Applying the Knowledge Innovation Value Chain Model to Land Administration Research

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SUMMARY

Land administration research regularly links to other disciplinary areas for inspiration, invention, and alternative solutions: concepts from outside the study area can help to look at older problems in a new light. With this paper, we follow this trend and introduce the 'Knowledge Innovation Value Chain Model' (KIVCM) as a tool to support implementable and scalable land administration research. The idea is to make land administration R&D more visible to key stakeholders, and more innovation-oriented so as to enhance its applicability. As such, the model proposed by Allen et al (2008) is adapted. The model shows how scientific research can be developed from foundation R&D through to transitional and applied research. Thereafter, with appropriate support from different stakeholders, knowledge products can be generated and enhanced in prototyping, pre-commercial and supported commercial development phases. The ultimate outcome is intended to be commercial production. This means oft-forgotten business models and governance models are considered within the research process. The first three stages of the model (scientific, translation or applied and prototype development) can be summarized as 'Technology Push': the next two phases of "Supported Commercial Development" and "Commercial Production" can be summarized under "Market Pull". Once the innovative product reaches the commercial production stage, it fulfills the market or societal demands. In this work, it is demonstrated how the model could be applied to land administration research. Specifically, cases of LADM adaptation for groundwater model development, and indigenous rights recordation in forested areas are considered. Potential application in other planned land administrated related projects are also discussed. In an era where the commercial value of research is apparently of great importance, we suggest KIVCM might be a supportive tool for land administration researchers.

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1. INTRODUCTION AND BACKGROUND

Land administration is an emerging academic study area: increases in scientific publications related to the domain are a testament to this. Many of the works explore new conceptual understandings for the domain, whilst others deal with more practical aspects of system design. In this paper, we would like to propose a stakeholder or client oriented approach for land administration research. Building from the ideas presented in Magis and Zevenbergen (2014), we introduce the Knowledge Innovation Value Chain Model (KIVCM) as another tool for focusing land administration research. Like Magis and Zevenbergen (2014), we agree it is important to consider the whole value chain, not just a organization's mandate: land administration researchers need to focus on supporting the clients and not just the internal processes of land administration agencies.

KIVCM has relevance given current climate for funded research. As an example, in the European context, the "European Paradox" is often mentioned, whereby it argued that despite the good quality scientific performance of European countries, there appears to be a non-transference of these research outcomes into innovation and commercial exploitation. Findings of some studies hint towards this becoming a regional and global problem (European Commission, 2013).

We argue there is a need to make land administration more visible and innovation-oriented, so as to enhance its appeal across the different strata of stakeholders. The stakeholders could be a government department, the citizens or civil society organizations it interacts with, or a private sector entity interested in developing its business around land administration and management applications.

It is important to note innovation "is neither the research process, nor the same as invention. Innovation is the process of creating something that is replicable at an economic scale and that answers a specific need. In other words, it must be economically viable and provide a solution to a challenge better than competing solutions." (Greenovate Europe, 2013). To provide market orientation, technological evaluation and cost-efficiency, non-conventional research partners in the form of customers, suppliers and innovative service companies, can be included as partners in R&D projects. This also promotes risk sharing of market launch of a R&D based outcomes (Greenovate Europe, 2013)

2. KNOWLEDGE INNOVATION VALUE CHAIN MODEL (KIVCM)

KIVCM is conceptually shown in Figure 1 (Allen et al, 2008). As described by its authors, it is a linear model commencing from basic R&D, focusing on experimental research, and then moves towards generating knowledge products, supported by consumers and government, as an output for consumers.

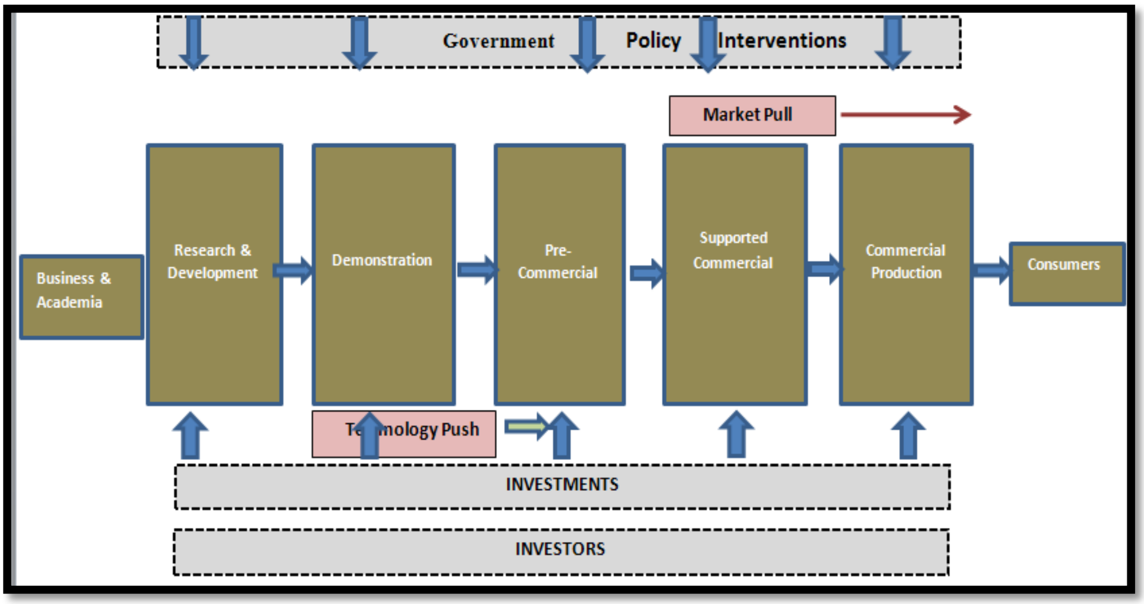

Figure 1: Knowledge Innovation Value Chain Model (Source: Prospects for and barriers to domestic micro generation: a United Kingdom perspective. Applied Energy 2008; 85 (6): 528-544.)

For the purposes of our study and land administration focus, it is slightly customized (Figure 2), however, it remains a linear model. As per Figure 1, the starting point is R&D, led by key research actors and supported by government, and potentially private sector investors. The next element involves transitional or applied research. Here, the focus is on relating the knowledge generated from basic science to a particular theme or issue. The success of knowledge products generated from such kinds of research can lead to a pre-commercial prototype. In next phase, prototypes, based on their assessed potential for success, are transformed into supported commercial development. At this stage, support can be provided fully by the government, or private players can also be involved, depending at their assessment of its future potential. Once successful, the product reaches the final stage of innovation value chain, commercial production. The whole value chain is impacted by national and international policy interventions, as well as investment support at different stages. The first three stages (scientific, translational or applied and prototype development) can be easily summarized as "Technology Push" while next two phases of "Supported Commercial Development" and "Commercial Production" can be summarized under "Market Pull". Once the innovative product reaches the commercial production stage, it fulfills the market or societal demands. Another aspect of this chain could be "Technology Pull" where market or societal needs drives the type of research that will take place at conceptual level of scientific research or applied research level.

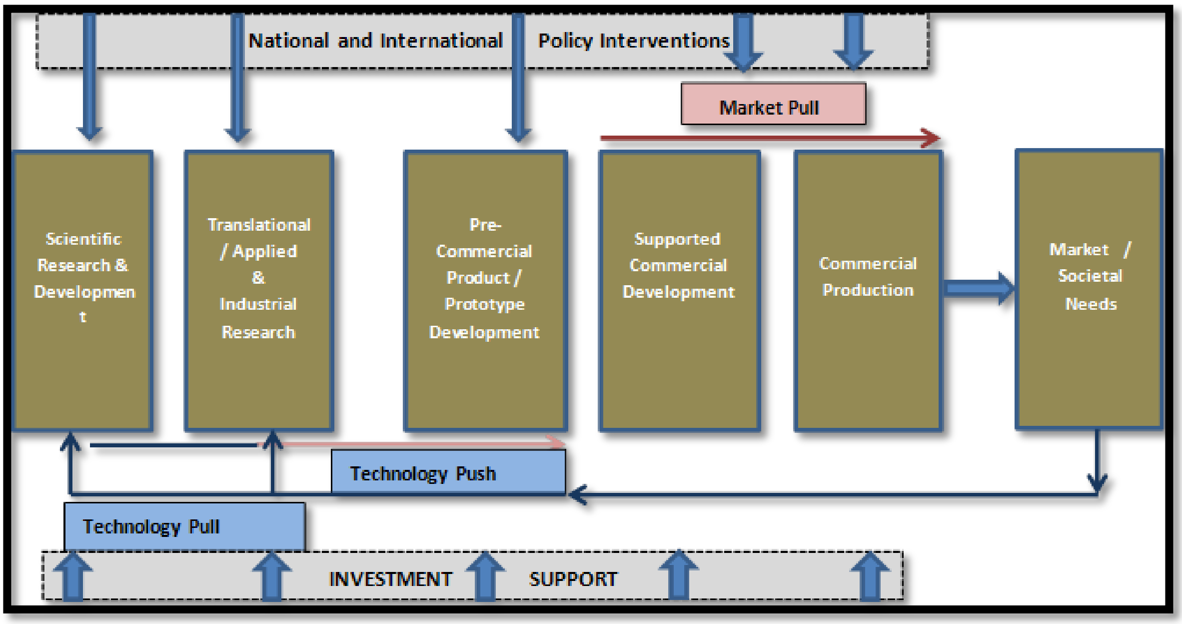

Figure 2: Slightly customized land administration approach including technology pull factor

3. APPLYING KIVCM IN THE LAND ADMINISTRATION DOMAIN

Similar approaches to KIVCM are no doubt already applied in some areas of the land administration – however, the authors argue more widespread use of the innovation-mindset could be of great benefit to the land administration domain. Here, a few examples applications are provided.

First, consideration is given to its potential application in the development of an integrated groundwater management model; one that is able to serve the needs of market or society. In this example, the land related R&D might be considered as attempt to build standardized UML models of core land administration related objectives. The prevailing knowledge product can be considered the ISO Land Administration Domain Model (LADM). Subsequently, LADM's spatial unit concept, allowing for both 2D and 3D objectives, can be effectively applied to research on groundwater management. In the next phase, depending on the successful generation of knowledge products, a prototype model for integrated groundwater management can be developed; one that considers land and water aspects in an integrated manner. Further, this model can be financially supported for advanced development by government or even private players based on potential assessment for societal or market needs. Once fully developed, the model can be commercially applied to address the specific needs of different stakeholders. This whole knowledge-to-innovation value chain follows the approach of "Technology Push" to "Market Pull" where the market accepts a conceptual development after its potential Commercial assessment. In this example, groundwater quantity assessment is demanded by farmers and urban area private water suppliers. These market needs could be the specific market or societal needs that can drive conceptual research stages to generate new knowledge (Figure 3).

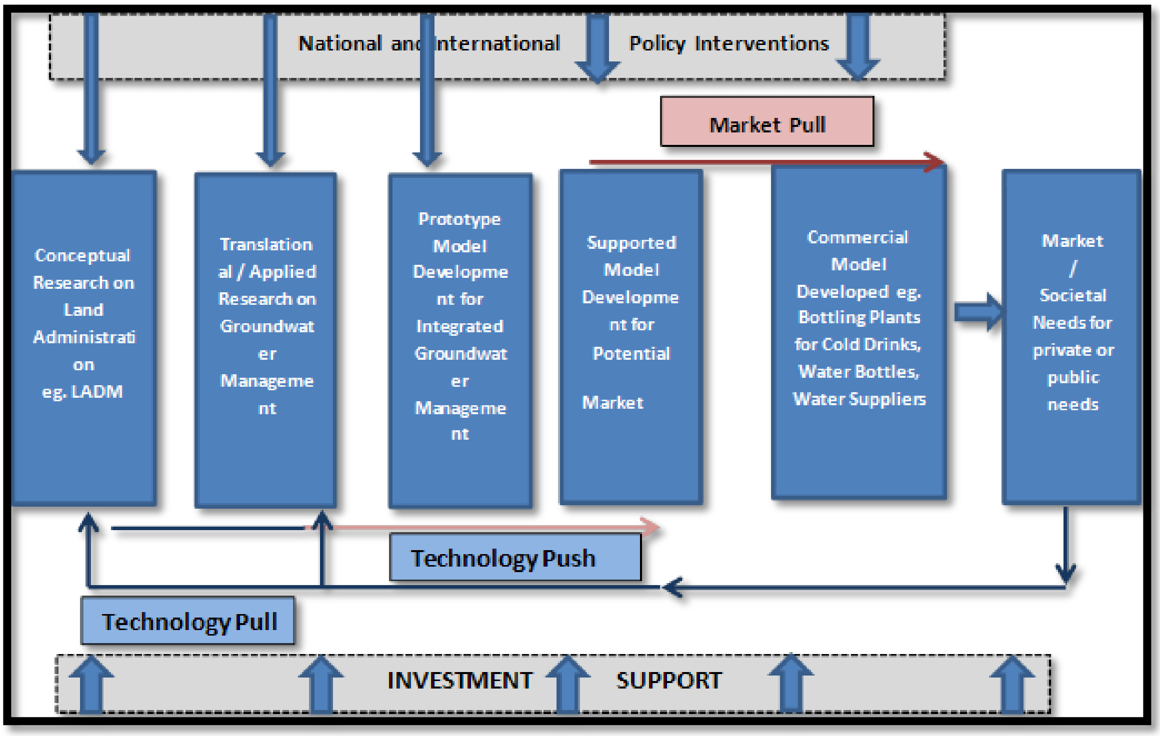

Figure 3: Knowledge Innovation Value Chain for the development of Integrated Groundwater Management

A second example is now considered: the case of the need to secure the rights of indigenous tribes on forest land – as demonstrated in Ghawana et al (2012) and Paixao et al (2013). Again, the LADM development process provides the base R&D and knowledge products. An application of the model, with the required customization for commercial use, could assist in meeting the specific needs of indigenous communities and mining companies alike: in the case, minerals are usually found in those areas which fall in forests that are claimed ancestral lands by tribal communities. A specific case from India, relates to the Niyamgiri Hills and surrounding forest area in Odisha Province (Centre for Science and Environment, India, 2010). In the case, the mining investor lost a bauxite claim: the tribe claimed on the project area. A tool for identifying the overlapping claims was not available from government-alone. If a such a tool existed, based on LADM, it could provide local communities, investors, and the decision making authorities, the ability to unpack the complexities associated with such an assessment. Moreover, it could assist different stakeholders investing large amount only to have plans scuttled at a later stage.

A third example can be found in Frederico (2014): a model, based on LADM, is proposed to assist in the evaluation and monitoring of public properties in Brazil. Currently, these lands are registered in different databases without integration. The proposed research aimed to use the LADM as the basis for an integrated cadastral system. Some of the properties have great economic value that need to be monitored and evaluated continuously, as those properties may have mineral resources or may be expropriated for the implementation of hydropower. Again, along with government, private sector investors would be willing to support the development of a service that enabled transparency in public sector property valuation.

A fourth and final case specifically relates to the development of 3D cadastres. Increased space constraints in highly urbanized areas are creating demands for high-rise buildings of commercial and residential purposes. This is resulting in the creation of 3D ownership volumes for individuals and in common spaces, and thus the societal pull for 3D cadastres. The project 'Modelling 3D Cadastre in Russia', commenced in 2010, demonstrates the converging forces of technology and societal pull in action – particularly in relation to supportive government policies, international coordination, and parallel investment. This Government-to-Government (G2G) project saw Russian and Dutch partners cooperate via the funding support of the Dutch Ministry of Economy, Agriculture and Innovation. The long-term objective was intended to be the introduction of a 3D cadastre in Russia. A pilot investigated potential tools for modeling five 3D-like cases in the area of Nizhny Novgorod – and built from previous R&D on 3D cadastres by the likes of Stoter (2004) and Stoter and van Oosterom (2006). The knowledge products were converted into practical implementations of 3D cadaster objects for a specific national context: technical, institutional, and legal implications of the 3D approach were gleaned. Moving forward, the pilot can be seen as a step along the innovation process building towards a complete 3D cadaster for the context (Vandysheva N. et. al, 2011).

CONCLUSIONS AND RECOMMENDATIONS

Building from the work of Magis and Zevenbergen (2014), we argue that land administration R&D needs to strategically organize itself towards an innovation mindset; one that could be supported via the use of KIVCM as per Allen et al (2008). The simple examples presented here demonstrate how the model can be, and is being, customised and applied to different aspects and applications of the land administration domain. Arguably, the approach would lead to more market oriented and socially demanded land administration solutions. The example related to a LADM-inspired groundwater management system, and previous works relating to approaches for supporting indigenous forestry rights in India, public property management in Brazil, and 3D cadastre development in Russia, demonstrate the potential applications. In each, pre-existing land administration R&D is further developed to support a pressing societal need or pull. KIVCM-styled approaches can ensure land administration R&D remains focused on true societal needs, rather than retreating to the fabled ivory tower. Beyond the examples provided here, the approach can already be seen to be gaining traction in the EU context where many research funding agencies, including components of the EC's flagship Horizon2020 program, routinely require private sector engagement (and financial input), and evidence of multi-stakeholder input in proposal development or research execution. We temper the above claims by noting that a linear innovation model need not be applied in all cases of land administration research: research without recognizable societal impact at the outset has often led to significant applications decades later. However, in an era where access to research funding is a highly competitive, and citizens and government demand accountability on public spending, the KIVCM does provide land administration researchers a platform upon which to develop innovative and applicable works – at scale – and for immediate use.

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BIOGRAPHICAL NOTES

Tarun Ghawana is an MSc in GIS with specialization in natural resource management from International Institute of Geoinformation Science and Earth Observation, The Netherlands. He has executed assignments as a GIS expert in India, Netherlands and Germany on natural resources management projects with academic as well as private consultancies. His area of expertise includes spatial analysis and spatial data modeling in particular for natural resource applications. He was involved in Indian NSDI for Department of Science and Technology, India. Currently, he is an external Researcher with Integrated Spatial Analytics Consultants, a multidisciplinary firm which is based in India.

Rohan Bennett is an Assistant Professor working in Land Administration. He holds a PhD in Land Administration from the University of Melbourne. He also holds degrees in Engineering (Geomatics) Science (Information Systems) from the same institution. From the University of Twente he holds a university teaching qualification. His research focuses on supporting concerns relating to food security, 'land grabbing', and climate change – through technological developments in cadastres. He is currently working on design elements including crowd sourced cadastres, the global cadastres, and green cadastres – and the process of land consolidation.

João Paulo Hespanha holds a PhD in Cadastral Systems Modeling of the Delft University of Technology (The Netherlands). Previously (1992) he has done an MSc on Geoinformation Production at the Faculty of Geoinformation Science and Earth Observation from the University of Twente (The Netherlands). From 1997 he is an adjunct professor at the Technology and Management Polytechnic School of Águeda, University of Aveiro, Portugal. He has been involved in lecturing and research projects on Cadastre .

Andrea F.T. Carneiro is a Professor in the Land Administration at the Dept. of Cartography Engineering at Federal University of Pernambuco (UFPE), Brazil. Her emphases are on rural and urban cadastral systems, land registration and cadastral surveying. Author of dozens of papers and book chapters in land registration and cadastre and a book, she also has been participating as editorial board in Brazilian technical journal. She was member of the development of the Law# 10.267/2001, the implementation of National Cadastre of Rural Properties (CNIR) and development of the law to guide the urban cadastre in Brazil committees. She have been working actively with international projects and working groups.

Silvane Paixão holds PhD in Land Administration and Land Information Management with emphases in Brazilian Rural Cadastral System. She had published some papers about the Brazilian land administration issues. She has worked as a GIS expert in Brazil in projects related to the poverty, community development, health and urban planning. Dr. Paixão taught cadastral survey at Federal University of Pernambuco (UFPE), Brazil and was teacher assistant at University of New Brunswick (UNB) – Canada in disciplines related to Land Administration and Land Economics. Currently, she is working as Project Coordinator and GIS Analyst for the Faculty of Medicine – Dalhousie University.

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