allowing us to broaden our analysis of the interdependence and interaction of coupled systems. Such a conceptualisation needs to provide a dynamic and interfacing or mediating concept that provides insight into the complexity of boundaries between complex systems. By definition complex systems are impermanent, their boundaries, therefore, must be considered always in flux and edges in change (Porter & Córdoba-Pachón, 2014). Therefore boundaries are better seen as transitional zones connecting the properties of one system to others in its environment. As systems approaches in service research require us to 'zoom out' in our in understanding of change and stability, we need to ensure that we go beyond 'focussing on the internal workings of systems, depicting them as largely self-contained, autonomous worlds' (Fligstein & McAdam, 2012, p. 18). To this end we turn back to the useful metaphor/model/concept of natural ecosystems, which has inspired the ecosystems concepts in social and economic systems (Mars et al., 2012), to draw on their explanatory properties, specifically the notion of ecotones to inform our conceptualisation. Ecotones represent a boundary concept that has provided explanatory success in addressing natural systems. Consequently as Weber and Hine (2015) and Lewin (1999, p. 199) suggest, biological ecosystems and social-economic systems "share some fundamental properties" as mechanisms due to their underlying structure as complex adaptive systems.

Ecotones as a conception of transitional zones

Ecologists argue that boundaries are ubiquitous and important in nature, particularly through the way they differentiate habitats and organisms, regulate the transfer of material, organisms or information and generally affect neighbouring systems (Post, Doyle, Sabo, & Finlay, 2007; Taylor, 2010). Boundaries between ecosystems form in response to topographical, hydrological, geological, or climatic variation in a landscape disrupting continuity and contributing to separate groups of species and composition and interactions within these groups (Kolasa, 2014). Ecotones are commonly defined as the transition zone between adjacent

ecosystems (Holland, 2012). The term has a strong grounding in ecology and geography, among other natural sciences, emerging in the work of Clements (1905) and Odum (1971) who addressed a transiton between two or more diverse communities as, for example, between forest and grassland. Ecotones do not simply represent a boundary or an edge; the concept of an ecotone assumes the existence of active interaction between two or more ecosystems with properties that do not exist in either of the adjacent ecosystems (Lidicker, 1999; Odum, 1971). Ecotones frequently support comparatively large amounts of diversity, activity, and tension—a phenomenon known as the edge effect (Strayer, Power, Fagan, Pickett, & Belnap, 2003). These edges often support and feature the nature and the inhabitants of the overlapping systems, but also have their own unique array of characteristics including inhabitants or species that are restricted to the ecotone (Odum, 1971; Turner, Davidson-Hunt, & O'flaherty, 2003). Ecotones have four overarching characteristics (Seidman, 2009) diversity, resilience, tension and adaptation, which are the drivers of edge effects (considered in Table 1). These characterisitcs emphasise boundary dynamics; how boundaries affect the exchanges or redistribution of resources, and inhabitants between unique landscapes; and how these transfers can, in turn, act to change the location and nature of boundaries and the properties of the ecosystems (Gosz 1991, 10). The original work of Clements (1905) and Odum (1971) focussed on competition between adjacent systems and Seidman (2009) notes that the etymology of ecotone is from the Greek—eco meaning house, and tonos, meaning tension. In addressing CAS the recognition of tensions and their role in de-structuring and restructuring systems is central (Buckley, 1968). It is this tension along with the diversity present in ecotones that leads some authors to propose that ecotones are the centres of evolutionary novelty (Kark, 2013).

Table 1 Characteristics of Ecotones

Characteristic	Description	Reference
Diversity	A high level of variation of communities and individual species, including species that are unique to these zones of transition. This also leads to increased diversity of interactions and their complexity of interaction	(Décamps & Naiman, 1990)
Resilience	Ecotones are often considered instable and transitional. Ecotones can serve as buffer zones potentially conferring stability to adjacent systems by mediating the impacts of interacting systems Their mediating role and diversity provides the ability to reassemble resources and activities in ways that enable	(Delcourt & Delcourt, 2012; Walker, Holling, Carpenter, & Kinzig, 2004)

	their adjoining systems to continue to work despite disruptions. The increased diversity and strength of direct relational interactions found in these areas provides increased flexibility	
Tension	The increased diversity in these zones and the stress imposed by a number of systems means these areas are areas of increased energy The intersection of different areas of life create 'complex zones' where action is governed by perpetual tension.	(Décamps & Naiman, 1990; Murray, 2010; Odum, 1971)
Adaptation	Ecotones are often seen as the centres of evolutionary novelty and as indicators of changes that may move through the landscape of ecosystems. The unique pressures in these areas and the diversity of resources and interactions act as generative mechanisms of adaptation.	(Kark, 2013; Risser, 1995)

As a number of authors have argued principals and tools from natural ecosystems provide new ways to understand the properties of social and economic systems (Mars et al., 2012; Weber & Hine, 2015). Our discussion suggests that ecotones provide a useful concept to take forward and utilise in understanding service (eco) systems. As Abbott (2005) argues, we need to understand fields not as disconnected, but as 'linked ecologies'. Similarly, Furnari (2016) argues that we need to systematically theorize the relations linking fields. We therefore propose ecotones as a framework which through translation and contextualisation into the service (eco) system conceptualisation becomes an effective way to think about dynamic, constituting boundary zones. In the next section we undertake this translation by drawing on relevant fields informing the development of service (eco) system concepts.

Structuring the concept from insights of other frames of reference

There are clear differences between natural ecosystems and the SEs we study (Mars et al., 2012). While there are debates about parallels drawn between natural and social ecosystems, there is conceptual value in utilising the remarkable properties of ecosystems as a theoretical framework with which we can interpret social structures, such as SEs (Barile et al., 2016; Lusch, Vargo, & Gustafsson, 2016a; Mars et al., 2012). Therefore, the task is to take the basis of the

ecotone concept and translate its underlying properties into parallel and theoretically useful properties in the service systems we analyse. We specifically put forward service ecotones as the complex interactional and transitional zones formed by the intersection of relational, technological and institutional boundaries that separate functioning and coherent SEs. The preceding discussion highlights that the 'edge effects' found in the diversity of landscapes, resources and actors or inhabitants and their interactions are the basis for understanding ecotones. Therefore, we focus our efforts on the translation of these factors to structure the conceptualisation of the service ecotone concept.

Unique Landscapes

In ecology, landscapes are the varying topological features, differences in natural materials such as soils, vegetation and fauna etc. and supporting features such as climate which distinguish natural spaces (Décamps & Naiman, 1990). It is the resulting gradient changes that connect these separate landscapes that form ecotones (Décamps & Naiman, 1990). Taking the basis of this conception we can understand social fields (SEs) in a similar manner, recognising that these fields are landscapes, topologically constructed of fiat (human-demarcated) symbols and conceptual distinctions made by social actors to categorise objects, people and practices including institutions and the more material relations that organise networks of individuals (Sternlieb et al., 2013; Vandenberghe, 1999). Greenwood and Suddaby (2006) suggest the boundaries of fields, the identities of field members, and the interactions between field members are delineated and maintained by shared institutional logics. As Lusch, Vargo, and Gustafsson (2016b) suggest, even though SEs are inherently dynamic, stability emerges as part of an institutionalization process and shared intentions become norms that serve to constrain and enable actors. Similarly, a number of social theorists have recognised that we find boundaries or gradients manifesting in different landscapes of social spaces constructed by distributions of difference material and nonmaterial phenomenon, e.g. those resources, relations and institutions and purposes that characterise different groups, cultures and areas of social life (Lamont & Molnár, 2002). The relationships or intersections between social fields creates complexities (Smets & Jarzabkowski, 2013) and boundaries exist as complex zones of tension and conflicting purpose and logics (Murray, 2010). For example, Villani, Rasmussen, and Grimaldi (2017) address the coming together of universities and industry fields, recognising the cultural, institutional and regulatory differences that serve to separate these fields (Bruneel, d'Este, & Salter, 2010). Similarly, the boundaries between politics and science are a common identified

area of tension as the relations between two very different landscapes shaped by values, culture, institutions and practices (Guston, 2001). Boundaries are therefore discontinuities or gradients in interactions and properties (Abbott, 1995).

The coherence of a SE exists in the shared and dynamic institutional arrangements and common aim towards value creation characterised by shared resources, technology, social networks and organisational ties which forms the structure and function of SEs (Lusch et al., 2016b; Taillard et al., 2016). Here we find underlying symmetry between natural ecosystems and SEs as both have structural based and functional based boundaries (Post et al., 2007). SEs are bounded, however permeable and transitionary these boundaries are, by their differing institutional rules and regulations, values, norms and practices and different informational and technological features (Sarkis, 2012). We can provide a simple example, drawing on Valkokari (2015) and furthering the of universities and industry fields focus of Villani et al. (2017), in looking at business and knowledge ecosystems, representing unique service (eco) systems, in Table 2.

Table 2: Business Ecosystem and Knowledge Ecosystem (adapted from Valkokari, 2015)

	Business Ecosystems	**Knowledge Ecosystems**
Function of Ecosystem	Focusses on market and social resource integration to co-create unique value with customers and stakeholders	Focusses on knowledge exploration
Relationships and Connectivity	Business relationships, both competitive and co-operative, that facilitate value co-creation	Decentralized and disturbed relationships built around knowledge exchange
Actors	Social-economic actors focussed on market exchanges	Research institutes, technology entrepreneurs, NGOs and governmental agencies and Universitites.
Logic of Action	Resource integrating practices and institutional logics that enable and constrain interactions.	A large number of actors that are grouped around knowledge exchange or a central non-proprietary resource for the benefit of all actors

Different ecosystems have unique actors (or species), roles, relationships and interactions taking part in fields, landscapes or spaces characterised by different symbolic, conceptual and material typographies. This leads to our second key aspect, unique species.

Unique Species

While ecotones often harbour or support the species of different ecosystems they often support and give rise to their own unique species. Recently Weber and Hine (2015), have referred to the inhabitants of business ecosystems as Technospecies - an organisation consisting of a distinct combination of routines capabilities and technology. A number of researchers have recognised the roles of different species and the importance of understanding the roles these different actors play in ecosystems. Examples include, keystone species (Iansiti & Levien, 2004), flagship species (Kim, Lee, & Han, 2010) and organizational species barriers (Gaba & Meyer, 2008). An important part of the ecotone concept for SEs would be understanding the unique actors or technospecies that exist within, and facilitate interaction in, these transitional zones between the boundaries of SE. There is a number of streams of literature that support such a conceptualisation and point to the importance of understanding actors who inhabit transitional or boundary zones.

Literature usefully grouped under the umbrella term "transboundary organizations", examines boundary organizations, intermediaries and bridging organizations (Sternlieb et al., 2013). Although these organisational types have been used both interchangeably and intentionally to demarcate, the literature suggests they represent a type of organisational species (Berkes, 2009; Sternlieb et al., 2013; Villani et al., 2017). These actors represent unique species who by virtue of the social spaces they inhabit preform unique functions and roles (Guston, 2001). Transboundary organisations serve to mediate relationships between distinct fields. These actors exist between two social worlds interacting with both sides of the boundary utilising unique resources that facilitate this role (Carr & Wilkinson, 2005; Vakkayil, 2014). As Guston (2001, p. 403) notes, transboundary organizations "perform tasks that are useful to both sides and involve people from both communities in their work but play a distinctive role that would be difficult or impossible for organizations in either community to play". Additionally, Vakkayil (2014) describes boundary objects as resources that allows actors from different fields to interact. Transboundary organisations therefore provide access to diversified resources and provide opportunities to facilitate organisational learning and generation of new resources (Berkes, 2009). Returning to addressing the coming together of universities and industry fields, Villani et al. (2017) address the role of intermediary organisations such as Technology Transfer Offices, University Incubators, and Collaborative Research Centres as facilitators across

resource and knowledge systems, serving to co-produce resources, sense making, learning, collaboration and conflict resolution. Additionally, Powell and Sandholtz (2012) address 'Amphibious Entrepreneurs' who cross boundaries influencing disparate social worlds and contributing to the emergence of new forms of organisation by carrying practices and assumptions across domains.

Similarly, studies in institutional theory also suggest the importance of organisations that occupy structural positions that bridge multiple institutional logics or find themselves at points of institutional complexity and tension (Thornton, Ocasio, & Lounsbury, 2012). A number of authors propose that these organisations are able to distance themselves from existing institutions, and their constraints, and to translate or recombine practices (Battilana & D'aunno, 2009; Leca, Battilana, & Boxenbaum, 2008; Tracey, Phillips, & Jarvis, 2011). Tensions stimulate adaptation and choices, allowing different responses to institutional pressures (Greenwood, Raynard, Kodeih, Micelotta, & Lounsbury, 2011; Greenwood & Suddaby, 2006). Similarly, Greenwood et al. (2011) suggest that organisations near the periphery of institutional fields are less caught by institutionalized relationships and expectations. While these studies address the positional and structural aspects of actors, Furnari (2014) recognises that there are spaces in which actors from different institutional fields can 'enter', allowing them to temporarily break free from the existing institutions of their respective fields and experiment collectively with new activities and ideas.

Going Forward

Recognising that there are complex zones of tension and gradients between social systems and fields, areas in which unique actors or species exist as mediators between different fields and unique spaces in which actors interact away from their typical fields, the translation of a service ecotone is a viable conception. Indeed it seems that 'edge effects', the diversity, activity, and unique features found at the boundaries of different landscapes, can be seen as important properties for understanding stability and change in SEs. More over, we can give weight to the relations between complex systems as an important source of their dynamics and the exchanges between these systems as important functions in maintaining their viability.

The social sciences, the study of complex systems and SE research, each recognise that boundaries are not readily visible lines of demarcation (Cilliers, 2001; Gustafsson et al., 2016;

van Broekhoven, Boons, van Buuren, & Teisman, 2015). Rather as the present work suggests we search to understand points of intersection between SEs characterised by boundary stabilities and the distinctions and differences between activity and institutionally structured systems. This means understanding the delineations that form through social relations between actors, their material, technological and resource interdependencies and shared identity, norms, interpretations and purpose. These delineations allow us to find the intersections or transitional zones between SEs. Therefore we can begin to further understand tensions, whether they be institutional or material, in SEs. The service ecotone concept provides a conceptual contribution to calls to understand institutional complexity in relation to field infrastructures and the conditions of fields, and their implications for systems dynamics (Vermeulen, Zietsma, Greenwood, & Langley, 2016; Zietsma, Groenewegen, Logue, & Hinings, 2017).

The complex transitional zones can be seen as areas of diversity in which actors exist who, by virtue of their position, interact with actors within separate systems and mediate the interactions between different systems. These actors exist or evolve with different roles, experience different institutional pressures, and have access to and create resources which serve to facilitate their interaction with the adjoining systems. Recognising the existence of these diverse interactional properties in these zones, service ecotones can be addressed as centres of evolutionary novelty (Kark, 2013), where the unique 'landscape' serves as a generative locality. The tensions culminating at the boundaries between SEs or fields, along with the diversity of actors and their subsequent resources provide fertile ground for change and adaptation as the distinct properties of the two systems and the ecotone, can be combined in novel ways, giving rise to new practices, resources and institutions, relationships and even actors (Furnari, 2014; Padgett & Powell, 2012). To this end, service ecotones may provide an important area of analysis through which self-organisation in SE is stimulated as producing new dynamic or properties on the 'edge' of the SE which may ripple up from micro-interaction to create new macro-level orders. For example, ecotone interactions at the boundary between knowledge and industry ecosystems may result in the establishment of new technology and subsequent practices that eventually redefine industry standards. Similarly ecotones may be core to understanding co-evolution between SE. These zones may be used to explain how the interaction between systems and environmental influences become part of the system's structure entering through these permeable boundaries. Utilisation of the concpet should be grounded in providing insight into the role this boundary zone (the service ecotone) plays in transmitting, transforming, amplifying, absorbing or reflecting the material, energy etc. that define the systems exchange.

Going forward one must examine how service ecotones affect the composition, functions and nature of their adjoining systems. This means; 1) identifying these spaces in relation to SEs, finding the changing social typographies which characterise the meeting of different field/service structures; 2) addressing the edge effects associated with these spaces, the diversity of landscape, resources and actors, that form at the boundaries of SEs, and 3) determine the impact service ecotones have on their constituting SEs. A central point of future research will be understanding the specific functions of service ecotones in the interactions and flows between the systems and their environments in different contexts and at different times. Together explorations of the preceding points will allow ecotones to provide explanatory insight into the relationships between service systems and their environment, responding to the questions "how do we understand field boundaries?" And, "how do the relationships between fields (systems) affect stability and change?" (Fligstein, 2013; Fligstein & McAdam, 2012).

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