From past to present – development patterns of the Finnish land administration system

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Key words: land administration system; land information; multi-level perspective

SUMMARY

The dynamic nature of land administration systems is widely acknowledged in cadastral literature. This paper uses a multi-level perspective framework (MLP) as a theoretical lens to study historical development of the Finnish land administration system. Four periods are formulated: (1) Land book period, (2) Development of early modern land administration system, (3) Transition to digital land administration system, and (4) New millennium and open data initiatives. Using the concepts of MLP as a backbone, the paper characterizes each period, the biggest changes related to it, as well as the wider societal developments and various niche-level innovations leading to period shifts. The paper also discusses how the development periods align in an international comparison. Altogether, the study increases the understanding of land administration transitions and provides perspectives also to the future development of land administration systems.

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1. INTRODUCTION

Land administration systems (LAS) have co-evolved with people-to-land relationship already for centuries (Williamson et al. 2010; Wallace et al., 2006). For instance Wallace et al. (2006) state that organization of land tenure, values, uses and development are the basic functions of LAS. Surveying, registration systems and databases then are the primary tools to fulfil these functions. Here we aim to identify turning points that show clear regime change in these tools, in order to better understand LAS and its dynamics as a system (Zevenbergen 2004), more precisely, as a socio-technical system. Socio-technical systems are often path-dependent and may also encompass 'lock-ins' (Geels, 2002), which reasserts the usefulness of understanding historical developments of the system in question.

The role of land administration in a society has shifted due to different economic, social, cultural and political factors in a society, and land administration systems need to re-engineer themselves to be able to answer the changing role (Ting & Williamson 2000; Kalantari & Rajabifard 2009). The central role of land administration system in a society gives justification to the socio-technical systems approach, which has been applied before for instance by Ottens and Stubkjaer (2008). Examining LAS as a socio-technical system emphasizes how the system should not be understood only as technology-based representation of land units, but also as a system with institutional roots and a societal need to serve. In times of grand societal and global challenges like urbanization, climate change and rapid technological development, this kind of perspective is well justified.

Examining the historical development of a socio-technical system can be useful in understanding its dynamics and possible future transitions. A heuristic framework called multi-level perspective (MLP) framework has been developed by Geels (2002) to conceptualize socio-technical transitions. In this study we want to phrase different stages of recording land-related information, i.e. both cadastre and land register side of land administration, with the help of MLP framework. In particular, we are interested in following questions: Are there certain patterns and mechanisms in LAS transition processes? We answer this question by examining, how the landscape and niche level factors have shaped the socio-technical regime of LAS. The Finnish LAS is used as a case example. It should be noted, however, that this work does not intend to uncover new historical facts about Finnish LAS. Lappalainen (2002) has previously reported the history of cadastral development in Finland in a detailed manner. She focuses especially on describing the differentiated development of state and municipal cadastres.

We note that the design and functioning of each cadastral system depends heavily on the institutional setting of a nation, and reflects the historical development and legal and cultural background of that particular area (e.g. Williamson et al. 2010; Henssen 1995). For this reason, we want to bring the discussion into international context by reflecting our workshop results with the development of two other cadastral systems, each bringing a different aspect. Finland and Sweden share centuries of history together, and these two countries developed their cadastral system together until 1809, hence following similar steps (see Ekman 2008). Due to the shared history, we might reveal some interesting development patterns in the modern times. Additionally, we want to reflect our findings against development of a different type of a cadastral system. Where Finland and Sweden represent a quite classic example of a German cadastral system (Enemark 2006; Niukkanen 2014), we bring into the discussion an example on Torrens system, and discuss the development of Victorian (Australia) cadastral system.

The rest of this article is organized as follows. In the next chapter, the theoretical grounds of the study are explained shortly. Then, we go through the research design and material collection, followed by the presentation of the LAS periods. After that, we discuss about the relationship between societal and niche-level developments leading to period shifts, and use examples from Sweden and Australia to bring the discussion into international context. Finally, some concluding remarks are made.

2. MULTI-LEVEL PERSPECTIVE (MLP) FRAMEWORK

The MLP framework has become increasingly popular for studying especially the past evolution of socio-technical systems. It has been applied for example in the fields of transportation, energy, sanitation, and so on. As for instance Geels (2012) has noted, the MLP heuristic provides "a way of addressing the core analytical puzzle of transitions, namely stability and change". The MLP presents a socio-technical system through three analytical levels: landscape (macro), regime (meso), and niche (micro) level (Geels, 2002). Next, we go through shortly each level and their role in explaining transitions. Figure 1 illustrates the framework and the interactions between the levels.

Niche level provides protective spaces for innovations or radical alternatives to develop. The protection can happen for instance through subsidized projects, research or small market niches (e.g. the military). The radical alternatives deviate from existing regimes, and the actors working on them hope that the novelties eventually break to the regime level or even replace it altogether. Breaking through to the regime is challenging, though, because the regime is stabilized by many lock-in mechanisms (Geels, 2012). Niches may 'gain momentum' if the expectations of the niche actors align with the widespread expectations in the regime (Smith et al., 2010).

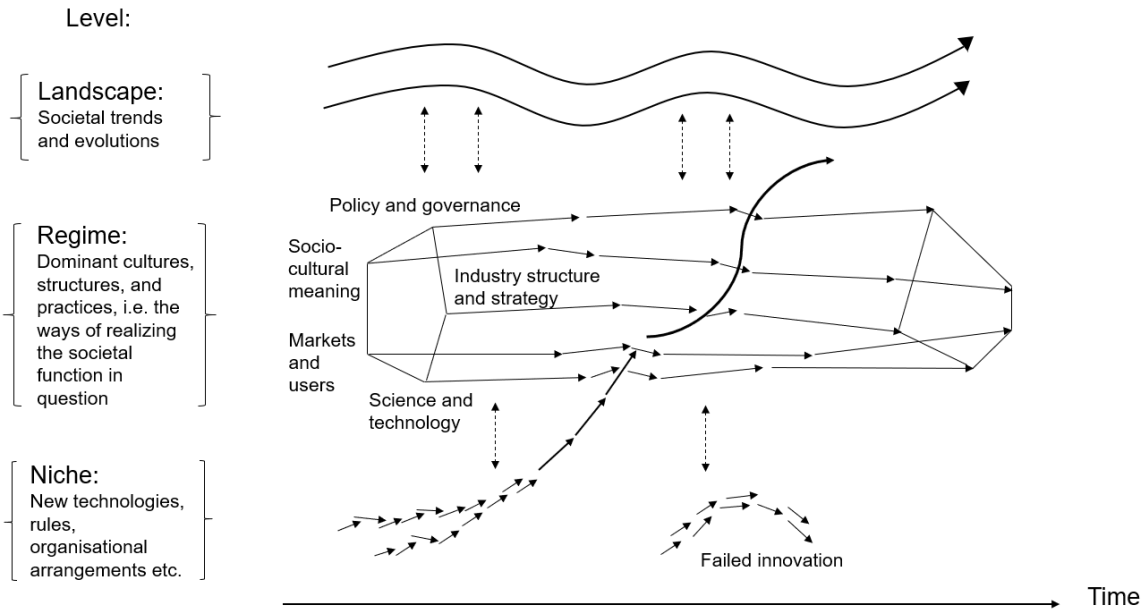

Figure 2. The multi-level perspective (MLP) framework, following Geels (2002).

The regime level summarizes the ways of realizing the societal function in question. This includes both physical and immaterial infrastructures such as routines, actors, networks, regulation, et cetera. The regime has been described as the 'deep structure' that accounts for the stability of the socio-technical system (Fuenfschilling and Truffer, 2014). The deep structure ultimately consists of institutional elements, i.e. the regulative, normative and cognitive rules like legislation, shared beliefs, norms and standardized ways of doing things. Two kind of regime dynamism can be distinguished: (1) Dynamics within the regime as a result of developments within regime components, and (2) dynamism that occurs in response to landscape processes. Both sources of dynamism create tension that in some cases open 'windows of opportunity' for niche innovations (e.g. Smith et al., 2010).

Finally, the landscape level presents the wider context. It includes processes that stretch over societal functions and take place autonomously of particular socio-technical regimes. For example, environmental and demographic change, shifts in politics, cultural developments, and macroeconomic development are considered as landscape processes (Smith et al., 2010). Both the regime and the niche level are influenced by the landscape developments. The implications are often interpreted followingly; the regime must respond to the pressure by adjusting its rule trajectories; and the pressure from the landscape also generates opportunities for niches to develop.

3. RESEARCH DESIGN

To study past regime shifts in the context of land administration systems, we set up a research process that includes a participatory element in form of an expert workshop, and a literature review (see Figure 1). The chosen methods for material collection complement each other nicely: With a workshop it is easier to identify the major turning points and most crucial regime

changes; literature review, on the other hand, makes it possible to elaborate the course of events with a higher level of detail and accuracy.

Hence, the purpose of organizing the workshop was to gain deeper knowledge and understand the insights of experts of those factors, which may have influenced to the regime shift or change of prevailing LAS. We did not provide any pre-made lists of the development elements for the participants. Instead, we wanted to provide a place for discussion and brainstorming. There were five participants in the workshop, and additionally one facilitator and one secretary (about planning an expert workshop, see e.g. Slocum 2003). The participants had different backgrounds, but they all are experts in the field of cadastral studies and have long experience on the field. Academia, government, and the National Land Survey (responsible authority for cadastral and land registry operations) were represented. With participants' permission, the workshop audio was also recorded. Secretary took notes on the discussion, and the notes were then afterwards complemented and revised, when needed, based on the recordings. The duration of the workshop was 3 hours and it was organized in June 2018.

In the literature review, we relied mainly on books covering the history of Finnish LAS, and some additional scientific articles. Some legislation texts were reviewed as well. Literature review was guided by the workshop discussions. The goal was to verify some facts such as dates and terms, but also to elaborate the topics brought up in the discussions more closely.

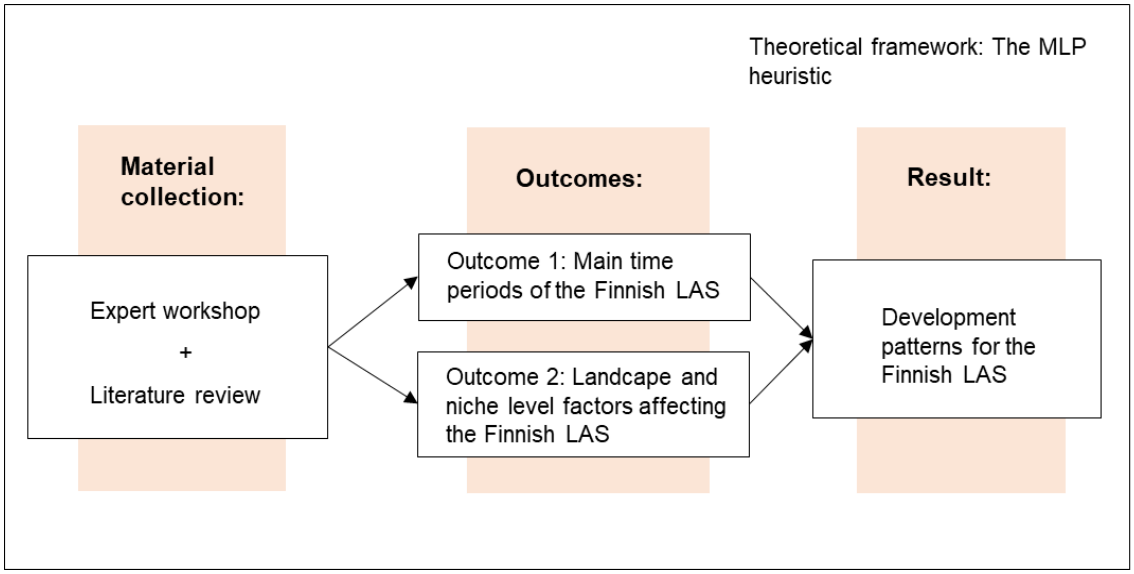

Figure 1: The research design presented.

4. THE FOUR DEVELOPMENT PERIODS OF FINNISH LAND ADMINISTRATION SYSTEM

This section presents a synthesis of the workshop and literature review. Based on them, we divide historical development into four periods (Table 1): land book period (1), development of early modern LAS (2), transition to digital LAS (3), and new millennium and open data initiatives (4). This division follows up to some extent the classic development trajectory of LAS from fiscal to juridical and then from planning to multipurpose cadastral systems as presented for instance in Williamson et al. (2010), or Enemark (2009), who describes that "mature multi-purpose cadastral system could even be considered as LAS itself". After presenting the characteristics and regime shifts of each periods, we continue with analysis of the landscape and niche-level factors and their relationships with regime shifts.

Invention of scientific surveying was made possible with plane table and triangulation back in 17th century. Thus, this century marks the beginning of land surveying in its current meaning. In Finland, geometric land books that were introduced around 1630 can be seen as a first real instrument of recording land-related rights. The main rational was to collect taxes for the crown. Geometric land books can also been seen as a primitive form of economic maps – some historians have even suggested that they were drafted without any financial incentives (i.e. connections to taxation). Period of geometric land books can be divided into two: (1) early period of 1635-1652 when the surveyed unit was a village and its houses individually, and (2) later period after year 1680 when a partition unit consisting of number of houses was the surveyed unit. Kammarkollegiet (State Legal, Finance and Administrative Services Agency in Sweden *avant la lettre*) prepared instructions for land surveyors but technical instructions were rather scarce at this point. Particulars of geometric land books ranged from roads and waterways to buildings and livelihoods. Special attention was given to entries of landowners, landowning conditions, and yield and quality of land that were considered as the central components.

The early European land books or cadastres were usually created for taxation purposes (e.g. Enemark 2003) and Finnish case was no different. At the time of the creation, Finland was part of Swedish Kingdom. Sweden and Germany were in a war together that time, and the Swedish King needed extra financial resources for the war, so he set up the land book for that purpose. Since Finland was otherwise a remote part of the kingdom with very low population, there was no additional pressure from the landscape level to shape the regime. Only after beginning of industrialization, the population started to grow. Finland's geopolitical situation changed during 19th century, as it became an autonomous part of Russian Empire, creating a link from Russia to Scandinavia, increasing the value of the land, generating the need for more accurate land registration (Feder & Nishio 1999). Already during 19th century, it was clear that land books were not equivalent to constantly alternating land ownership conditions. Further, the Basic Land Consolidation and crofter institution challenged the prevailing "recording system". At first the goal was to create a complete list of real property units that would include records of all the changes occurred due to the Basic Land Consolidation as well as changes in land use, taxation and outcomes of partitions. However, this goal was never achieved mainly due to lacking resources.

Around the turn of the 20th century, other means of earning one's living started to edge out agriculture and the relative importance of land taxes decreased. Thus maintaining the land book system simply was no longer as necessary as it was at the time of its establishment. Also the partition legislation was liberated, which led to a rapid increase of non-recorded farm estates. All these factors combined created a pressure to revise the whole system. In year 1895, a decree on keeping cadastre was given.

Real estate register presented a new outlook on landownership: private rights were in the central instead of collective rights. Overall the information content was wider and more up-to-date than in land books, with for example referencing to deeds of partition and (cadastral) maps. In retrospect the most important improvement was inclusion of registration numbers: individualization of real property units supported secure transaction processes and, hence, development of land markets that had been practically non-existent up to that time. Inclusion of cadastral survey records, easements and markings of ownership rights further enhanced quality of real estate register compared to land books.

The decree on real estate register given in 1895 was only targeted to real properties located in rural areas. Plot measuring and keeping of 'an urban cadastre' became statutory for municipalities later in 1930's. Hence 1930's marks the expansion of cadastre into urban areas as well. A prominent feature of municipal 'cadastre keeping' was a strong separation between plot and non-plot areas. The so-called plot register consisted of four catalogues: list of plots, list of public areas, records of plot formations, as well as records of public area formations. In addition it was required to keep a plot register map of all listed plots. (Lappalainen, 2002.)

In the period of developing early modern cadastral systems, we can clearly recognize two of the most dominant landscape factors for this period. These were industrialisation and urbanisation. As Finland started to develop from a rural agrarian country into a more urban one, new sub-urban residential areas were born throughout Finland, but most of all in Helsinki. The growing urban population catapulted plot prices and created a fruitful environment for land speculation businesses. When these 'land developers' opted to maximize their profits the goal was to subdivide the land area into equal sized and shaped plots. This task was often times performed by a land surveyor - a general view was that architects wanted to address too much space for parks and other common interests in their proposals for a detailed plan.

Digitizing maps began in early 1970s, which marks the beginning of computer era for Finnish LAS. Digitizing produced first databases for geographic information. This opened many possibilities, such as creation of any kind of theme maps, but also challenges. Before 1970s, no mutual rules had been laid down for the shared use of geographic information. An important milestone was reached in 1977 when basic mapping that was implemented through aerial photography covered the whole country. (Huhtamies, 2008.)

From registration point of view, the automatic data processing enabled a shift to computer-based cadastre. This was a gradual shift that started already in 1978. Fully digital cadastre was finally reached in 1994. Before the project was started, it was well-known that real estate register units covered only two thirds of the total land area of Finland, and that regional

provinces had divergent ways to maintain registers. After the existing records were transformed into digital format in the first stage, the second stage concentrated on improving the quality by completing missing records and correcting inconsistencies. Coverage of cadastre increased substantially after joint property units were added to register. (Hautala 2011, p. 147.)

The breakthrough of global positioning system (GPS) is probably the clearest example of a radical innovation that pervades from niche to regime level in the context of LAS. GPS started to develop in an army niche in 1960s and gained wider significance in mid-1980s after it was expanded to civilian usage in 1984. Finnish land survey agency rented a five piece satellite receiver equipment in 1986 for geodetic surveying. Though at first stages the functioning of GPS equipment was rather slow and unsteady, it was clear that new technology would before long displace the old triangulation technique. GPS based measuring provided several advantages such as cost savings, better occupational safety and considerable flexibility to field planning since GPS points could be positioned anywhere regardless of existing points. (Huhtamies 2008, p.456-458.)

Increasingly both production and services of land survey agency started to move towards more electronic form. This enabled also better monitoring of market segments and user profiles: statistics show that households form the largest customer segment for NLS and they require especially subdivision procedures. Several factors affect the demand for subdivision procedures: urbanization (less need for subdivision in rural areas), economic conditions (growth increases demand and vice versa), EU agricultural subsidies (subsidy policies increase need for subdivision). In addition, the reform on Code of Real Estate (540/1995) in 1997 where the order of title registration and subdivision procedure was reversed increased substantially the number of subdivision procedures.

The period for developing digital LAS in Finland started in the 1970's. The landscape changed rapidly on technological but also on other fronts. We can recognize for instance the changing role of government. Parties involved became customers and the role of land surveying agency was to provide services for them. The political and economic landscape also changed dramatically during the period. First the Soviet Union that Finland had strong political and economic bonds with collapsed. Soon after Finland entered a period of depression during which the gross domestic product slumped hard. This alone put a strain to rationalize government spending, including land surveying services. In fact, a privatization scheme of land surveying agency was introduced in 1994, but the idea was abandoned in the end. Nevertheless, the agency went through a change into a net budgeted institution where only the basic tasks were covered with taxpayers' money.

In year 2005, a renewed Land Information System was launched. Faster and more convenient access to cadastral information can be seen as main contribution of electronic system. The number of overlaps in municipal and state maintained registers was also diminished. Since the beginning of 2010, the land survey agency (NLS) and the land registry (the authority of the courts) have operated as one organization in Finland. Many other European land administration systems have pursued similar mergers as well, thus this can be seen as a common tendency in the field.

Especially digitalization and globalization have shaped the sociotechnical landscape of LAS in recent years. Digitalization of public services has reached all sectors. Real estate markets have globalized and new investors have entered the Finnish market. Also, goals to harmonize and standardize geographic information, including cadastral information, can be seen as embodiments of globalization in the context LAS.

Table 1 summarizes the main characteristics, as well as the recognized regime changes and landscape factors for each period. It should be stressed that the table lists only niche factors that were able break through to the regime (i.e. GPS, aerial photography) and hence there is no separate column for the niche innovations.

Table 1 The development periods summarized.

PERIOD	CHARACTERISTICS	REGIME CHANGE	LANDSCAPE FACTORS
LAND BOOK PERIOD: APPR. 1630-1905	- Cameral nature: land ownership and quality of land as core information - Recording of communal rights: the surveyed unit was a whole village or number of houses	- Lack of institutions - Code of Real Estate 1734 - Land reform: Basic Land Consolidation - Statute codification 1848 - Land tax abolished in 1925 - Change in official language: from Swedish to Finnish in 19th century	- Finland part of Swedish and later Russian realm - Finland an agrarian country with low population and low-income level - Geometric land books were a pan-European phenomenon - Warfare between Sweden and Germany in 1630's - Rapid population growth after mid-18th century
'LAND REGISTER/ EARLY MODERN LAS': 1905-	- Dualistic system: 'Real estate register system' for rural areas and 'list of titles system' for urban areas. - Recording of individual rights - New actors enter regime as land markets start to develop - Subdivision procedures increase, leading to increased land fragmentation - Legislation develops	- Decree of real estate register keeping 1895 - Higher technical standards - Liberalization of partitioning legislation - Decree of Division Act 1917 - Division Act 1951 - Division Act for Planning Areas 1960 - Creation of land market - Technological leaps: e.g. aerial photography and implementation of basic mapping	- Industrialization - Rapidly accelerating urbanization - Uncontrollable land trade and speculation, increasing land values - Second World War: a total standstill in land surveys - Resettlement tasks after WWII
'TRANSITION TO ICT BASED LAS':	- Fully digital cadastre since 1994, partly digital since mid 1980's - Geographic information as concept is born	- Digitizing of maps - Urban and rural registers one register (cadastre) - Real Estate Register Act 1985	- ICT revolution - Global political turmoil: collapse of the Soviet Union - Economic depression of the 1990s

	- Land surveying agency adopts the role of service provider	- Reform on Code of Real Estate 1995 - Global positioning system (GPS) started functioning with needed accuracy mid 1980s	- Finland becomes an information society: change in the role of authorities - Development co-operation and international co-operation in general
NEW MILLENNIUM AND OPEN DATA INITIATIVES	- Better e-services - Increasing number of actors/ users or cadastral data - Data harmonization	- Land Information System renewal in 2005 (KTJ 2000) - INSPIRE directive 2007 - Merger of land register and cadastral agencies in 2010 - Fundamental improvement of cadastre - Possibility to combine field work and survey proceedings 2015 onwards - New registration system launched in 2015	- Digitalization (and economic rationalization) of public services - Open data movement - Globalization of real estate market, new (institutional) investors - Standardization (LADM, ISO 19152)

5. Discussion

This study recognizes development patterns of the Finnish LAS by looking back to history, and thereby, provides some interesting learning outcomes. First, the framework forces to contemplate development from wider perspective and challenges to seek patterns in transitions from one regime to another. The findings imply that in context of LAS the pressure from landscape level was the primus motor in transition from land books to real estate register system. The second shift that marks the beginning of computer era for Finnish LAS was more a mixture of technological leaps from niche level and changing political, social and economic landscape. The third transition was again characterized more with landscape level changes such as digitalization of public services and standardization on the international level. We should, however, be cautious in comparing transitions that took place over such long period of time. For example, Geels (2002) has stated that the nature of innovations has changed between centuries: science-based innovations have replaced craft-based innovations when moving to 20th century, which naturally affects the dynamics of socio-technical change.

Another question that could be addressed here is ‘Does history provide evidence of inertia?’. Sociotechnical configurations tend to be stable and changes in elements do not occur easily. Often it is said that new innovations have a hard time to break through because regulations,

infrastructure, user practices etc. are aligned to the existing system (Geels, 2002). Indeed, also in the case of LAS we can pinpoint only two clear radical innovations that have shaped the regime: computers and global positioning system. So, a short answer to the question would be, yes, inertia is evident in the sociotechnical configuration in land administration. But it seems, however, that the system is not totally 'closed' either - which of course encourages us to pursue alternative configurations for the future.

To connect the findings to international context, a short comparison to development patterns of other countries' LAS is in order. As mentioned in the first section, we restrict our reflection to the Swedish and Victorian cases. Development of the Swedish system shares many similarities with the Finnish one, starting from the establishment that states back to 17th century. The fundamental structures related to land ownership and other rights, restrictions and responsibilities in Finland and Sweden date back to the establishment, and hence remain similar (Anderberg 1991). The system was established to collect land taxes to the Swedish Crown and shared legislation, and even today the similarities in the structure of cadastral procedures is evident (Vitikainen 2004). In addition, Ekman (2008) has described that since early 2000's the development of web services has been in a key role, which aligns with the fourth development period of the Finnish LAS (New millennium and open data initiatives). When compared with the development of Victorian land administration, we can notice that although developed later and using different cadastral system, the activity of legislative works and need for a more systemised processes and register keeping dates to the 19th century (Quick 1883). Further, somewhat unsurprisingly the shift to electronic services falls on same point, albeit in Australia electronic property transactions were made possible few years earlier, as such service was available in 2008 in Australia and in 2013 in Finland (Deloitte 2018; Kukkonen, 2016).

Despite the congruent development patterns, previous studies suggest that the drivers of change may vary between country contexts, which should be kept in mind when considering the future development of the systems. In the Finnish case, tightening requirements for accuracy in the system have been in a key role, which is in line with the finding that Finnish land administration experts tend to emphasize technological drivers as sources of change (Krigsholm et al. 2017). However, in a global context the drivers have been perceived differently as a group of international experts emphasized the importance of social and political drivers for land administration dynamism (Riekkinen and Krigsholm, 2018). This view connects to the common tendency of land administration domain to underline the role of LASs in supporting sustainable land use, and therefore, sustainable development by promoting economic, social, environmental and institutional sustainability (e.g. Williamson et al., 2010; Yang & Rajabifard 2019). Victoria also raises the question of sustainability in terms of equality and recognition of indigenous people's land rights, which is a clear difference to the Nordic cases.

Looking back to changes in the society and development of LASs, we can conclude that for the future development, a holistic approach is needed. We cannot neglect the role of technological development, especially digitalization has already shaped our systems, and will continue to influence them in the future. But although technological advances enable the development of cadastral systems, understanding the potential transitions requires acknowledging other

developments as well, and especially the institutional elements, i.e. rules that coordinate and structure the activities of actors (Author et al. *forthcoming*).

6. Conclusions

This paper has identified four development periods for the Finnish LAS. The work was guided by the MLP framework, i.e. we were especially keen to find out what changes, innovations, or new features we can find in the system during each period (regime change), and what was the prevailing situation in the society as a whole (landscape factors). Therefore, the paper adds to a relatively narrow branch of studies that contemplate development of land administration systems through a theoretical framework (see e.g. Lin et al., 2015).

We note that the study has some clear limitations. Since a workshop is used as a method for material collection, the selection of experts participating in the workshop plays a big role in the results as well. The number of workshop participants was rather small, but the rationale behind this is that we wanted to promote dialogic and brainstorming atmosphere where small group of experts might be more efficient and provide deeper knowledge than large group (Lauttamäki 2014). Although many of the landscape level developments are national, we can find international landscape developments and connections to global megatrends, studied e.g. by Krigsholm et al. 2017. This notion, as well as the limited examples provided in the previous section indicate that the results of this study are scalable to other nations as well, at least to some extent.

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