A Complexity Perspective on Institutional Change: Dealing with Land Fragmentation in Galicia

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ABSTRACT

As land use planning aims at changing land use through a variety of institutions, theories on institutional change have become increasingly important to understand planning processes. Two discourses can be distinguished in institutional change, one saying that institutional change is mainly efficiency-driven and tales place in small controlled steps, the other arguing that institutional change occurs as the often unexpected outcome of a design in response to a contextual change. Some authors consider both discourses to be complementary. We wanted to improve our understanding of this complementarity, by using the case of the newly established Galician Land Bank as an example and describing its policy making process over the last thirty years. We put the policy-making process in a Complexity perspective regarding land use planning and governance, since Complexity Theory has not yet been introduced into the institutional change discourses. We conclude that each of these discourses excludes some of the phenomena in-

Social Evolution & History, Vol. 14 No. 2, September 2015 77–107

cluded in the other, and the inclusion of Complexity enables us to relate and connect the two discourses. In the Galician case, a long-term study of institutional change processes from a Complexity perspective, excluding none of the relevant phenomena, enables us to integrate the two discourses.

INTRODUCTION

In the Spanish region of Galicia, land fragmentation is weakening the structures of agriculture and thus the opportunities for rural life in such a way that there is a rising fear of a collapse of the traditional rural society of Galicia. During the last 30 years, various land use planning attempts have been undertaken by the Galician government to solve the land fragmentation problem. As land use planning aims at changing the land use through a variety of institutions, theories on institutional change have become increasingly important to understand planning processes.

In an earlier paper we concluded that land use planning in Galicia was developed to tackle negative outcomes, measured in social acceptance, of former institutional settings (Tubío-Sánchez *et al.* 2013). We discussed the question why new discourses in planning occur. We focused on two different approaches of institutional change considered complementary by Hodgson (2008).

In this current paper we continue our search and we introduce a framework based on Complexity Theory for the Galician case, to improve our understanding of the case as an example of the complementarity of the two discourses on institutional change. First we introduce the two main discourses on institutional change, which we will refer to as the efficiency-driven and design-oriented approaches. We then describe land use and the land use problems in Galicia by giving a historical overview of regulations introduced to deal with land fragmentation, which influenced the Galician public agenda on the topic and the way the perception of the problems of land fragmentation developed. We then attempt to understand the developments over time regarding the land fragmentation problem by relating them to the two discourses. Next, we do the same from a Complexity Theory perspective and we ask ourselves whether this clarifies certain features that cannot be understood with the institutional change discourses. We finally propose a new framework for institutional change inspired by Complexity Theory.

TWO DISCOURSES IN INSTITUTIONAL CHANGE, EFFICIENCY-DRIVEN AND DESIGN-ORIENTED

We define the institutions of planning as all rules and norms, formal and informal, which influence the planning behavior. Aspects of institutional change in planning processes have become increasingly important to understand such processes (Bromley 2006; Buitelaar *et al.* 2007). Kingston and Caballero (2009) and Tubío-Sánchez *et al.* (2013) distinguish two discourses in institutional change, one saying that it is mainly efficiency-driven and takes place in small controlled steps, the other arguing that it occurs as the often unexpected outcome of a design in response to a new contextual change.

In the efficiency-driven approach, social order and institutions are regarded as resulting from individual interactions. Efficiency is considered the main driver of decision-making processes in organisations and the economy. Changes tend to be incremental, as institutional improvement takes place where payoff can be maximized. This leads to development paths that do not differ too much from the existing ones. Thus, North (1990) considers institutional change as mainly happening through the accumulation of small changes by continuous marginal adjustments. North (1998) points out that competition is an important trigger of institutional change, and according to Jones *et al.* (1997) less efficient organizations will not survive in the long run. This view has heavily influenced transaction-cost economists like Williamson (2000), who argues that inefficient forms of organization cannot survive the pressure of competition. The efficiency-driven approach to institutional change has gained prominence in the planning realm in recent years. For instance, authors have discussed the development and implementation of land use policies by arguing that market competition forces a policy change towards a more efficient and productive system (Webster and Lai 2003; Zhu 2004). In this paradigm, zoning is considered an important land use policy tool (Chung 1994; Lubell *et al.* 2009; Pogodzinski and Sass 1990), used by local governments to regulate land use to achieve an efficient allocation of land use functions (Chung 1994; Lai 1997).

In the design-oriented approach, authors have stated that institutional change happens by design and is not necessarily driven by non-intentional forces like efficiency or competition. In this de-

sign-oriented paradigm, actions are based on the purposes and intentionality of actors actively influencing their environment, rather than merely surviving in the environment. The reason is that efficient coordination and control cannot deal with uncertainties that often emerge suddenly, and cannot always help organizations adapt to changes in their environment, because problems arise which simply force communities to choose and decide based on the intention to achieve desirable futures. Institutional design is therefore about collective action aimed at achieving certain futures. Seo and Creed (2002) argue that institutional changes are produced by a strong enough group of actors reacting to a major contextual change caused by conflicts or contradictions in the previous institutional setup, enabling them to leave the existing institutional pathways. Bromley (2006) describes a similar pattern, where the existing institutional arrangements cause a problem because they do not fit in with the developing circumstances, so that the agent authorities discuss and finally create new institutional arrangements to solve the problem. Bromley (2006) states that the outcome of the actions is not the result of calculation or estimation, but of a process of imagination, necessary to construct workable and socially accepted new arrangements; the outcome is established as a 'warranted belief'. In this paradigm, the outcome of the discussion is not calculated or estimated (Kingston and Caballero 2009; Tubío-Sánchez *et al.* 2012). Seo and Creed (2002) call this type of institutionalization an adaptive process as a consequence of a previous institutional setup that is unable to respond to changes in the environment, and the accumulation of tension between the institutions and the environment over time. While Bromley (2006) sees the institutions as the result of an acting power, Seo and Creed (2002) consider contradictions between institutions as very important for institutional change. Usually, the core actors in the main organization try to prevent changes (Battilana 2006), while agents in the periphery of the main organization are interested in change and look for opportunities that come up when unexpected and unexplained disorder occurs (Seo and Creed 2002). Buitelaar *et al.* (2007) developed a model of institutional change following Kingdon (1995), where external societal developments and institutional reflection can create a critical moment if developments are strong and decisive enough, through a critical juncture or institutional transformation. They state that

institutional change is often 'induced by actors and through processes originally operating at the margin of the societal arenas'.

Kingston and Caballero (2009) as well as Buitelaar *et al.* (2007) mention that the discourses of efficiency-driven and design oriented institutional change should be regarded as complementary. In our opinion, both approaches are insufficient on their own to explain the evolution of institutions in complex systems. Although their complementarity has been analyzed extensively by Hodgson (2008) and Hodgson and Knudsen (2006), the question has not been addressed why there are points in the evolution of institutions where the efficiency-driven approach is more dominant than the design-oriented approach, and vice versa. In this paper we evaluate this complementarity by developing a Complexity Theory perspective on institutional change.

LAND USE AND LAND FRAGMENTATION IN GALICIA, AN INTRODUCTION

The following case analysis was carried out following Ragin and Becker (1992). We gathered quantitative data as well as secondary qualitative data. In addition, semi-structured interviews were held with key agents in the process of legislative development. The interviewees included political leaders, such as the directors general of the Departments of Agrarian Structures and Infrastructures of the Galician Ministry of Rural Affairs, technically responsible key actors like the first Director of the Galician Land Bank, and significant academic actors like Lopez Iglesias, who addressed the issue of land fragmentation in Galicia in the early 1990s. The legal framework was also analyzed, including the definitive versions of the laws as well as various unpublished drafts that were provided by the above respondents.

Galicia is a region situated in the northwest of Spain, with a population of about 2.8 million. Population density is 93 inhabitants per km^2, and most of the inhabitants are concentrated in the coastal zone and in some larger towns. Nevertheless, the remaining inhabitants (36 per cent) are distributed across the rest of the region in numerous small villages, in such a way that Galicia as a whole is sometimes considered to be urbanized; about 50 per cent of all Spanish settlements are in Galicia (Crecente *et al.* 1999). Land use encompasses 32 per cent forested land, 25 per cent agricultural

land and 33 per cent scrublands (IGE 2011). Land is mainly privately owned and highly fragmented, since about 80 per cent is privately owned by approximately 1.6 million people who own an average of 1.7 hectares each (DGC 2010); the remaining 20 per cent is common land. Half of the population owns a piece of land. In the twentieth century, conflicts over property rights resulted in processes of fragmentation and privatization. The land structure and the farming system functioned well for centuries, with high demographic pressure and low capital and technology input. Since the 1960s, however, when the processes of substituting labour force by capital grew rapidly, the disfunctionalities and tensions became apparent. Although the number of land owners exceeds the million and a half only a small proportion of people actually manage directly their land and live nearby it. This gap has been growing sharply during the last two decades. From a traditional agricultural society with a strong social structure and a diverse and multifunctional land use in balance with the natural system, Galicia tended to change in a society consisting of some large cities surrounded by urban sprawl and a rural area consisting of abandoned villages and land and large monoculture eucalyptus and pine plantations. Especially outside the cities a dramatic loss in complexity was feared. It was only after the end of the Franco regime in the 1970s that the farming structure was increasingly felt as problematic, and multiple attempts were made to put the land fragmentation issue on the political agenda. We will describe these attempts using the time line of Figure 1, which shows the introduction of regulations to deal with land fragmentation, as well as events that influenced the Galician public agenda and the development of the perception of the problems. What steps were taken by the Galician government?

LEGISLATION

In 1978, immediately after the end of the Franco regime, the new Spanish constitution created the autonomous region of Galicia and delegated spatial planning and agricultural policies to the regions.

In 1985, Parliament passed the first Galician Land Consolidation Act, which did not differ much from the existing Spanish law, and the first Galician Spatial Planning Act. The focus was on the

devolution of power from the government of Spain to the Galician government.

In 1990, a proposal was sent to the Galician Parliament to establish a Land Bank, which included the power to expropriate non-farmed parcels and sell them to the active farmers; however, it was not approved by Parliament.

In 1997 a new Spatial Planning Act transferred the responsibility for land use planning to the municipal authorities. The act reflected an urban vision of rural land use, with regulations on how to rezone rural land into urban land, which did not protect rural land uses.

In 2001, a new Land Consolidation Act was passed by Parliament, which did not differ much from the existing one. The law did not favour the expansion of farms (Crecente *et al.* 2002) and did not transform land consolidation into a very successful instrument.

In 2002, a new Spatial Planning Act was passed by Parliament that brought a policy on rural land use adopting a rural view, different from the previous law, which considered rural land as a resource for urban development. The act was the first to address the fragmentation of rural land.

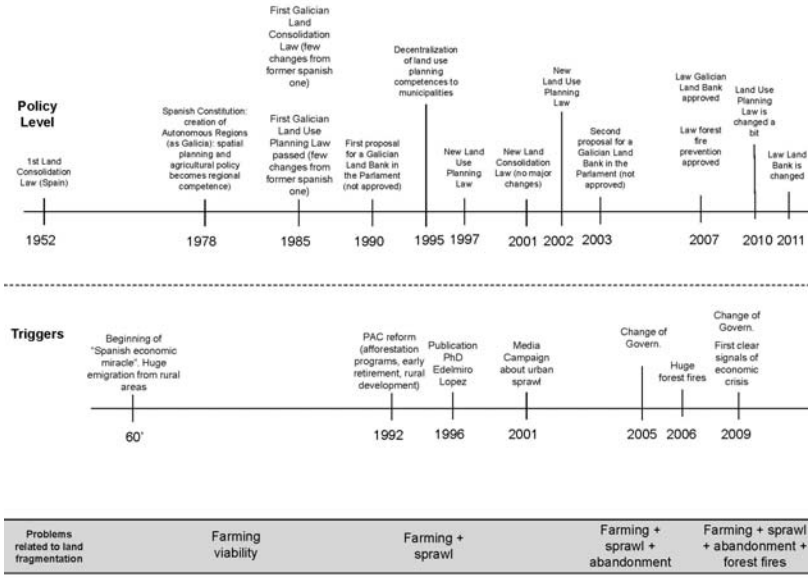

Fig. 1. Timeline of regulations and events relating to land fragmentation in Galicia

In 2003, a second proposal for a Land Bank Act was sent to Parliament, which included the idea of intervention in property rights, enabling expropriation in case of land misuse. It was again rejected: expropriation seemed to be unacceptable to Galician land owners.

In 2007 the Land Bank Act was redesigned in parallel to the Act on Forest Fire Management. The combined acts enabled the Galician government for the first time in history to intervene in land owner rights when land is abandoned, which had formerly seemed unacceptable. The Act on Forest Fire Management forbids further afforestation of arable or pasture land.

In 2011, the Land Bank Act was slightly modified, but the basic principles of the Land Bank did not change.

GROWING URGENCY OF THE LAND FRAGMENTATION PROBLEM

As discussed above, many attempts were made to deal with the land fragmentation problem in Galicia, but it was not until 2007 that seemingly substantial action was taken by enabling the government to intervene in land owner rights. What was the context?

From the 1960s onwards, the agricultural sector saw a decline in the labour force and a rapid increase in capital assets and industrial inputs. But the newly adopted production system demanded a different land structure. In the first stage, after the Franco regime, the problem of land fragmentation was only perceived as a highly unfavourable agricultural condition: rural land ownership was highly fragmented, farms were extremely small and land owners tended to keep their own land, impeding an improvement of the land use structure. Traditional agricultural and grazing uses of common lands changed and many plots were abandoned or afforested, increasing the risk of wildfires. However, since many people were moving to the cities, the problems in the rural area were not felt to be very important. Then, after the Spanish accession to the EU, the need for restructuring the farming sector increased, and new functions, mainly residential or service-oriented, became more important. Urban sprawl was beginning to emerge, and public awareness of these processes began to rise. Agrarian unions, representing professional farmers, demanded an adaptation of the institutional framework regarding land.

In the 1990s, in the periphery of policy making, PhD student Lopez-Iglesias started a debate on rural land use. In his thesis he adopted a comprehensive approach responding to the growing perception of failure of the Galician farming structure. He identified that land mobility was very low, mainly because urban sprawl and afforestation with species such as eucalyptus and pine were raising land prices, which became too high to make farming viable. Lopez-Iglesias (1996) proposed land use planning in rural areas, the two main planning principles being a zoning system for urban development, controlling land prices in areas not intended for urban development and facilitating the transfer of land to farmers. Lopez-Iglesias focused on both urban sprawl and farming structure. But his book had a limited reach at the political level and his ideas were not adopted at the time. The next year (1997) saw attempts to improve the farming structure and land mobility by creating a Land Bank, which became a central element in the electoral programme of the Nationalist Party (BNG). However, the party did not get enough electoral support.

In 2001, a public campaign was initiated by the main regional newspaper *La Voz de Galicia.* It was led by some architects and planners who wanted to make Galician society aware of the problem of generalized urban sprawl, including rural land, and involving housing designs very different from traditional architecture. They succeeded in increasing the public's awareness of uncontrolled urban sprawl, which became a core issue in the 2002 Spatial Planning Act (Tubío-Sánchez *et al.* 2013; Garcia Vidal 2003). Again the left-wing Nationalist Party included the idea of a land bank act as an important element in their 2005 election program. This time they won the elections, together with the Socialist Party, and became part of the new government, where they started to develop the idea of a land bank. Different options were considered during the first year of mandate: one based on raising taxes on rural land not being farmed (partly based on suggestions by Lopez-Iglesias [1996]); one based on the transfer of lands owned by retiring farmers, inspired by the example of the neighbouring region of Asturias; and one based on the buying-selling model, emphasizing a pre-emption rights mechanism. Despite a year-long intensive debate, however, no agreement was reached.

In 2006, huge forest fires devastated Galicia, burning about 93,000 hectares of forest and causing an economic loss of about 210 million Euros. Small seasonal fires were already a common feature in Galicia, but this time the wildfires became a severe threat to villages, houses and the people living in them. A total of 73,000 hectares of forest were burned in August, when the fire brigades could not manage the situation, and many homes were at great risk. This came as a shock to the Galician people. According to the President of the Galician government, forest fires had become a major challenge for Galicia, and he claimed that they were caused by land abandonment, which was partly the result of land fragmentation. Direct government action was broadly felt necessary. The debate about the three potential actions at government level was revitalized: one based on more stringent spatial planning, one based on taxes on land abandonment and one based on the principle of transfer of land of retiring farmers. The fourth option, the believed threat of the decline of the traditional Galician rural model, was the one to be avoided. The disarticulation of rural areas would lead to the increase of environmental risk of wild fires, threatening villages, monoculture production forests and natural areas. Traditional rural society in Galicia was under threat and would become less complex.

Suddenly the ideas earlier suggested by Lopez-Iglesias (1996) and some other experts became the core of a new policy. Within four months, the new Land Bank Act and the Act on Forest Fire Management were sent to Parliament and adopted. More stringent regulations regarding forestry and abandoned land were included, with measures that sought to increase land mobility and to restructure farms to combat land fragmentation. The Land Bank Act forbids abandonment of agricultural land, and stipulates that it has to be maintained in sound agro-environmental condition, either by the owner or ultimately by the Land Bank of Galicia (Banco de Terras de Galicia, Bantegal), which was created by the government. Bantegal mediates between land owners who cannot maintain their land by themselves and new or existing farmers who need more land. Both land owners and farmers negotiate directly with the Land Bank, which is responsible for reaching agreement between them. Bantegal leads the negotiation about contracts and payments, lease time – between 5 and 30 years – plot boundaries and rents, based on ref-

erence prices. The reference prices are set by a technical committee with representatives from the government, agricultural organizations and the local communities. Bantegal is also responsible for the collection of payments on behalf of the owner and the evaluation of possible property damages after the rent is terminated.

Although the Land Bank Act avoided major public intervention in private property, there was no complete consensus about the new act. In the 2009 elections, the Conservative Party (PP) made a campaign promise to drop the Land Bank Act, arguing that this was 'a communist issue'. The PP came into power and after some consideration they decided to 'keep the good things and change the bad things'. In 2010б a proposal for modification was prepared by the new government, which was passed by Parliament in 2011. Two main modifications were proposed: the first was to remove the so-called pre-emption right, which gave the government the first right to buy a plot of land when the owner intended to sell. This pre-emption right had actually never been exercised under the former act. And, second, the Land Bank was integrated in the Rural Development Agency. Despite this, the main purpose of the Land Bank and the main problems to be solved remained.

EXPLAINING THE GALICIAN CASE IN TERMS OF INSTITUTIONAL CHANGE

In the efficiency-driven approach, which was the point of view in the New Institutional Economics (NIE), the land fragmentation, considered as a problem of land mobility, is linked to land markets and thus to land transactions. Local transaction costs are determined by the combination of formal institutions such as property rights, informal institutions such as the emotional value that land owners attach to their own land (Dale and Baldwin 2000) and governance mechanisms such as land markets, policy instruments and agencies, and businesses (Sevatdal 2006; Onega-Lopez *et al.* 2010). In a given institutional framework, people search for a proper governance structure to more efficiently trigger land transactions (Onega-Lopez *et al.* 2010). NIE explains that, given the circumstances of Galician transaction costs, the Land Bank, which was established in 2007 and modified in 2011, is the best option to deal with formal and informal institutions. However, NIE does not explain everything. If a Land Bank is the best option to deal with land

fragmentation from the point of view of transaction costs, why was the Land Bank not created earlier in the 1990s when the situation was the same? The idea of a Land Bank already existed in the 1990s and was even part of the political program of the Nationalist Party. In fact, a proposal to create a Land Bank was sent to Parliament in 1990 and was rejected; and another proposal for a Land Bank was rejected by Parliament in 2003. Whereas NIE claims that the Land Bank established in 2007 and modified in 2010 is currently the best option to deal with land fragmentation from a point of view of transaction costs, a Land Bank would have been at least a very good option according to NIE in 1990 and 2003, for the same reasons, but there was no Land Bank then, and NIE does not consider this, nor explain it. NIE explains that in the current situation, the Land Bank is the better option; it does not consider and explain why it was not already there much earlier, or why it only came about in 2007 even though the ideas were there much earlier, when transaction costs were also high.

NIE also has difficulties explaining the relevance of informal institutions. In general, Boettke *et al.* (2008) state that progress always has to be 'rooted in indigenous institutional order'. Onega Lopez *et al.*, analyzing the development of the Land Bank from an NIE perspective, stress that land in Galicia is not merely considered in an economic sense, and that in Galicia in particular, land ownership has a strong emotional aspect, as was also reported by Marey-Perez *et al.* (2007) and Gimenez *et al.* (2012). Again, NIE can explain that the Land Bank is currently the best option, but its explanation neglects and underestimates emotional aspects.

The design-oriented approach to institutional change focuses on the accumulation of tensions between institutions and their environments. Uncertainties that suddenly emerge due to changes in the environment or organizations are followed by collective actions. As a result, new institutional arrangements are established to solve the problem, but the outcome is unpredictable as it is not the result of rational calculation; it is established as a 'warranted belief'. The observed time frame is relatively short; Buitelaar *et al.* (2007) refer to critical moments. The design-oriented approach to institutional change merely focuses on the moment of change, and tries to explain it from there on. The design-oriented approach to institutional change would explain the establishment of the Land

Bank in Galicia as the result of problems arising due to the ongoing fragmentation of agricultural land. Existing institutions were unable to control land fragmentation; historically and culturally, land ownership was extremely important; and only after severe and threatening wildfires did societal pressure become high enough to enable successful collective action to force the authorities to establish the Land Bank. However, this approach does not consider that at a certain moment pressure was big enough to force a change, while earlier attempts were not successful. What is the mechanism behind the change? Neither does it explain what happens after the change; is there another radical change or is there some kind of stable further development?

Both the efficiency-driven approach and the design-oriented approach can partly explain the change in land use planning institutions that we have seen in Galicia. These two approaches are seen as complementary by various authors. Can processes of institutional change be better understood if described as complex processes?

COMPLEXITY PERSPECTIVE

Complexity Science, the science studying the behavior of complex systems (Prigogine 1996; Kauffman 1993, 1995), is a relatively new and developing field of study. Going from closed systems via computer simulations of artificial life and later social systems, Complexity Science ultimately focused on open systems like networks and social systems (Axtell and Epstein 1996; Barabasi 2002), including real life. Prigogine (1986) claimed that Complexity Science, although originating in thermodynamics, is highly relevant to the social sciences by stating that people contribute creativity, leading to unpredictable and irreversible changes in human complex systems, and introduces not just physical and social components, but also intellectual components, which have to be considered. Scholars as Lansing 2003; Nowotny 2005; Urry 2006 and Liu *et al.* 2007 consider Complexity Science as the science bridging the gap between the social and natural sciences.

How do complex systems behave? Byrne (1998) emphasizes a number of broadly accepted aspects which he considers to be important for an understanding of the behaviour of complex systems. Complexity Theory considers the behaviour of whole systems.

It rejects 'the validity of analytical strategies in which things are reducible to the sum of their parts' (Byrne 1998; Cilliers 2005a). New properties emerge, making a holistic approach inevitable and necessary. Complex systems develop nonlinearly and change over time. Moreover, in complex systems, small changes in the initial conditions do not necessarily produce small changes to the system or its subsystems; they can produce huge changes and there may be many possible changes, including totally unexpected ones. Finally, complex systems develop in an evolutionary way and are not, as in Newtonian thinking, reversible in time (Prigogine 1996; Tiezzi 2003).

Prigogine (1996), Prigogine and Stengers (1984) and Kauffman (1993, 1995) have described the basics of the behaviour of complex systems. Following them, many authors from various natural and social sciences and disciplines have made attempts to describe the behaviour of complex systems by explaining individual characteristics, which has improved our understanding of the behaviour of complex systems. Although such systems have to be considered as more than a sum of their individual parts, it is nevertheless worthwhile to consider the individual characteristics in some more detail.

The order exhibited by a complex system is highly dynamic, yet such a system can remain in a stable equilibrium state for a long time – this state is called an attractor. The systems are under pressure from interactions with their environment, in that they receive new energy or information from the outside. Prigogine (1996), Geldof (2001) and others have concentrated on systems developing towards greater complexity, although they also devoted some attention to the possibility of decline. Systems change their structure slightly to adapt to these outside developments so that they can remain within their current attractor, that is the systems behave as if they are in equilibrium. While a system is in one attractor, there are other attractors (alternative states of form and operation) present to which the system can shift, but only after a shock that drives it out of its current attractor.

Every complex system, although seemingly unchanged, is likely to become unstable as a consequence of changes in its environment. There is a growing likelihood that a shift will occur in some direction at some moment. When linear and gradual adaptation be-

comes more and more difficult, the system can develop into an unstable and chaotic situation. The system goes from one state of order (attractor), through a chaotic situation, into another state of order or attractor. The change is rapid, nonlinear and chaotic, and its direction is unpredictable. However, Byrne (1998) claims that there is no endless supply of possible new attractors. Within a given path dependency, there is a limited, although often unknown, number of possible attractors.

Byrne (1998) and Harvey and Reed (1994) have addressed the bifurcation point as a very important element for the study of social systems. This is the moment where a system turns from a more or less equilibrium type of development to a radical regime change. Although 'the difference in the controlling parameters may in incremental terms be small, the outcome effect is enormous'. At the bifurcation point, the complex system changes its development route 'from simple determination through the realm of complexity within which there are multiple but limited outcome situations towards a realm of chaos in which there are very large possible sets of outcomes'. On the other hand, there is the phenomenon called deterministic chaos (Byrne 1998; Kauffman 1993, 1995) in which 'the system's successive states are not anywhere but ... are to be found within a restricted set within the range of possible solutions'.

Social system development appears to have a nested character. Systems are nested or embedded in larger systems (Teisman *et al.* 2009b). Nesting runs in all possible directions, not only top-down. At the same time, all systems and subsystems interfere with each other (Byrne 2005); observation and action by the researcher is decisive for the definition of any system. Byrne (1998) gave the example of climate change in Northern Europe. Fossil and geological evidence shows that only two types of climate regime have occurred in Europe: the relatively warm current regime and that of the ice ages. Similarly, Scheffer *et al.* (2001) showed that in shallow lakes, shifts occur between particular alternative stable states. Complex systems have a path dependency, which implies that history matters. Time is irreversible and initial conditions of a system are highly important for the system's further development (Prigogine and Stengers 1984; Tiezzi 2003). Small differences in the initial condition of two systems can force their further mutual devel-

opment in a totally different direction. Geldof (2001) gave the example of canoeing downstream on a river and approaching a point where it splits in two. Little energy is needed to choose one direction, but after the bifurcation point has been passed, a tremendous effort would be needed to canoe back and take the other direction.

COMPLEXITY SCIENCE AND SOCIAL SCIENCES

Complexity Science has been accepted by researchers in a wide range of social scientific disciplines, including organisation, innovation, governance, and planning. Organisation Science can be regarded as one of the early adopters, focusing on nonlinear interactions between and within organisations (Anderson 1999; Plowman *et al.* 2007), leadership (Vicenzi and Adkins 2000; Artigani 2005; Mason 2007), discontinuous workflow (Hodgson 2004; Geraldi 2008) and turbulent environments (Geraldi 2008; Kelly and Stark 2002). Although Organisation Science devotes much attention to self-organisation and thus to change, or more particularly the moment of change, Gersick (1991) was already aware of 'an alternation of long periods when stable infrastructures permit only incremental adaptations and brief periods of revolutionary upheaval'. The literature on innovation, for instance Ayres (1994), Stacey (1995), Macintosh and Maclean (1999), Cheng and Van der Ven (1996) and McCarty *et al.* (2006), describes processes of new product development as complex adaptive systems, partly linear and partly chaotic, showing nonlinear, self-organising and emergent properties. The innovation literature focuses not only on the moment of change, but also examines the periods before and after the change. Many authors have described breakthroughs and maturation periods in product development (Tukker and Butter 2007; Kash and Rycroft 2002). Much attention has also been given to the drivers of innovation, such as technical developments, growing competition, new consumer needs or cultural factors (Shane 1992; Cooper 1999; Teece 2006; Chang and Shih 2004). Whereas Organisation Science and Innovation Science have both been influenced by ideas stemming from Complexity Science for more than two decades now, Complexity Science related literature on governance and planning is not yet common. A comprehensive effort to integrate Complexity Theory into governance was made by Teisman and Klijn (2008) in a special issue of *Public Management Review*, and by Teisman *et al.* (2009a) in a book entitled *Management of Com-*

plex Governance Systems. First of all, according to Klijn (Teisman and Klijn 2008), the conceptual move from government to governance is regarded as the result of the growing interest in complexity in public administration. Klijn states that Complexity Theory as a conceptual framework can be particularly helpful to examine public administration phenomena in the case of so-called 'wicked problems'. Governance 'can result in substantially different outcomes from initial expectations' (Teisman *et al.* 2009b). Teisman and Klijn (2008) and Teisman *et al.* (2009b) discuss aspects of studies in which Complexity Theory was used to investigate public administration: nonlinear dynamics, self-organization, co-evolution and process management. Butler and Allen (2008) identified nonlinear dynamics when national policies are reinterpreted at the local level, making their implementation unpredictable. Self-organizing systems develop emergent new properties through interactions between their individual elements; Bovaird (2008) showed how a central government can stimulate self-organization by enabling local authorities to influence emerging new national policies through joint local experimentation.

Interactions between complex systems can be another cause of unexpected system change; this was described by Gerrits *et al.* (2009), who studied the interaction between social and physical systems. A project manager dealing with a complex process will always have to deal with a fuzzy process, blurring borders between public and private domains, and various and interacting levels of governance. Edelenbos *et al.* (2009) argued that a project can benefit from the existing dynamics if a mix of effective project and process management systems is available. The contributions to the above-mentioned special issue and book, based on case studies, were made by different authors, with different backgrounds and preoccupations, using different data collection methods, and with a focus of analysis ranging from elements of the systems and the systems themselves to the relation between the systems and their environment. Nevertheless, these contributions can be used to construct general patterns (Buijs *et al.* 2009), and the contributions together help to 'name, define and analyze the disposition of complexity and its consequences for decision-making and policy processes' (Boons *et al.* 2009).

In this paper we consider land use planning aiming, in one way or another, at changing the land use. As the actors involved in land

use planning include public as well as private parties, and developments at different scales can interact, land use planning processes are considered a specific type of governance processes. There is a rich literature on the complex (and uncertain) features of spatial planning. Portugali (2006) and Manson and O'Sullivan (2006) used Complexity Theory in attempts to integrate the spatial concept of space with the social concept of place, once again bridging the gap between the natural and social sciences. Another widely used approach is that of agent-based modelling (Crawford *et al.* 2005) which enables the spatial effects of clearly defined and easily ruled societal developments to be studied. O'Sullivan (2004) suggested treating the models as geographical narratives. The introduction of Complexity Theory into the literature on real-life planning and regional development is relatively new. This can be explained by the fact that planning is deeply rooted in the concept of control. Since the 1970s, however, thinking about planning has changed; first there was a shift from a technical, value-free and objective approach to a more process-oriented and communicative one, with a growing role of numerous stakeholders. Instead of value-free facts, communication and power became highly decisive for the outcome of the planning process (Faludi 2004; Healy 1997, 2003; Innes 1996, 2004). Nowadays, both theorists and practitioners of spatial planning have become aware of the fact that planners have to deal with uncertainty and unexpected outcomes (Timmermans 2004, 2009), fuzziness (De Roo and Porter 2007) and wickedness (Roggema and Van den Dobbelsteen 2008) of the planning processes, all relating to long-term planning processes, and with a growing emphasis on adaptation to climate change (Roggema 2012).

How can we describe a complex land use planning process? The behavior of a complex system has been visualized by Prigogine and Geldof, as shown in Fig. 2. The system is initially in state x1. When x1 becomes less stable or less favourable, the system quickly changes to a new state x2, with a higher degree of complexity, although a development into a lower degree of complexity is also possible. The shifts occur rapidly.

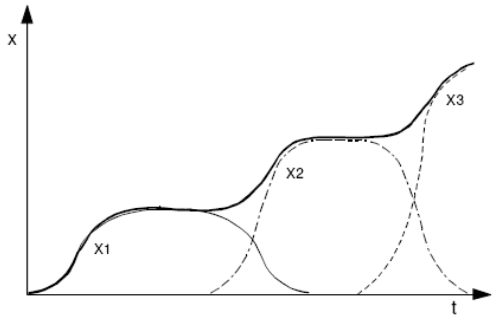

Fig. 2. Evolution of a complex system showing the rising and falling complexity of the system (x) against time (t) (from: Geldof 2001)

The graph in Fig. 2 has been adjusted to illustrate land use planning processes as complex processes, as shown in Fig. 3. Key phases of a complex planning process include:

1. The current routine of a complex system;
2. Changes in the environment of a complex system resulting in pressure to change its routine;
3. Micro-scale developments within the complex system enabling it to adapt to changes within the current routine;
4. Chaotic phases in the complex system where pressure becomes so large that current routines are no longer appropriate and where unexpected triggers can cause a sudden change of the system;
5. A range of mostly unknown new possible future routines of the system with no obvious linear connection to the existing routine;
6. Sudden and rapid change into one new routine of the complex system;
7. New routine of the complex system (after Geldof 2001; Timmermans 2004, 2009; Timmermans *et al*. 2011).

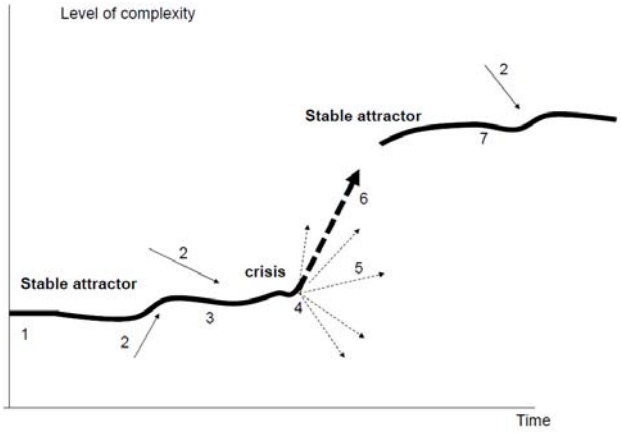

Fig. 3. Detailed development of a dynamic open or complex system changing from one attractor to another (after Timmermans 2009)

EXPLAINING THE GALICIAN CASE IN TERMS OF COMPLEXITY

We can now re-describe the Galician case from the perspective of Complexity Theory by considering the problem of land fragmentation and the steps undertaken to deal with it as a complex open dynamic system with physical, social and intellectual components (Timmermans 2009; Prigogine 1986; Geldof 2001), referring to the seven phases in Fig. 3.

In the rural areas of Galicia, farming was traditionally an important factor; farmers produced food and maintained the landscape; land ownership was fragmented and land mobility was low, but the situation was accepted by society (1). Since the 1980s, however, large areas of rural land were being abandoned, mainly because people stopped farming and moved to the cities. As a consequence, the remaining agricultural structure deteriorated (2). The Galician government attempted to improve the farming structure (3): land consolidation, a well-known instrument to deal with a fragmented property structure, was implemented, but only in a limited area, due to lack of financial resources and political priorities (3). At the same time urban sprawl in urbanized areas was counteracted by implementing zoning plans (3) to avoid rising land prices which would deteriorate the agricultural structure even more. Despite the government's attempts, however, land was increasingly being

abandoned, the situation worsened and the government came under growing pressure to act, but measures dealing with land ownership were not adopted. The system was under pressure but did not change. Lopez-Iglesias and others added further pressure on the government through media campaigns, and some parties included the problem of land fragmentation in their party programmes (3). In 2005, elections were held and the government of Galicia changed; the Nationalist Party, which had included the issue of land fragmentation and land abandonment as one of the main issues in its electoral programme, became part of the new government (3). In 2006, dramatic forest fires shocked Galician society as for the first time they seemed to be out of control and threatening people's properties and lives on a large scale. Public opinion became convinced that something had to be done as soon as possible; that it was time for a change (4). The government thought about possible solutions to deal with land fragmentation discussing the three different options in the light of the believed and feared fourth option: the decline of the traditional rural Galician society (5). Within four months the Land Bank Act and the Act on Forest Fire Management were sent to Parliament and approved (6). Both laws mean that for the first time ever, the Galician Government intervened directly in land ownership in rural areas, in a break with tradition. When the act was passed, it was uncertain whether it would be accepted by society or whether it would work (5), but due to the enormous pressure, ideas that had not been acceptable for decades suddenly (6) became the basis of the new rules. Later, new elections brought a new government with parties that had previously opposed the two acts in Parliament and had intended to block them. Once in office they decided – after intense debate – to make some minor adjustments (2). The land fragmentation issue in Galicia thus entered a new attractor (7).

Considering Fig. 3 the efficiency-driven approach fits well as systems developing within one attractor (1) while external pressure was slowly rising (2) and external influence was addressed by efforts such as land consolidation and zoning to keep the situation in Galicia as it was (3). The efficiency-driven approach closely fits the situation of a complex system trying to stay within its current, stable attractor. The design-oriented approach to Institutional change can also be recognized in Fig. 3, when a complex system

shifts very rapidly (6) due to a crisis or unexpected event (4) to another attractor (7), which was formerly unknown (5). The design-oriented approach to institutional change thus fits in with the situation of a complex dynamic system moving from one attractor to another.

DISCUSSION

In this paper we explain the Galician case in terms of Institutional Change. We find that the efficiency driven approach of NIE cannot explain everything. Why was not the land bank already established in 1990 and 2003? What is the role of emotional aspects in NIE? The design-oriented approach is not able to fully understand the mechanisms behind the sudden change, nor does it explain what will be the situation after the change. We also explain the Galician case from a Complexity Theory perspective. A complex system is characterized by a succession of stable linear and unstable chaotic changes. In the context of Complexity Theory, we expect the system to be in a relatively stable situation for a certain time; after a while a more unstable situation may arise, bringing the system through a chaotic situation into a new stable situation. Usually the complexity of the system is higher; however, there is always the possibility of a development into lower complexity. Can Complexity Theory help us to explain what both theories of Institutional Change cannot?

Why was not the land bank already established in 1990 or 2003? From an NIE point of view, this question cannot be answered; early attempts to change as in 1993 and 2006 are simply not considered in NIE. From the point of view of the design-oriented approach the informal attempts in 1990 and 2003 to radically change the system and to set up a Land Bank seem to fit into the design-oriented approach to institutional change. However, most design-oriented literature only examines successful attempts to change the institutions. Considering the Galician case as a complex system learns that before the system moves to another attractor there can already be instability resulting from unsuccessful attempts to radically change caused by external or internal factors (2, 3 in Fig. 3).

NIE underestimates the role of emotional aspects. In Galicia emotional aspects of land ownership are extremely important. Peo-

ple keep their land, even if they just have to leave it abandoned and even if that is not efficient for themselves or for the regional Galician rural societal system. Neither the emotional aspects of the forest fires are recognized by NIE. The design-oriented approach is aware of the role of a 'group of actors' trying to force a radical change, which can be emotion driven. In Complexity Theory the Galician case is considered as a complex dynamic system including as well physical, as social and intellectual components which interact. This means that emotional aspects of land ownership are included in the analysis. Even more it shows that the feared and believed potential collapse of the traditional Galician rural society (5 in Fig. 3) can be the driver for changes considered necessary by groups of actors.

The design-oriented approach to institutional change does not fully understand the mechanism behind the change. The informal attempts to achieve change by design seem to be considered only when they are successful; unsuccessful attempts are often not taken into account. Also institutional change does not comprehensively explain what triggers the sudden change. Moreover, it does not adequately include the role of physical factors, such as forest fires. Surprisingly, Williamson's NIE approach devotes more attention to them, though excluding them as long-term events, not to be taken into account. If we consider institutional change as a complex system, we see that the trigger for the change can be manifold; it is determined by the level of complexity and it can be any mix of physical, social or intellectual changes inside or outside the system (2, 3), in combination with any crisis (4).

Also the design-oriented approach does not explain what happens after the sudden change. From Complexity Science we learn that the crisis finally shifts the system to a new attractor (7), which can start to be affected by external influences (2) willing to change immediately.

CONCLUSION

Can Complexity Theory help us improve our understanding of institutional change? First, it allows us to connect the two paradigms, that is the efficiency-based and design-oriented approaches, into one single framework. Since 1980, the process of dealing with the problem of land use fragmentation in Galicia has been based on

both efficiency-driven and design-oriented approaches, succeeding each other in time. This is in line with Seo and Creed (2002), Buitelaar *et al.* (2007) and Kingston and Caballero (2009), who implicitly suggest that the efficiency-driven and design-oriented paradigms are somehow connected to each other and are a part of the same continuum.

If we consider both discourses in more detail, we find that the period of time considered by different authors is very important. The time span considered in the efficiency-driven approach differs greatly from that considered in the design-oriented one. Williamson (2000) studied behaviour over a long period, while most design-oriented authors concentrate on the moments of institutional change, without paying much attention to their evolution over time (Bromley 2006; Buitelaar *et al.* 2007). As mentioned above, Bromley (2006), Seo and Creed (2006) and Tubío-Sánchez *et al.* (2013) all found that after the change by design, some kind of stable situation returns, but they did not study this new situation. We think that there is a high probability that they would find a more stable period with small changes, corresponding to the efficiency-driven approach. Williamson (2000) based his theory on stable levels and excluded long-term components, such as tradition, whose changes often create tensions between the system and its surroundings, which according to him finally result in instability. By this exclusion, Williamson was able to identify over a time span of decades efficiency-based approaches (1, 2 and 3 in Fig. 3) as stable, as he did not consider external crises, which are often the cause of sudden and unexpected changes (4, 5, 6 in Fig. 3). We conclude that the exclusion of these phenomena can lead the debate on institutional change into the efficiency-driven discourse, while their inclusion can relate it to the design-oriented approach. When institutional change is studied over longer periods, as in the Galicia example, both discourses occur side by side.

Complexity Theory, by considering physical, social and intellectual components of the complex Galician system, is applicable here. The development over time of an open complex system includes both the slow gradual and the more sudden radical changes which are described in the efficiency-driven and design-oriented approaches, respectively. The Galician example illustrates this.

However, more research based on new case studies is necessary to learn whether Galicia is the rule or the exception.

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