

The university as an adaptive resilient organization: A complex systems perspective

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Abstract

This chapter provides an alternative conception of universities and the higher education systems in which they operate in an attempt to comprehend the ways in which such institutions and systems adapt and maintain themselves over time. Conceptually, it builds on complex systems theory, most notably critical insights from the study of complexity. We base our empirical analysis on developments across the European continent in the light of recent efforts to modernize university systems in the context of rising competition and pressures towards vertical and horizontal differentiation. We contrast two models of the university – strategic vs. resilient – and critically reflect on the implications their differences have for the development of systems and universities and future research work in the area.

1. Introduction

There has been a tendency in the extant literature on university systems to adopt reductionist (linear) perspectives whilst tackling the complexity inherent to both institutions and the systems in which they are embedded. We argue that this rather linear and rationalistic posture not only misrepresents what the university is all about as an entity/system, but, more importantly, has

the potential for destroying universities' inbuilt capacity to respond to external demands and circumstances, i.e. to be resilient in the context of a rather volatile external environment. In this chapter we provide new insights on approaching the university as a resilient organization by viewing it from the perspective of a complex adaptive system.

Our primary aim is to provide an alternative conception of universities and the higher education systems (HE) in which they operate in an attempt to comprehend the ways in which such institutions and systems adapt and maintain themselves over time. Conceptually, we build on complex systems theory, most notably critical insights from the study of complexity (Byrne & Callaghan, 2014; Duit, Galaz, Eckerberg, & Ebbesson, 2010; Morçöl, 2013; Room, 2011; Sawyer, 2005). Complex systems literature takes as a starting point that systems are more than the sum of their individual parts, and thus rejects reductionist approaches to science. In so doing it moves away from a physics-inspired model of understanding, and instead turns towards a biology-based one, that is, the laws of physics are replaced with the dynamics of evolution (Room 2016). Systems, biological or otherwise, evolve because they adapt to emerging circumstances, gaining new properties which either enhance or constrain their maintenance (survival) over the long run. As a process, evolution “is a thick and tangled bush of branchings, recombinations, transformations, and sequential path-dependent trajectories” (Padgett & Powell, 2012, p. 2). Recently this literature has been applied to social scientific phenomena such as organizations and markets (Padgett and Powell 2012), public policy and institutions (Morçöl 2013, Room 2011), sociology (Sawyer 2005), and governance systems (Teisman et al 2009), but little has been done with it in the field of HE. Complex systems are non-linear, dynamic and are characterized by many sub-entities and multiple connections or linkages between them (Morçöl, 2013), and thus describe well the university and its environment. In so doing, we make a parallel between the university and biological entities, like coral reefs, since both are multi-level systems, i.e. both are actors as well as function as arenas for other actors (Brunsson & Sahlin-Andersson, 2000).

Empirically, we base our analysis on the European continent in the light of recent efforts, on both national and supra-national levels, to modernize university systems in the context of rising competition and pressures towards vertical and horizontal differentiation. Both internally (through management) and externally (through policy pressures), the university is becoming more tightly coupled so as to embody the role of a strategic actor that rationally creates and

follows strategic plans (Pinheiro & Stensaker, 2014). Very often this results in ‘unintended consequences’ or other empirical puzzles. In contradistinction, we present a model of the university as an adaptive resilient actor, one which behaves more according to biological models of evolution and niche-seeking than to Newtonian physics. Complex systems theory thus provides an alternative way to answer the fundamental question of what a university *is* and how *it evolves* over time. In this chapter we begin by demonstrating how those external pressures can be seen from the perspective of complex systems theory, and how the latter can be used to make better sense of the HE system. Following that, we present two stylized models of the university; strategic actor vs. resilient actor. Finally we reflect on how a complex systems perspective can reframe current thinking on the university and HE system in a way that allows it to better address its varied and multiple missions.

2. Complex theory for higher education systems

Over the past decade, complex systems theory has been making its way in to the social sciences (Urry, 2005). While in general parlance complexity is often used a negative descriptor, i.e. something which blocks our understandings of how things work, complex systems theory attempts to reverse that and provides a set of conceptual tools which allow sense-making and analysis of phenomena that are seemingly chaotic.

There is not a comprehensive theory of complex systems, rather there are a broadly accepted set of interrelated concepts (developed in biology, chemistry, physics, and information science) that are the building blocks upon which such a theory may eventually rest (see Mitchell 2009 for a broad overview), but even as isolated concepts they are powerful and revealing. Moving from the hard sciences into social sciences requires translation, and this process is fraught with challenges (see McLennan 2006, pp. 139-155), particularly the tendency to use these concepts metaphorically, which can divorce them from their findings and hence possibly meaningfulness and validity.

A system is thought to be ‘complex’ when it cannot be fully described through its individual components due to the non-linear nature of the interactions amongst them. Simple systems are composed of a few entities with a few linkages or connections between these entities; complicated systems have more entities and linkages but can still be explained in a linear model of causation. In contrast, complex systems possess many sub-entities and multiple connections

or linkages between them that cannot be reduced to linear interactions; instead they are dynamic and co-evolutionary, and show traits of emergence and self-organization (cf. Padgett and Powell, 2012).

Understanding a system as complex also precludes several things. First, it undermines the idea that policy is an intentional act by the government or the university administration. Complexity means not only that there are multiple actors with fragmented power to act, but also that intentionality is ambiguous. Drawing on Luhmann (2012), we can argue that there is a horizontal configuration between policy and HE systems, which can communicate but not control each other (Young et al 2016). Second, it challenges the idea that reductionism and linearity can be used to analyze public- or university- policy. In other words, the outputs of the system cannot be fully explained by the inputs, and the simplest solution is not necessarily the best/trupest solution. This is counterintuitive both to positivist science as well as to a conventional view of governance.

Insights from the analysis of complex systems, like networks (Owen-Smith and Powell, 2008), contend that an entity and/or entire system is complex because of two critical characteristics. First, the considerable number of sub-systems it entails within, and second, the synergies that occur as a result of the mutual interactions amongst the system's components. These elements, in turn, casts light on: a) the multifaceted nature of complex systems and the fact that they are part and parcel of a complex whole which is larger than the sum of its parts; and b) that isolating individual components – the strategy used by scientific reductionist and the linear paradigm – is problematic given the level of nestedness that exists amongst the various units, accounting for the observed outcomes.

Complexity arises in many aspects of the HE system, but our focus in this paper is twofold. First, the *internal complexity* that is a result of the multiple sub-entities; by which we mean the departments, research groups, institutes, and faculties which have at least semi-autonomous positions within the overall university structure. While these are all regulated by the university, they are also subject to numerous outside institutions and actors, particularly that of the academic profession, the discipline, and granting agencies and other principals (Pinheiro, 2015). This autonomy and matrix of control influences (see Ashby, 1957, below), is the grounding for loose coupling. Second, the *external complexity* of the competitive landscape created by economic and societal forces as well as policy initiatives. Universities must determine not only how to position themselves strategically within that landscape, but how to

adjust to the constant changes that are a result of other universities positioning and re-positioning themselves (Fumasoli, Pinheiro, & Stensaker, 2015).

Following Morcöl (2012:9), we define HE an emergent, self-organizational, and dynamic complex system where the relations amongst the actors or agents are characterized as nonlinear, with the relations amongst system elements and with other systems being co-evolutionary. There are multiple elements to unpack; here we only briefly summarize the key concepts (see Mitchell 2009, Morcol 2012 and Room 2011 for fuller treatments). To say that something is emergent, is to build on the idea that it is more than the sum of its parts, but at the same time not randomly so. Complexity theory shows us that emergent phenomena result from actions based on relatively simple rules, but producing something that cannot be reverse engineered, that is, the parts cannot be derived by deconstructing the whole. A classic example of this is the behavior of birds flying in a 'V' formation, which is formed without 'management' or 'leadership' on the part of any of them. In more technical terms we can say that there are stable patterns on a macro level, as regards system dynamics, that derive from micro level activities, but which are not explainable with a simple (linear) causal model. John Holland (1998: 7) writes that emergence "involves patterns of interaction that persist despite a continual turnover in the constituents of the patterns". The key here is that emergence is a pattern rather than an one off event or phenomenon, and this in part explicates a link between complex systems thinking and institutional theory (Padgett & Powell, 2012). It points us towards an explanation as to how institutions can retain an identity over generations of personnel turnover.

Graham Room (2011) argues that institutionalism and complex systems theory are complimentary. Institutions, i.e. sets of formal and informal rules that determine the behavior of social agents (cf. March & Olsen, 1996), show emergent properties. The structures and path dependencies observed by institutionalists can be made dynamic when coupled with complex systems theory; that is, the institutionalization which constrains individual actors (Mahoney & Thelen, 2010; Zucker, 1991), can, simultaneously, present new opportunities and enable evolution, agency, and the seeking of new niches (Room 2011). This suggests a possible response to the common critique that institutionalism, particularly historical institutionalism, fails in its ability to explain change (Peters 2012). Further, it allows us to build on the significant work treating the university as an institution that has travelled a remarkably similar path since its establishment in the middle ages in Europe (Meyer & Schofer, 2007).

Several other concepts appear in the definition that we will treat briefly here. *Self-organization* refers to the notion that systems have an internal capacity for their own organization and continuation. This is at the heart of systems theory, and seminal works by Luhmann (2012) which find their basis in biological models of autopoiesis (Maturana and Varela 1973), i.e. self-reproducing and maintaining systems, and those dealing with cybernetic theories like Ashby (1957). The university system, particularly within the ideal type of a republic of scholars (Olsen, 2007) has strong parallels to this model to the extent that it is an autopoietic system (Young et al 2016).

The second part of the definition brings in the concepts of *non-linearity* and *co-evolution*. The former describes a situation in which there is a disproportionality of effect. The term comes from mathematics, in which a rather simple equation can produce something that looks entirely chaotic when plotted on a graph (Morcol 2012: 28-32). This suggests that complexity is not chaotic, but only appears so when viewed as an output. Again this challenges reductionist approaches to social science, as tracing an effect backwards to its cause becomes problematized. Finally, *co-evolution* builds on the concept of evolution, which suggest that actors, and institutions, will evolve, undergo selection, and eventually thrive by finding niches in their environments. Co-evolution recognizes that this is a dynamic process, meaning that as one actor adapts, it enacts changes in the environment which will require subsequent adaptations. In evolution, the selection environment is relatively fixed, but in HE this is not the case; a change of one variable (e.g. regulation) leads to change in others (e.g. competition), and in that way to a reshaping of the selection environment. Co-evolution captures this dynamic by claiming that the selection environment adjusts over time (Padgett and Powell 2012): as one actor or system changes, that creates a new selection environment in which the other actors and systems must adapt and evolve so as not to face extinction.

Approaching HE as an emerging, self-organizing and evolving system allows us to investigate the complexity inherent to the system as a whole rather than investigating its constituent parts in isolation, as is often the case. This also implies that, albeit certain parts of the system can be held together by design (through policy), the broad dynamics of the system, including its evolutionary path, are beyond control (Walker and Salt 2006). At the micro level, this phenomenon is similar to that of organized anarchies where no single actor is in charge or has an overview of what is going on across the organization (Cohen, March, & Olsen, 1972). By allowing the system to emerge and evolve rather than trying to steer it into a given direction or predisposed outcome, self-adaptability to new environmental dynamics is enhanced (Room,

2011). This, in turn, increases the system's ability to overcome or absorb major disturbances, resulting in enhanced resilience, i.e. "the ability of a system to absorb disturbance and still retain its basic function and structure." (Walker & Salt, 2006: 1)

2. The quest for differentiation: the university as a strategic actor

The traditional view of universities as organized anarchies (Birnbaum, 1988) has recently been contested as a result of increasing formalization and rationalization (Ramirez and Christensen, 2013), largely as a result of the rise of managerialism in HE (Berg & Pinheiro, 2016). Universities are, more than ever, seen as accountable for their own actions and responsible for their destinies, including the ability to operate efficiently in a competitive market place (Olsen, 2007). Universities face strong policy pressures for two types of differentiation: *vertical*, which calls for stratification based on quality (i.e. excellence) and *horizontal*, which calls for diversification of missions. For the most part, universities have embraced vertical differentiation, through rankings, indicator based management, scoreboards, and excellence initiatives (Huisman, Meek, & Wood, 2007; Pinheiro & Stensaker, 2014), but in large part have resisted horizontal differentiation.: "From the point of view of a system theory of functional differentiation one can argue that the university as a modern institution can be characterised by over-complexity and under-differentiation (Enders and de Boer 2009: 174)." Rather than leading to differentiation, universities have continually added on new functions and units, resulting in what Clark Kerr (1963) termed the "multiversity". Why has one form of differentiation succeeded while the other seems to have had more limited effects?

In Europe, excellence initiatives (Langfeldt et al., 2013) and the logic of excellence embedded in EU programmes such as Horizon 2020 (Young, 2015) are rooted in the idea that it is better to have a few excellent universities and others that are less prestigious, rather than having a more even distribution of quality. Particularly in Northern Europe (Germany, the Nordics, the Netherlands), this is a radical change for a system that had previously been highly egalitarian in both inputs and outputs (Geschwind & Pinheiro, 2017). The vertical differentiation has largely been built on a common model or organizational archetype, namely the research-intensive university with an entrepreneurial bent (Pinheiro & Stensaker, 2014). The model is defined not on the input side, but rather, as the only means by which to meet the output characteristics that allow an institution to be grouped with others that are considered "world-class". This model is driving both comprehensiveness of mission and homogeneity. Though

there are a limited number of institutions that could meet these conditions, nevertheless, there is a broad trend of attempting to compete for this status regardless. An example of this can be seen in the recent trend to amalgamate or merge existing institutions to enhance their fit with the archetype, and thus survivability in an increasingly competitive market place (Pinheiro et al. 2017; Kyvik & Stensaker, 2013). In this context, *size* (more so than variety) is seen as a precondition for market success, despite the fact that in ecological systems the reverse is often the case, i.e. smaller but more diverse organisms tend to adapt faster, making them more resilient (Walker & Salt, 2006).

The mission stretching that is part and parcel of being a more complete institution that addresses a multiplicity of societal demands also can be a threat. According to Enders and de Boer (2009: 166):

“this also makes the university a rather vulnerable institution that tends to be overloaded with multiple expectations and growing demands. The mission impossible of the modern university is that it means too many things to too many and too diversified stakeholders. Overload becomes endemic as growing and multiplying expectations seem to follow erratic public ‘issue attention cycles’.”

The strategic actor conception of the university rests, amongst other things, on a particular model of competition and understanding of how the competitive environment shapes an institution’s behavior. As institutions increasingly follow a common archetype, competition is head on, i.e. all institutions are competing with each other, not just those that belong to their particular type or niche. This competition is supported and promoted by a neo-liberal policy trend across Europe, and while the aim of introducing competition is often benign, i.e. pressuring institutions to improve themselves, the result is less so: in fact, some become winners and others losers. This type of vertical differentiation is increasingly part of policy objectives, but taken to the extreme, the model leads to organizational closures, or what Schumpeter (2012) termed ‘creative destruction’.

Ongoing structural changes in the internal fabric of universities, in large part as a result of managerialism and mission stretch, tend to focus on improving short-term efficiency or optimization at the expense of long-term adaptability and, hence, resilience. This, in turn, has created a mismatch between fast paced external dynamics and universities’ abilities to address them. This situation is made more acute by the construction of a European-wide policy environment substantiated in competition and quasi-markets (Olsen and Maassen, 2007) that

instead of enhancing horizontal diversity seems instead to be constraining it. From a complex systems perspective, a less diverse HE system (i.e. fewer forms or types of institutions) may result into an overall decline in the system's ability to address unexpected events or external shocks, i.e. a reduction in its overall levels of resilience. A less resilient system or environment will, in turn, negatively affect the institutions (their ability to adapt and evolve) that are tightly nested in it.

3. The resilient university: key features

Resilient organizations and institutions tend to buffer themselves from environmental constraints, such as external attempts for co-opting internal goals, structures and resources (Selznick, 1966). This, however, does not mean that they do not change or adopt. To the contrary, it means that they are capable of doing so while keeping their inner core (functions, proposes, identity, etc.) intact. In this respect, resilience can be seen as the flexibility to adjust without crossing thresholds of identity (Walker and Salt 2006), that is the degree of change that is possible before becoming something entirely different. In many respects, the history of the university as an institution, going back to the medieval era, is an example of resilience in the face of enormous socio-economic, political and technological changes (Frank & Gabler, 2006; Rothblatt & Wittrock, 1993). However, despite this, the university remains a unique and recognizable type of institution. It has not been pushed beyond its thresholds.

That said, recent policy initiatives, both inside and outside the university, pressure it to become more like a business and/or instrument of the government for economic purposes. Both of these trends threaten to push it over a threshold, one that would cause its demise as an *institution*, i.e. an enduring collection of rules and organized practices (Olsen, 2007), although not necessarily as an organization, i.e. a set of structures and activities aimed at accomplishing pre-determined goals (for a discussion see Scott, 2008). Following earlier work by institutionalists like Maassen and Olsen (2007) and Krücken (2003), amongst others, our aim here is to identify key features of the university that allow it to maintain resilience. The burgeoning literature on systems thinking and complexity (Meadows & Wright, 2008; Morçöl, 2013; Room, 2011; Stroh, 2015; Walker & Salt, 2006), sheds light on three critical features directly associated with a system's ability to foster resilience: *slack*, *decoupling* and *requisite variety*.

Slack

We conceive of slack as pertaining to repositories of redundant resources, human or otherwise, at the disposal of organizational actors. In an attempt to enhance internal efficiency, managerial efforts to handle increasing environmental complexity are, more often than not, geared towards reducing rather than embracing slack. Following systems theory:

“Being efficient, in a narrow sense, leads to elimination of redundancies – keeping only those things that are directly and immediately beneficial... Though efficiency, per se, is not the problem, when it is applied to only a narrow range of values and a particular set of interests it sets the system on a trajectory that, due to its complex nature, leads inevitably to unwanted outcomes... A drive for an efficient optimal state outcome has the effect of making the total system more vulnerable to shocks and disturbances.” (Walker and Salt 2006: 7, 9)

Thus, if slack depends on the existence of an internal repository of redundancies (per the definition adopted), the reduction of the latter would imply an overall decline in slack within the organization. Organizational scholars like Thompson (1967) conceive of slack as a strategic resource in protecting organizations from environmental influences, thus being associated with ‘buffering’ mechanisms (Selznick, 1966). From an evolutionary perspective Bourgeois (1988: 30) contends that slack provides “that cushion of actual or potential resources which allows an organization to adapt successfully to internal pressures for adjustment or to external pressures for change in policy as well as to initiate changes in strategy with respect to the external environment.” Sharfman et al. (1988: 603) go one step further in linking slack to efficiency while stating that, there is an optimal level of slack, with performance likely to decrease in situations where there is an abundance of slack. From a functional perspective, slack refers to the fulfillment of certain functions by a given sub-system(s) or functional group: “workers’ perform the same [internal] functions, but in different ways.” (Walker and Salt 2006: 71). It is associated with resilience in the sense that it enhances the system’s range of responses (variety) to external disturbances. For example, when compared to Caribbean coral reefs, Australia’s great barrier reef has been found to be more adaptable or resilient to emerging events like global warming since it possesses a greater number of functional groups (species performing similar functions in the ecosystem), which, in turn, helps enhancing its repertoire of responses (ibid. p. 72).

From a system’s perspective, the literature refers to three critical factors in the development of organizational slack: a) exogenous conditions, e.g. competition or changes in regulations; b) the endogenous characteristics of the organization, e.g. size or age; and c) the values and beliefs

of influential internal actors or political coalitions (Sharfman et al, 1988). Earlier studies found a direct relationship between slack, as a function of the extent to which resources are allocated to either external (market) versus internal elements of efficiency, and the degree of environmental response; with internal orientations resulting in negative effects (Cheng & Kesner, 1997). Studies investigating the interplay between organizational slack and risk-taking suggest that increases in the former appear to be followed by more risky decisions (Moses, 1992). The same study also found evidence that slack is a multi-dimensional construct, thus pertaining to more than simply resources.

Slack, either real or perceived, is often the reason for government and university reforms that promote efficiency. When it comes to internal complexity (see above), in the realm of research there are ongoing attempts to centralize resources (people and funding) across selected/fewer research groups in the quest for enabling world class excellence (cf. Pinheiro and Stensaker, 2014). Similarly, in teaching, managerialism and the rationalization that follows, is resulting in a reduction of study- seats and /or programs that are considered to be too costly and inefficient, as currently being observed in Denmark. As for external complexity, and in a number of European countries, recent governments have exerted profound changes in the managerial structures of universities, by replacing elected with appointed leaders (Pinheiro et al. forthcoming). Similarly, current science policies across Europe are increasingly geared towards a logic of “picking winners” as a means of exploiting excellence, avoiding duplication, and leveraging the societal returns on public investments (Sørensen et al 2016).

Requisite variety

According to cybernetics, a stream of systems theory focusing on the study of complex systems, *requisite variety* relates to the total number of states observed in a given system (Ashby, 1968).

“The law of requisite variety states that for every perturbation, there must exist an action to counter it...The diversity of potential responses must be sufficient to handle the diversity of disturbances. If disturbances become more diverse, then so must the possible responses. If not, the system won’t hold together” (Page 2011: 210-1).

Diversity has been found to enhance the performance of complex systems (Page, 2011). Going back to our earlier example of coral reef resilience, a key factor of why the Great Barrier Reef was found to be more resilient than the Caribbean lies on the fact that the former has more

species of fish in all trophic functional groups. These groups “play different and complementary roles in preconditioning reefs to permit the recovery of corals.” (Walker and Salt 2006: 71). In their absence, the reef’s ecosystem would lose its ability “to absorb disturbance, regenerate and retain critical functions” (ibid.).

When applied to modern organizations operating in complex environments, like universities, requisite variety postulates that the level of internal variety – in terms of structures, skills, knowledge, people, etc. – needs to match the variety present in the external environment if the organization is to survive and prosper. This view is similar to the population ecology perspective on organizations, arguing that only those organizations fit for survival – in terms of matching or addressing the environmental factors they face - are likely to prosper in the long run (Hannan & Freeman, 1989). The concept of ‘bounded rationality’ (Simon, 1991), plays an important role in this regard. Organizational actors (managers and others) face cognitive limitations as to comprehend the complexities inherent to their internal and external environments. Cameron (1984: 134) contends that given the limitations associated with adaptive (rational) strategies, the organizations themselves “will have to be designed so as to enhance their ability to adapt, aside from the manager’s specific strategies”.

There are several examples of ongoing efforts, either purposive or unintentional, that are reducing the internal diversity of universities as organizational forms. From the perspective of internal complexity, there is evidence of a willingness to close down departments that are considered weaker or which do not fit universities’ strategic and competitive profiles (Newman 2009, Hodges 2006). Similarly, with respect to external (system-wide) complexity, some governments have allowed certain institutional forms to decline and gradual fade away. Concrete examples include the university colleges in Norway, currently being amalgamated as part of comprehensive universities, as well as private universities in countries like Russia, Poland and Portugal. Comparative scoreboards and the use of indicators (including university rankings) serve rather to restrict the possible niches and through pre-planning prevent variety from emerging.

Decoupling

Traditionally, universities have been characterized as loosely-coupled entities where authority is distributed and located downwards (Birnbaum, 1988; Clark, 1983), and thus resemble organized anarchies (Cohen et al., 1972). This has created frustrations for both government and managers within universities, and, as alluded earlier, attempts have been made of late to transform the university into a more complete organization, i.e. to rationalize internal processes and structures and centralize decision making (Ramirez & Christensen, 2013). Structurally, one of the ways in which this has been exercised is by increasing the degree of coupling – from loose to tight - between higher levels strategic goals (university/faculty level) and teaching and research activities on the one hand, and amongst teaching and research activities both within and across faculties and departments (Pinheiro & Stensaker, 2014). This increasing rationalization is expected to foster efficiency gains and address external accountability concerns associated with the universities' role in society and the economy (Butera, 2000). The policy environment reinforces this trend: European policymakers have recommended that modernization “requires universities to overcome their fragmentation into faculties, departments, laboratories and administrative units and to target their efforts collectively on institutional priorities for research, teaching and services (EC 2006: 5)”.

Tighter coupling allows the university to behave as a ‘strategic actor’, that is, one which through careful self-diagnosis can determine how to strategically maximize the opportunities and minimize the threats that its environment poses (Krücken & Meier, 2006). For universities, that environment is both the real social and economic environment as well as the constructed political environment which for most public European institutions sets the conditions for funding and accreditation at a minimum. The ubiquity of strategic planning activities in the university sector is emblematic of this strategic turn (Fumasoli et al., 2015; Rip, 2004)

One of the key characteristics of complex adaptive systems is that they possess independent yet interacting components (Levin 1998, in Walker and Salt 2006: 34-5). In adaptive emerging systems, sub-components are loosely connected to one another, which enables them to respond or adapt differently to emerging circumstances. What is more, increasing interdependency within a complex system tends to lead to a decline in the system's overall levels of diversity (Page, 2011: 138-9), which, in turn, negatively affects its ability to adapt. Educational organizations, like schools and universities, have traditionally been characterized as loosely-coupled entities with little interaction between their parts or sub-units (Weick, 1976). In the case of universities, this pertains both to vertical units, i.e. the relation between the central

administration or ‘steering core’ and faculties as well as relations between the faculties and their subsequent sub-components; departments, research centers/groups, etc. Stated simply, what happens in the faculty of education does not affect the faculty of engineering, and vice versa. This structural decoupling at the system level was best captured by work on academic leadership around the concept of ‘organized anarchy’ (Birnbaum, 1988; J.G. March & Olsen, 1979). In recent years, there have been attempts to couple the internal structures, strategies and value-systems (cultures) within universities. This is part and parcel of a process of rationalization aimed at enhancing control and predictability (F. O. Ramirez, 2010), and results from external pressures for enhanced efficiency, effectiveness and accountability (Pinheiro & Stensaker, 2014).

As with slack, attempts to increase the efficiency of systems is inversely related to loose coupling. From the strategic actor perspective, tighter coupling is what enables the central core of the university to create and enact strategy (Clark, 1998). It provides both the capabilities and the legitimacy necessary to enforce change on the institution as a whole, allowing it to act as a single unit pursuing collective aims. However, the multiplicity of missions discussed above (Enders and de Boer, 2009; Kerr, 1963) as well as the bounded rationality of the central administration, means that the very definition of a collective aim must be a simplification of this complexity, e.g. moving up in global university rankings or focusing on a particular mission or type of output.

Returning to the example of the coral reef, decoupling fosters both response and functional diversity, i.e. a redundancy of actors who perform similar functions in a variety of ways as well as performing a diversity of functions, which is found in the more resilient Great Barrier Reef but lacking in the Caribbean reefs that are in danger. We suggest that these correspond to the university sub-units, departments and academics, and the emergence from them of distinct functional roles and diverse responses to the needs of stakeholders and society. Decoupling allows the internal autonomy and adaptability necessary for units to explore and find their niches.

These three concepts of slack, requisite variety and decoupling, are central to an understanding of the university as an evolving, self-regulated and complex system. Each, in its own way, addresses a particular type of diversity, which serves to maintain the resilience of the university

as a system. The table below sums up the key differences between a Strategic actor and a Resilient actor model of the university.

Figure 1: Models of university: Strategic actor vs. Resilient actor

	Strategic actor	Resilient actor
<i>Strategic interface (internal & external dynamics)</i>	Reduce/manage complexity (plan, steer, improve)	Cherish complexity (emergence, self-organization, co-evolution)
<i>Core value</i>	Efficiency	Adaptability/Robustness
<i>Use of resources</i>	Maximize resources	Allow slack
<i>Approach to internal diversity</i>	Rationalize (streamline and standardize)	Support requisite variety
<i>Locus of control and unit interdependencies</i>	Tight coupling (hierarchy)	Loose coupling (networks)
<i>Preferred modus operandi</i>	Exploitation (specialization)	Exploration (diversification)
<i>Positional objective</i>	Winning (being the best overall)	Thriving (adaption to niche and excelling there)

6. Conclusive thoughts

This paper argues for an approach that conceives of both HE and the university as complex, emerging systems that self-organize and co-evolve. In so doing, it critiques current policy and managerial approaches throughout Europe focusing on rationalization and actor-hood substantiated on strategic planning, linear thinking and on mitigating the complexities associated with both internal dynamics and external forces. Current policy and managerial approaches centered on promoting competition have resulted in a gradual erosion of horizontal diversity whilst promoting vertical differentiation. This, in turn, has resulted in enhanced short-term efficiency gains, amongst other aspects, through the exploitation of existing internal assets and competencies, in the form of resource concentrations and the tackling of redundancies. This strategic posture is in stark contrast with the inner workings of complex, evolving and self-organizing systems, which require flexibility (loose coupling), slack and (requisite) diversity as a means of fostering long-term adaptability and hence the ability to overcome disruptions. System resilience is, thus, best leveraged through the adoption of a posture geared towards the continuous exploration of alternatives. In other words, to foster resilience HE systems and universities as systems alike need to re-visit a model akin to the ‘organized anarchy’ identified

in earlier historical periods. This, in turn, necessitates the embracing of complexity, both internal and external to the university, and unpredictability, yet it does not imply the institutionalization of chaos. The reverse is, in fact, the case. Emergence and self-organization are better suited to handle a complex and unpredictable environment, minimizing possible unintended outcomes such as a decline in horizontal diversity. A key lesson of complex systems theory is not that we cannot make sense of the world, but rather that looking backwards from effects to causes as is traditionally done in science, can be deeply problematic because of non-linearity.

The horizontal differentiation that policymakers (and academics alike) claim is important, would require a more biological approach. It would entail providing universities with a greater degree of autonomy, both substantive ('what') and procedural ('how')(Schmidtlein & Berdahl, 2005), but without the strong meta-governance pressures pushing universities to conform to the competing demands of multiple stakeholder groups. Rather it would require specialization of an evolutionary type, by encouraging niche-finding (in contrast to convergence or isomorphism), which it should be noted is the flip-side to competition. Finding a niche is an evolutionary means of avoiding competition through specialization – finding an area with less competition in which to thrive. Yet, as a system, the university is deeply embedded or nested into a dynamic and complex policy environment, thus one needs to pay close attention to the ways in which this policy environment affects university dynamics and, in turn, the ways in which resilience is either fostered or constrained.

Resilience, however, is the characteristic which allows adaptivity and is therefore critical for enabling institutions to differentiate horizontally. In his seminal article on New Public Management, Hood (1991) outlines an alternative policy regime which would foster what he terms 'robustness', which corresponds to the Resilient actor model sketched out in Figure 1 above. An organizational design to maximize resilience encompasses:

“multiple-objective ... a relatively high degree of 'slack' to provide spare capacity for learning or deployment in crisis; a control framework which focused on input or process rather than measured output in order to avoid building up pressures for misinformation; a personnel management structure which promoted cohesion without punishing unorthodox ideas; a task division structure organized for systemic thinking rather than narrow compartmentalization; and a responsibility structure which made mistakes and errors admissible. Relatively loose coupling and

an emphasis on information as a collective asset within the organization would be features of such a design structure.” (Hood 1991: 15)

Given the unprecedented pressures facing European universities, in the line of the aspects pointed out above, we contend that the conditions for fostering resilient universities (and HE systems for that matter) are not being met. Without resilience, universities could be pushed over the thresholds that make them unique societal institutions, resulting in unpredictable consequences for themselves and society. It should be made absolutely clear that our argument is not against change, but rather the contention that change can go too far, and a recognition that we do not (yet) know the precise thresholds at which that happens. A resilient university model that takes into account the complexity associated with the university as an institutional form as well as the non-linear ways in which its multiple sub-components interact with its surrounding environment both embraces change and the maintenance of the unique institutional profile of the university. Future studies building on seminal insights from complexity theory could illuminate the extent through which universities as systems are co-evolving, in addition to shedding light on the emergence of new organizational forms and the ways in which these affect diversity at the system level. What is more, they could further illuminate, empirically, the link (if any) between HE and science policy (national and supranational levels) and the degree of resilience both at the institutional and system’s level.

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