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A Divided Nation: Land Tenure, Governance, and the Korean (Re-)unification

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Abstract

The evidence that land, land tenure and a variety of land interventions with peace-building processes and state transformation is strong and conclusive. However, in the Korean context, exactly how land tenure and its governance is significant and influences the unification based on a nexus between theoretical-methodological-empirical grounds is still not yet fully understood. This indicates a need to understand the various perceptions of land tenure re-formalization and land governance re-arrangements. Furthermore, reflecting comprehensive and strategic frameworks on land management that consider the contextualized factors consisting of socio-technical, and economic, institutional, legal and political aspects is strongly recommended. This approach provides reasonably consistent evidence and knowledge of an association between land tenure/land governance and the unification. One of the main difficulties with this line of reasoning is that how to overcome limited data access, use restrictions, data quality and availability regarding geospatial and land administrative data. Due to these constraints, it is possible that the implications of the results may be biased, given the self-evaluated nature of the data collection, analysis and the interpretation. Therefore, a wide range of geospatial technologies can be applied to collecting, analyzing and interpreting the data and the research should represent a further step towards developing accurate and reliable analytical methods and validation according to the basic assumptions about the spatial, socio-economic, political and legal nature of land tenure and land governance. The overall aim of this thesis is to investigate the emerging role and significance of land tenure and land governance in the context of Korean unification by both reviewing empirical evidence and identifying the contextualized factors, relationship and priorities through the development of various methods, tools and techniques based on a responsible and smart land management framework.

This study develops the Context-Intervention-Mechanisms-Outcomes-Constraints (CIMOC) framework to identify and define the following discourses: under what conditions (C) does land tenure (I) influence the unification process (O), and what mechanisms operating under the influence of land tenure (M) frame the reunification process (O) with what constraints (C)? By employing embedded multiple case study design to compare the cases of the (re-)unification of China with Hong Kong (OCTS) with that of West and East Germany (OCOS), it is systematically addressed how the government interacts in response to transforming people-to-land relationship and which governmental tools were deployed within different institutional (re-)unification contexts. To supplement

and extend the methodological and epistemological assumptions of semantic land tenure relations through EO data interpretation, triangulation logic and information fusion approach is considered. Lastly, Chi-square and one-way ANOVA analysis are chosen to formally compare the views and judgements of scientific experts, bureaucrats and stakeholder group samples in both identifying geospatially informed proxies and measuring information quality (IQ).

The key findings of the research synthesis rationalize the significance of land tenure in the (re-)unification process, especially emphasizing security and transferability in transforming, legitimacy and identity in the integration process and creating a people-oriented process mechanism in with territorial development. Moreover, it is now possible to state that land governance has a pivotal role in transforming institutional forms and functions during and after (re-)unification processes. By employing a new notion of remote-sensing based proxies for interpreting land tenure relations that could be transferable and applicable in land administration domain at a semantic level, the finding presented here confirms that it is possible to standardize the identification and categorization of certain objects, environments, and semantics visible in EO data that can (re-)interpret land tenure relations in North Korea for the preparation of Korean (re-)unification. Using knowledge co-production methods that emphasize the collaborative and interactive process of synthesizing different sources and types of knowledge, the distributions of the opinions for the land ownership and land transfer rights identification across scientific experts, bureaucrats and stakeholders were different. Moreover, it was enabled to measure intrinsic, contextual, representational and accessibility attributes of comprehensive information regarding the associations between EO data and land tenure relations in North Korea from different viewpoints.

Firstly, the methods of synthesis of existing knowledge used for this study will help engaged knowledge to deepen their understanding of inconsistencies in scattered evidence and can identify gaps in scientific and empirical evidence to define future land policy formulation and implementation and stakeholder interests. It will also contribute to the knowledge translation process (e.g., voluntary guidelines; policy briefs; fact-finding projects etc.) for policymakers and practitioners by demonstrating and providing converging and consistent evidence for where unknown or unsupported land tenure and land governance exists. Secondly, the finding makes an original contribution to the normative responsible and smart land management framework and provides the comprehensive toolkit to assess, monitor and foster an responsible and smart decision-making for sustainable land management prior, during and after the reunification process. Finally, this present study has shed a contemporary light on the contentious issues of how the pixel (EO data) can be converted to technologically and socially acceptable land tenure knowledge and land governance practices. So, to conclude, the geospatially better-

informed analysis is not about how geospatial intelligence can directly detect information, but it is about how technology can support to better inform scientists, policymakers and stakeholders, smartly and responsibly, about the land issues.

Zusammenfassung

Es existieren starke und eindeutige Beweise, dass Grund, Landbesitz und Restriktionen auf Land einen Einfluss auf Friedensbildung und der Transformation eines Landes haben. Dennoch ist im Kontext von Korea noch nicht vollständig untersucht, wie Landbesitz und deren politische Rahmenbedingungen in Falle einer Wiedervereinigung sich beeinflussen würden, gerade da der theoretisch-methodische-empirische Themenkomplex nicht vollständig erfasst ist. Dies schließt auch den Bedarf ein, die zahlreichen Wahrnehmungen einer Wiederformalisierung von Landeigentum und Neuordnung der rechtlichen Rahmenbedingungen vollständig zu verstehen.

Außerdem wird sehr empfohlen umfangreiche und strategische Rahmenpläne zum Eigentumsrecht zu berücksichtigen, welche konzeptualisierten Faktoren bestehend aus sozial-technischen, ökonomischen, institutionellen, rechtlichen und politischen Aspekten, darstellen. Dieser Ansatz birgt kohärente Beweise und Wissen über den Zusammenhang zwischen Landbesitz/Bodenrechte und der Wiedervereinigung. Einer der Hauptschwierigkeiten innerhalb dieser Argumentationslinie ist die Verfügbarkeit an qualitativ hochwertigen Geo- und Verwaltungs-Daten und die Beschaffung dieser Daten trotz Nutzungsbeschränkungen.

Auf Grund dieser Einschränkungen besteht die Möglichkeit, dass die Ergebnisse voreingenommen sind, da die Datenbeschaffung, Analyse und Interpretation ausschließlich selbstevaluiert werden konnten. Deshalb wurde zur Sammlung, Analyse und Interpretation ein weites Spektrum an geowissenschaftlichen Technologien angewendet. Außerdem sollte diese Untersuchung als ein weiterer Schritt in Richtung der Entwicklung einer wissenschaftlich akkuraten und verlässlichen analytischen Methode zur Validation grundsätzlicher Annahmen über räumliche, sozioökonomische, politische und rechtliche Aspekte von Land, Eigentum und Landrechten gesehen werden.

Das übergreifende Ziel dieser Arbeit ist die Untersuchung, welche Rolle und Signifikanz der Landbesitz und die Eigentumsrechte im Kontext der Koreanischen Wiedervereinigung haben indem sowohl empirische Beweise, als auch konzeptualisierte Faktoren, Abhängigkeiten und Prioritäten analysiert wurden indem diverse Methoden, Werkzeuge und Techniken entwickelt wurden. Diese Methoden, Werkzeuge und Techniken basieren alle auf verantwortungsvollen und smarten Umgang mit Land.

Diese Untersuchung entwickelt zur Identifizierung und Definition einen Context-Intervention-Mechanisms-Outcomes-Constraints (CIMOC) Rahmen, um folgende Fragen zu beantworten: Unter welchen Umständen (C) beeinflusst Landbesitz (I) den Wiedervereinigungsprozess (O) und welche Mechanismen operieren innerhalb des Landbesitzes (M) während der Wiedervereinigung (O) mit welchen Einschränkungen (C)?.

Durch die Einbettung und den Vergleich verschiedener Fallstudien der Wiedervereinigung von China und Hong Kong (OCTS) und West- und Ostdeutschland (OCOS) konnte systematisch analysiert werden, wie die Regierungen interagiert und reagiert innerhalb eines wandelnden Mensch/Eigentum-Konstruktes. Außerdem können sich anhand dieser Fallstudien auch die staatlichen Methoden betrachtet werden, mit welchen die Wiedervereinigung durchgeführt wurde. Ferner wurden die semantischen Aussagen zu Landbesitz und Eigentumsbeziehungen methodisch und wissenschaftstheoretisch durch Pixel-Daten-Interpretation (EO-Daten), triangulierte Logik und Informationsverschmelzung analysiert. Zusätzlich wurde die Chi-square und ANOVA Analyse gewählt, um formell die Ansichten und Beurteilungen beispielhaft von Experten, Bürokraten und Stakeholder Gruppen zu analysieren und geographische Verortungen und Vermessungsinformationen qualitativ zu bestimmen (IQ).

Die Schlüsselergebnisse dieser Arbeit rationalisieren die Signifikanz von Eigentumsrechten innerhalb eines Wiedervereinigungsprozesses und legen dabei besonderen Wert auf Sicherheit und Übertragbarkeit des Rechtsanspruchs und der Identität im Prozess in Abstimmung auf räumliche Entwicklung.

Außerdem ermöglicht die Untersuchung die Aussage, dass staatliche Eigentumsrechte eine tragende Rolle innerhalb des Transformationsprozesses während und nach einer Wiedervereinigung spielen. Indem ein neuer Ansatz Anwendung gefunden hat um innerhalb der Fernerkundung Proxies zur Interpretation von Landrechten und Besitzstrukturen zu identifizieren und übertragen. Mittels dieser Proxies ist es möglich den Prozess der Identifizierung zu Standardisieren und zu kategorisieren, um bestimmte Objekte, die Umwelt und weitere Objekte in EO-Daten zu bestimmten Landnutzungen und Eigentumsverhältnissen zuzuordnen und auf Nordkorea zu übertragen um eine Wiedervereinigung Koreas vorzubereiten.

Indem partizipative und interaktive Methoden unter Berücksichtigung verschiedener Quellen und Wissensstände angewendet wurden, konnte das Spektrum und die Verteilung verschiedener Ansichten zu Eigentumstransfer und zur Eigentumsidentifikation zwischen wissenschaftlichen Experten, Bürokraten und Beteiligten unterschiedlich berücksichtigt werden. Zusätzlich wurden intrinsische, kontextabhängig und repräsentativ verfügbare Attribute zwischen EO-Daten und Landrechtverhältnissen in Nordkorea aus verschiedenen Blickwinkeln zu einem umfassenden Gesamtbild zusammengesetzt werden.

Zunächst helfen die Methoden dabei existierendes Wissen in diesem Umfeld zu vertiefen und bestehende Informationen zusammenzutragen und dabei Lücken zu identifizieren um empirische Beweise zu finden und künftige Bodenpolitik im Sinne der

Beteiligten zu schaffen und implementieren. Ferner hilft es Wissen für Politiker und Anwender zu transferieren (z.B. „Voluntary guidelines“, Politikeinweisungen, fact-finding-Projekte, usw.) indem nachvollziehbare wissenschaftliche Beweise gezeigt und zur Verfügung gestellt werden für Fälle in welchen unbekannte Eigentumsstrukturen vorherrschen oder kein offiziell gestütztes Eigentumsrecht vorliegt. Außerdem tragen die Ergebnisse dieser Arbeit originär zum normativen verantwortlichen Umgang mit Land und zum smarten Flächenmanagement bei, indem ein umfangreicher Werkzeugkasten erstellt wurde zur Erfassung, Überprüfung und Unterstützung von nachhaltigen Landmanagement und dessen Lösungsfindung, vor, während und nach einem Wiedervereinigungsprozess.

Zu guter Letzt hilft die vorliegende Arbeit dabei Pixeldaten (EO Daten) in technologisch und sozial verständliche Eigentumsrechte und staatliche Bodenrechte zu transferieren. Schlussfolgernd ist es nicht Ziel besser geographisch verordnetes Wissen zu erfassen, sondern wie Technologie die Wissenschaftler, Politiker und Beteiligte dabei unterstützen kann smarte und nachhaltige Entscheidungen in Bezug auf Land zu treffen.

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Abbreviations

A

AE. - Unsupervised authencoders

AI. - Artificial intelligence

AIMQ. - Methodology for information quality assessment

ALB. - Automated property register

ALS. - Airborne laser scanning

ANOVA. - Analysis of variance

ARoV. - District German offices dealing with the resitution claim

B

BADV. - Federal offices for central services and unresolved property issues

BARoV. - Federal German offices dealing with the resitution claim

BauGB. - Federal building code

BiH. - Bosnia and Herzegovina

BLH. - Bureau of land and housing

BRH. - Federal court of audit

BUILD. - Buildings department

BVS. - Federal agency for special tasks related to unification

BVVG. - Land administration and privatization agency

C

CAP. - Common agricultural policy

CCP. - Chinese communist party

CEDD. - Civil engineering and development department

CEE. - Central and Eastern Europe

CEPA. - Closer economic partnership arrangement

CIMOC. - Context-intervention-mechanisms-outcomes-constraints

CIS. - Commonwealth of independent states

CLC. - European CORINE land cover

CNNs. - Convolutional neural networks

CORINE. - Coordination of information on the environment

COVID-19. - Coronavirus disease 2019

CVE. - Committees for valuation experts

D

DBN. - Deep belief networks

DEM. - Digital elevation model

DLHO. - Division of land and housing office

DLR. - Department of land and resources

E

EALG. - Indemnification and compensation act
ECA. - European cooperation administration
ENVI. - Environment for visualizing images
EO. - Earth observation
ESP. - Estimation of scale parameter
EU. - European union

F

FADN. - Farm accountancy data network
FAHGC. - Framework agreement on Hong Kong/Guangdong co-operation
FAO. - Food and agriculture organization of the United Nations
FCNs. - Fully convolutional networks
FGD. - Focus group discussion
FIErwV. - Land purchase impenmenting regulation
FX. - Feature extraction
FYP. - National five-year plan

G

GAN. - Generative adversarial networks
GDR. - German Democratic Republic
GEOBIA. - Geographic object-based image analysis
GHKCJC. - Guangdong-Hong Kong co-operation joint conference
GHKMCCZ. - Guangdong-Hong Kong-Macao close co-operation zone
GIS. - Geographic information system
GP. - Garden plot
gPb. - Globalized probability of boundary
GPRD. - Greater pearl river delta

H

HKSAR. - Hong Kong specail administrative region
HLMS. - Hierarchical land management system
HLP. - Housing, land and property
HRSI. - High resoultion satellite imagery

I

IACS. - Integrated administration and control system
ICNK. - Information centre on North Korea
ICT. - Information and communication technology

IEG. - Intergovernmental expert groups
IQ. - Information Quality
ISO. - International standard organization

J

JSC. - Joint steering committee

K

KCNA. - Korean central news agency
KRIHS. - Korea research institute for huam settlements

L

LACO. - Legal advisory and conveyancing office
LADM. - Land administration domain model
LandsD. - Lands department
LAO. - Lands administration office
LARoV. - Provincial German offices dealing with the resitution claim
LARs. - Land access rights
LCM. - Land cover map
LGSA. - Land administration companies
LHI - Land & housing institute
NLCD. - National dynamic land cover database
LOCPG. - Liaison office of the central people's government
LPGs. - Agricultural production cooperatives
LULC. - Land use and land cover
LULD-C. - National land use/cover database of China
LURs. - Land use rights
LTRs. - Land transfer rights
LX. - Korea land and geospatial informatix corporation

M

MCDA. - Multi-criteria decision analysis
MLR. - Ministry of land and resources
MoE. - Ministry of environment
MOEF. - Ministry of economy and finance
MoLEP. - North Korean ministry of land and environment protection
MOLIT. - Ministry of land, infrastructure and transport
MRS. - Multi-resoultion segmentations

N

NATO. - Nodality, authority, treasure, and organization
NK. - North Korea; Democratic People's Republic of Korea

O

- OBIA. - Object-based image analysis
- OCOS. - One-country one-system
- OCTS. - One-country two-system
- OECD. - Organization for economic cooperation and development
- OSDPC. - Offices for the settlement of disputed property claims

P

- PHARE. - Poland and Hungary assistance for restructuring of economy
- PlanD. - Planning department
- POI. - Point of interest
- PRD. - Pearl river delta
- PRC. - People's Republic of China
- PTGs. - Private treaty grants

R

- RF. - Random forest
- RNN. - Recurrent neural network

S

- SBLC. - Sino-British land commission
- SCPRC. - State council of PRC
- SCNPC. - Standing committee of the national people's congress
- SDC. - Swiss development and cooperation
- SDI. - Spatial data infrastructures
- SEZ. - Shenzhen special economic zone
- SEZs. - Special economic zones
- SIRI. - Spatial information research institute
- SJP. - Side-jop plot
- SK. - South Korea; Republic of Korea
- SMO. - Survey and mapping office
- SOZ. - Socialist occupation zone

T

- THA. - German trust agency
- TOEAD. - Trade office of the economic affairs department
- TPL. - Tiny patch of land

U

- UAVs. - Un-named Ariel Vehicles

UAVs. - Unmanned Aerial Vehicles

UN-GGIM. - United Nations committee of experts on global geospatial information management

UN-Habitat. - United Nations human settlement programme

UNDP. - United Nations development programme

UNFPA. - United Nations population fund

UNECE. - United Nations economic commission for Europe

UNICEF. - United Nations children's fund

USSR. - Union of soviet socialist republics

W

WHO. - World health organization

WertV. - Valuation Ordinance

Chapter 1. Introduction

1.1 Research Background

Broadly speaking, the role of land and land tenure in post-conflict peacebuilding processes has received increased attention across a number of disciplines in recent years that include environmental sciences, geospatial sciences, international development, land management, public administration and spatial planning (e.g., Bruch, Muffett, & Nichols, 2016; Matthew, Brown, & Jensen, 2009; Unruh & Williams, 2013; Young & Goldman, 2015). The importance of land tenure has been widely discussed in the light of cultural, historical and political influences as well as technical and legal systems (Bruce, 1998; Payne, 2004). In the history of transitional economies, land and property rights has been thought of as a key factor in determining the state success or failure. For example, where land and land tenure effectively manage, it provides long-term improvements in livelihoods, governance, and the economy, on the other hand, if it fails to address the issues, it causes or perpetuates potentially destabilizing grievances (Unruh & Williams, 2013). It has also been argued that a holistic rights-based approach—land administration—to housing, land and property (HLP) should be taken into account in every post-conflict environment to improve security of tenure and it is regarded as critical element of reconstructing economic and social stability (Augustinus et al., 2007; Pantuliano, 2009; Leckie, 2009).

In the last few decades, there also has been a surge of interest in the economic, social and environmental effects of land reform, registration and titling programs, especially in many developing countries and countries in transition (Deininger, 2003; Feder & Nishio, 1998; Galiani & Schargrodsky, 2010; Ho & Spoor, 2006; Lerman et al., 2004; Lipton, 2009; Zevenbergen, 2004). At one end, for the economic advantage of these land-related interventions, evidence suggests that it may lead to better access to formal credit, higher land values, higher investments in land and higher output/income (Feder & Nishio, 1998); at the other, it mainly fosters equity and poverty alleviation and mitigates social segregation through socially desirable land allocation and utilization (Deininger, 2003). Ho & Spoor (2006) point out that land reform appears to be positively related to both rural and urban transformation as well as state and society relations in the developmental context. In another major study with the experimental work in the allocation of land titles, Galiani & Schargrodsky (2010) conclude that entitled families substantially increased housing investment, reduced household size, and enhanced the education of their children, but not in access to credit. There is also evidence that land registration

plays a crucial role not only in regulating the land market, planning urban and rural land use and taxation of land given for development, but also improving trustworthiness in a society by analyzing both developed and developing countries (Zevenbergen, 2004).

Recent trends and pressures in territorial fragmentation and partition have led to a proliferation of new separatism and regionalism such as Brexit, Kosovo, Scotland, Sudan, Yugoslavia, Macedonia, and Spain/Catalonia (Beber, Roessler, & Scacco, 2014; Borgen, 2010; Bourne, 2014; Hettne, 2005; O’Leary, 2007; Waterman, 1987). Meanwhile, globalization has led to the unification, integration and cooperation movements both at sub-national or supranational levels, with the establishment of organizations on economic, political and regional cooperation and integration such as European Union (EU) (Agranoff, 2017; Etzioni, 1962; Haas, 1984; Kölliker, 2006; Perkmann & Sum, 2002). Korean peninsula is divided over the past 70 years and thus made up of wicked problems in line with a range of ‘different administrations’ approach for unification policies, scientific uncertainty and value discrepancies (Balint, Stewart, Desai, & Walters, 2011; Kim, Friedhoff, Kang, & Lee, 2015). However, in light of recent events in the Korean peninsula and fluctuating relationship, it is becoming difficult to ignore that such a unification ever happens. Despite the ongoing tension on the peninsula, inter-Korean dialogue on humanitarian aids and economic cooperation have always continued as a crucial tool of peacebuilding. Considering the ‘unexpected’ or ‘intended’ occurrence of state transformation, socio-economic integration, and opportunities of spatial development, land tenure and varying governmental land interventions that take comprehensively into account socio-technical, and economic, institutional, legal and political aspects could be an important contributing factor to the realization of policy implementation in Korean unification.

1.2 Problem Definition

To date, there are a large number of studies (e.g., Choi & Lee, 1998; Choi et al., 2015; Kim, 2012; Kim et al., 2014) that describe the link between land tenure and Korean unification and the debate continues about the best strategies of land tenure arrangements in North Korea for the land management in the era of Korean unification. Although studies have recognized the importance of land tenure and comprehensive land governance frameworks, research has yet to systematically investigate the evidence and impacts of these issues on the unification with very little scientific methods and a lack of well-grounded theoretical considerations to enhance the reliability and legitimacy of the research findings. While existing research has been mostly restricted to very limited scopes as follows: (1) dealing with the land confiscated under the land reform of 1946 and

appropriate and legitimate forms of land tenure in North Korea after unification (e.g., Ahn, 2013; Bae, 2020; Kim, 2014; Kim, 2017; Park, 2015); (2) focusing on the case studies of land tenure re-formalization and land governance re-arrangement where countries have experienced unification or in transition from former socialist systems (e.g., Choi, 2015; Kim & Zheng, 2015; Lee & Lee, 2015; Park, 2011; Yoon, 2009); (3) analyzing costs and benefits of geospatial information/land taxation in Korean unification and the methods of procurement (e.g., Lee, Moon, Kim, & Kim, 2015; Lee, Moon, Kim, & Kim, 2016; Lim et al., 2015; Seong, 2012); (4) addressing inclusive land management and spatial planning after unification (e.g., Jeong & Choi, 2015; Heo, Jun, & Nam, 2009; Park, 2012; Ryu, 2016). Results from earlier studies so far, however, has not been able to provide robust evidence and remained repetitive and iterative.

North Korea has been treated as subjective, fragmentary, and temporal objects rather than investigated and presented in an objective, empirical, systematic, and constant manner. This is because it has regarded as the objects in textbooks, the limited access due to ideological barriers, and a South Korea-oriented awareness of North Korea (KRIHS, 1992). Owing to the highly complex and variable nature of social-political and economic conditions before and after Korean unification, the research to date has tended to focus on a scenario planning approach; in particular, of all the options for both land tenure re-formalization and governance re-arrangement, most have only been carried out using discriminatory and biased attitudes and values rather than a balanced standpoint. In other words, such contention reflects wishful thinking and illusions on North Korea's collapse and the Korean unification scenarios that define research scope and the content of the existing accounts. A large body of literature has shown a distorted view that land tenure and land governance in North Korea should be transformed, modified and integrated based on the South's standards. (e.g., Jeong, 1998; Lim et al., 2015; Heo et al., Nam, 2009; Yoon, 2019; Yun, 2012) Therefore, the generalizability of much published research on both land tenure re-formalization and land governance re-arrangement in the Korean unification context, aligning with South Korea's systems and institutions is problematic.

Unification is not simply a source of capital, but the most important factor of production that cannot be reproduced and imported. In particular, the subject on land tenure and land governance are linked to all the issues that include housing, industry, financing, taxation, prosperity, social conflicts and resource distributions (Lee, 2016). However, the comprehensive review in identifying the internal and external factors, relationship and priorities that have a positive or negative impact on land tenure and land governance within the outlook and overall frameworks of a unification preparation is

considered relatively insufficient. What remains unclear is what the contextual factors of economic, political, legal constraints that influence land tenure and governance in the process of unification are, or vice versa. Despite the importance of these aspects, there are certain drawbacks with the use of the empirical data and analysis available to the research in its current state of the peninsula as the unification is the future fact that we have not yet experienced. Analyzing the land reform of the post-Soviet countries, Germany, Vietnam and China among Korean scholars is one of the most commonly used techniques for both data gathering and evaluation (e.g., Kim, 2013; Lee, 2019; Ochirbat & Jun, 2019; Oh, 2017; Park, 2018). However, much of the literature clearly is not valid for analyzing the evidence in a systematic manner based on the time sequence and a number of aspects based on patterns found. Thus, there remains a paucity of evidence on how, where, when land tenure and land governance could be significant in different historical contexts and institutional arrangements.

Studies on North Korea has been attracting considerable interest since Korean peninsula has been divided for more than 70 years (e.g., Jung, 2016; Kang, 2015; Koh, 2015; 2019; Lee, 2010; Ryu & Kim, 2012); meanwhile, a lack of data and information is one of the most frequently stated problems. More recently, literature has emerged that offers new insights into what is happening and what has changed in North Korea thanks to the accumulation of relevant datasets related to North Korea, an increase in the number of North Korean defectors and an introduction of different methodologies and related tools for the in-depth analysis (Koh, 2015). However, in the midst of a deluge of information aforementioned, Jung (2016) argues that the ‘fact’ must be justified based on the objective grounds with the rigorous and well-defined approach to the research methods and a more balanced stance on the matter. Although the source of information has become relatively abundant, researchers still have not been able to treat the data in much detail due to the limited access of substantial parts. Gathering geospatial and land administrative data in North Korea and its analysis is an important as fundamental building blocks for land and geospatial policymaking in the Korean unification context, but understudied, cause for concern (e.g., Choi, Choi, Lee, & Hong, 2015; Lee et al., 2014, Lim, Seo, Lee, & Cho, 2013; Lim, et al., 2015; Sakong, Seo, & Han, 2006). Furthermore, the cause of data deficiency has been the subject of intense debate within the scientific community in land management and geospatial sciences. Despite the rapid demands for basic data on land tenure, land use, land value and land development in North Korea, lack of systematic data collection and investigation measures has accentuated the problem of existing accounts. Therefore, investigating geospatial and land administrative data in North Korea is a continuing concern for the establishment of integrated land management and

geospatial information framework in a smart and responsible manner.

1.3 Research Rationales

The evidence that land, land tenure and a variety of land interventions such as land reform, registration and titling programs are associated with peacebuilding processes and state transformation is strong and conclusive. However, in the Korean context, exactly how land tenure and its governance is significant and influences the unification based on a nexus between theoretical-methodological-empirical grounds is still not yet fully understood. This indicates a need to understand the various perceptions of land tenure re-formalization and land governance re-arrangements without a distorted view that exist among the available scholarly literature and expand its scope to the Korean unification context. Furthermore, reflecting comprehensive and strategic frameworks on land management that consider the contextualized factors consisting of socio-technical, and economic, institutional, legal and political aspects is strongly recommended to enable the subjects of land tenure and land governance to become important elements of the Korean unification process. This approach provides reasonably consistent evidence and knowledge of an association between land tenure/land governance and the unification which relatively little is known. One of the main difficulties with this line of reasoning is that how to overcome limited data access, use restrictions, data quality and availability regarding geospatial and land administrative data. Due to these constraints, it is possible that the implications of the results may be biased, given the self-evaluated nature of the data collection, analysis and the interpretation. Therefore, a wide range of geospatial technologies can be applied to collecting, analyzing and interpreting the data and the research should represent a further step towards developing accurate and reliable analytical methods and validation according to the basic assumptions about the spatial, socio-economic, political and legal nature of land tenure and land governance.

From this point of view, the combination of ‘responsible’ and ‘smart’ land management frameworks (de Vries & Chigbu, 2017; de Vries, Bugri, & Mandhu, 2020; Zevenbergen, de Vries, & Bennett, 2015) are central to provide some support for building the theoretical and methodological premise across technology and society that cover key thematic accounts of the thesis: (1) land tenure; (2) land governance; (3) land administration and; (4) urban remote sensing. Responsible and smart land management considers to the both informational and decision/behavioral dimension in which on one hand, it relates to the completeness, accuracy and guarantee of geospatial and land administrative data but on the other hand, social rules and legal norms of different stakeholders should be reflected (de Vries et al., 2020). The notion of responsible and smart land

management has been a matter of ongoing discussion among smart use of information and communication technology (ICT) and informed and responsible decision-making concerning the impacts of land management interventions in both land management sciences and practices. Moreover, this framework sheds new light on a scientifically valid, policy-relevant and socially robust approach by ensuring: (1) multi-stakeholders' engagement; (2) incorporating multi-disciplines from computational and information science to the social science and humanities; (3) laying the cutting-edge system design; (4) connecting the global context to the local and vice versa; (5) transfer knowledge into the practice, and vice versa.

The responsible and smart land management framework embodies a multitude of key concepts which needs to be taken into account. Firstly, land tenure, as a social construct, denotes “the relationship, whether legally or customarily defined, among people, as individuals or groups, with respect to land (FAO, 2002: 7).” In other words, land tenure reflects people-to-land relationships involving complex set of norms and rules that affect the way who can use what resources for how long, and under what conditions (Dale & Mclaughlin, 2000; FAO, 2002; Payne & Durand-Lasserve, 2012; UN-Habitat, 2008). Secondly, according to Borrás & Franco (2010), land governance is a set of the political process for desired land policy outcomes, involving multiple stakeholders at a different level of the polity. Deininger and Feder (2009) also find that institutional structures of land governance have long-term beneficial effects on the economic and political power distribution. Thirdly, while a variety of definitions of the term ‘land administration’ have been suggested, a generally accepted definition is “the process of recording and disseminating information about ownership, value, and use of land when implementing land management policies (UNECE, 1996, p. 14).” In the same vein, it is regarded as the infrastructural basis for the 3Rs (rights, restrictions and responsibilities) and considered responsible when it aligns processes and resources with societal demands (UN-GGIM, 2019). Lastly, one of the most significant current discussion in land management domain is the application of urban remote sensing technologies that fill the gap between physical delineation and social identification of land based on artificial intelligence with semantic algorithms (Lee & de Vries, 2020). Three discrete reasons emerged from this recent convergence of urban remote sensing into land management is not to only improve the value of information and maximize cost-effectiveness but also decrease capacity demanding (Enemark et al., 2014). In sum, these research syntheses rationalize the significance and impact of land tenure and land governance and developing the geospatially informed analysis in the Korean unification context in a responsible and smart manner.

1.4 Research Objectives and Questions

The overall aim of this thesis is to investigate the emerging role and significance of land tenure and land governance in the context of Korean unification by both reviewing empirical evidence and identifying the contextualized factors, relationship and priorities through the development of various methods, tools and techniques based on a responsible and smart land management framework. Specific research objectives and questions pertaining to the main research objective are formulated as follows:

RO1. To identify what (re-)unification is and describing how, where land tenure could be significant in a (re-)unification process.

RQ1. How has (re-)unification been identified and defined?

RQ2. Under what conditions, and using which mechanisms, does land tenure influence the (re-)unification process?

RO2. To evaluate how land governance is re-arranged in a state restructuring process, exploring land governance and unification through theoretical and practical lenses—structuration theory and the government tools-based approach.

RQ3. What are the similarities and differences in the two cases and why is this so?

RQ4. What are the implications of these differences for land governance re-arrangements?

RO3. To standardize the identification and categorization of certain objects, environments and semantics visible in earth observation (EO) data that can (re-)interpret land tenure relations.

RQ5. Which kind of land tenure-related data can one derive and acquire when information access is limited?

RQ6. Which proxies can help to derive currently unknown land tenure relations in conjunction with EO data?

RO4. To provide evidence through a validation that determine whether a geospatially informed analysis is scientifically valid, policy-relevant and contextual and local.

RQ7. To what extent does scientific, bureaucratic and stakeholder knowledge coincide with a set of identified proxies?

RQ8. How have the pixels converted to technologically and socially acceptable land tenure knowledge?

RO5. To address a smart and responsible land management framework when significant uncertainty exists about information access, integration and reliability in the difficult-to-access regions.

RQ9. Which views and strategies on transformation of land tenure and land governance within responsible and smart land management framework can be reflected for the realization of policy implementation in Korean unification?

1.5 Research Methods

Due to structural constrains, the thesis does not have an overarching chapter for the research methodology and therefore cannot provide a comprehensive review of research design that refers to the choice of specific methods of data collection analysis. However, it is concerned with the procedures and methods employed for each specific objective of this study. This section provides a brief overview and the justification for the methodological choices to answer the following specific research questions. A more detailed account of methodology is given in the following chapters respectively.

A combination of different approaches to research designs was used in this investigation that consists of four main stages as shown in Figure 1. Firstly, a normative research framework was developed in order to frame what (re-)unification is, and addresses how (re-)unification processes align, adapt or merge with changes in land tenure relations. A theoretical research design confirms previous findings and contributes additional evidence that suggests. Moreover, theoretical studies provides an opportunity to extend the body of knowledge relevant to disciplines and identifies areas for further empirical research (O'Sullivan, Rassel, Berner, & Taliaferro, 2017). In this vein, the Context-Intervention-Mechanisms-Outcomes-Constraints (CIMOC) framework was adopted to capture the complexities of the factors that affect phenomenon in a systematic and detailed way: Under what conditions (C) does land tenure (I) influence the unification process (O), and what mechanisms operating under the influence of land tenure (M) frame the reunification process (O) with what constraints (C)?

Secondly, an exploratory design was undertaken. One of the most common and useful purposes of research is exploration that typically occurs at a preliminary stage and exploratory research design is thus essential: (1) to help familiarize a subject and interest with better understanding, (2) to assess the feasibility of assuming a more extensive

examination research, and (3) to develop potential methodological approaches (Babbie, 2016). In this project, a secondary research technique through an embedded multiple-cases study (Yin, 2003) was chosen to obtain the institutional extractions from the theoretical parameters of the analysis on how the government interacts in response to transforming land governance and which tools of government were deployed within different institutional (re-)unification contexts as one-country, one-system (OCOS) and one-country, two-system (OCTS) approaches. The selected cases were Germany and China-Hong Kong from the 'divided nations perspective'. In line with Structuration Theory and Tools of Government, this approach provides rigorous evidence through integrating viewpoints from the 'sociological-institutional' and 'public administration', addressing critical research questions as well as drawing empirically valid inferences regarding land governance rearrangements.

Thirdly, we outline the methodological development of geospatially informed analysis (GIA) based on combination of qualitative (land tenure) and quantitative (earth observation(EO)) nature of data. The mixed methods research is often used to describe combining or associating both quantitative and qualitative forms that interconnect the two different research strategies within a single project. (Bryman, 2016). Drawing on an extensive range of sources, Bryman (Bryman, 2006) classified the different ways (18 types) in which quantitative and qualitative research are combined and it was decided that the best approach to adopt for this investigation was 'triangulation' since it is one of the more practical ways of using more than one method or source of data so that research findings could be cross-checked. Moreover, data integration plays a pivotal role in identifying major elements for the qualitative and quantitative data interpretation from multiple sources such as spatial documented knowledge, ground-truth and geospatial information and, subsequently, for spatial decision-making. It is therefore concerned with a mixed methods research design (focusing on triangulation) and information fusion approach that usefully supplement and extend the methodological and epistemological assumptions of semantic land tenure relations through EO data interpretation.

After having discussed how to construct a concept and methodology of GIA in the third step, the fourth stage was empirical-based research and experimental in nature that offers another advantage in qualifying and quantifying empirical evidence. Experimental research investigates the factors and relationships that determine if a specific treatment influences an outcome (Creswell & Creswell, 2017). The specific characteristics which drive the experimental research are: manipulation of one or more independent variables and control over extraneous variables (Bordens & Abbott, 2018). The experimental work presented here provided the first investigations into which proposed 66 geospatially

informed proxies academic, governmental professionals and stakeholders consider relevant and useful and how they evaluate the information quality. A survey consisted of 77 sample respondents recruited from scientific, bureaucratic and stakeholder groups. Data for this study were collected using a web-based questionnaire and the both Chi-square test and one-way ANOVA test were chosen for the analysis.

With respect to the key research questions above, the fifth objective is reached using narrative synthesis methods to summarize and explain key findings of the thesis from the different sets of evidence presented in this investigation (Bailey, Madden, Alfes, & Fletcher, 2017; Rodgers et al., 2009; Scott-Little, Hamann, & Jurs, 2002). Overall, this approach strengthens the idea that how a responsible and smart land management framework can be adapted for the realization of policy implementation in Korean unification and provides deeper insight into role of land tenure and land governance in peace-building process.

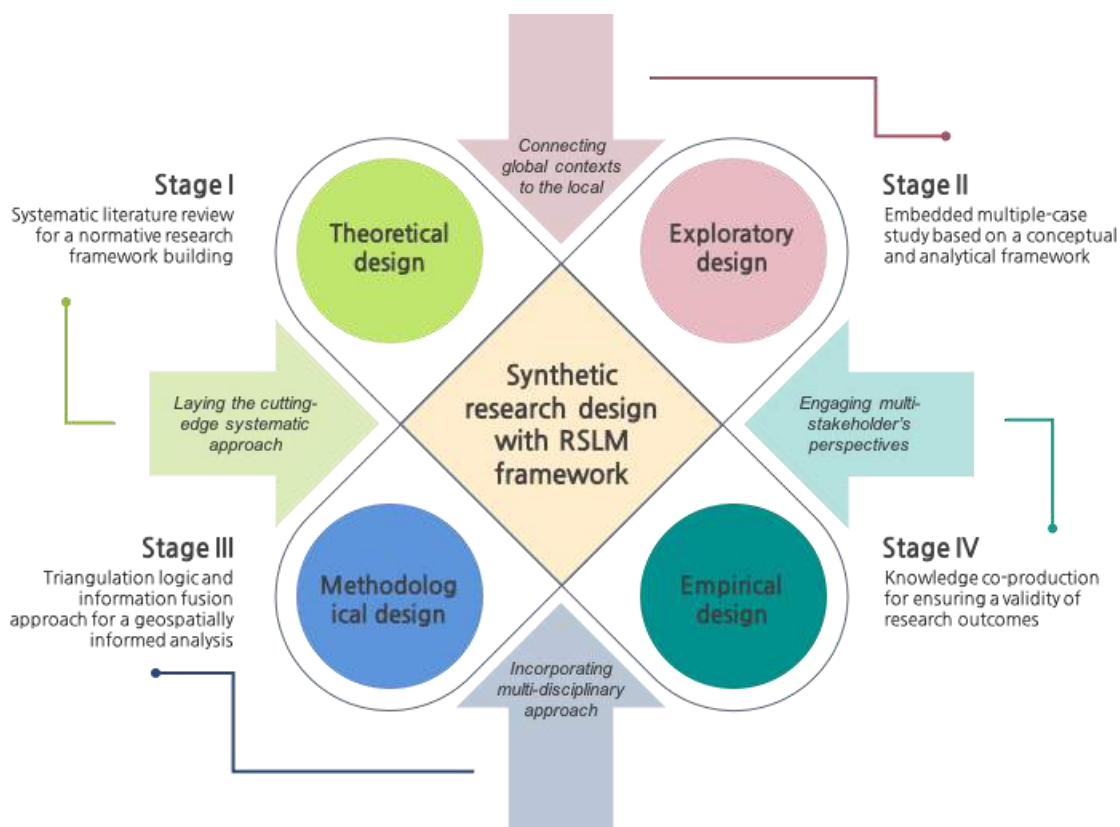


Figure 1 The Developed Set of Research Methodologies based on the Responsible and Smart Land Management Framework (source: devised by an author)

1.6 Structure of Thesis

This thesis is structured as a cumulative collection of different peer-reviewed publications: published and forthcoming (See Figure 2). A total number of five research papers are the outcome of this dissertation. This section outlines the content of each

contribution and presents the structure of the thesis.

Paper I is presented in *Chapter 2* and elaborates definitions of (re-)unification, followed by the continuum of (re-)unification and descriptions of preconditions of reunification processes. It also rationalizes the significance of land tenure to (re-)unification, leading to discussions on possible consequences for land tenure relations, concluding by analysing implications for expected roles and impediments of land tenure both during and after Korean (re-)unification.

In *Chapter 3*, **Paper II** represent the theoretical foundations for describing and connecting different aspects of land governance and (re-)unification. In addition to theory-building, this contributes to existing knowledge of land governance re-arrangements by providing an analytical foundation for a systematic classification of institutions and its tools based upon a comprehensive account of socio-economic and political variables for land governance.

Paper III strengthens the idea in *Chapter 4* that data mining for North Korea related land (tenure) information in the context of Korean (re-)unification is possible and feasible. This account seeks to propose a new notion of remote-sensing based proxies for interpreting land tenure relations that could be transferable and applicable in land administration domain at a semantic level. Then, it demonstrates how the process of socialization of pixels can take place and how EO data can be (re-)interpreted into semantic land tenure relations with a geospatially informed analysis.

In *Chapter 5*, it provides empirical evidence for the claim that it is possible to standardize the identification and categorization of certain objects, environments, and semantics visible in EO data that can (re-)interpret land tenure relations based on **Paper IV**. It establishes validation methods by combining multiple values and the forms of knowledge co-production to determine whether geospatially informed analysis is scientifically valid, policy-relevant and contextualized and localized in a given context.

To conclude, this thesis yields one more significant contribution with peer-reviewed publication in *Chapter 6* (**Paper V**, forthcoming) that address the issue of land tenure and land governance within the responsible and smart land management framework in the context of Korean unification. It also outlines policy recommendations for land managers who intends to engage decision-making for the realization of land tenure re-formalization and land governance re-arrangements in the Korean unification process.

In Figure 1, the structure of this dissertation is depicted, including the research design and methods, related themes and objectives, as well as resulting publications.

Chapters	Designs	Methods	Themes	Objectives	Publications
2	Theoretical	Systematic literature review with CIMOC framework	Land Tenure	Identifying what (re-)unification is and describing how, where land tenure could be significant in a (re-)unification process	Paper I Lee, C., & de Vries, W. T. (2018). <i>Land Use Policy</i> 75, 127-136.
3	Exploratory	Embedded case study based on OCOS and OCTS approach	Land Governance	Evaluating how land governance re-arranged in a state restructuring process, exploring land governance and (re-)unification	Paper II Lee, C., de Vries, W. T., & Chigbu, U. E. (2019). <i>Administrative Sciences</i> 9(1), 21.
4	Methodological	Triangulation logic and information fusion	Land Tenure Remote Sensing Land Administration	Standardizing the identification and categorization of certain objects, environments and semantics visible in earth observation (EO) data that can (re-)interpret land tenure relations	Paper III Lee, C., & de Vries, W. T. (2020). <i>Remote Sensing</i> 12(2), 255.
5	Empirical	Knowledge elicitation and co-production	Remote Sensing Land Management	Providing empirical evidence through a test and validation process that determine whether social and geospatial data on land tenure of North Korea for the unification can be aligned or not	Paper IV Lee, C., & de Vries, W. T. (2020). <i>Land Use Policy</i> (under review)
6	Synthetic	Narrative synthesis in smart and responsible land management framework	Land Management	Addressing a smart and responsible management framework when significant uncertainty exists about information access, integration and reliability in the difficult-to-access regions	Paper V Lee, C., & de Vries, W. T. (2020). <i>Land</i> (In preparation)

Thesis A Divided Nation: Land Tenure, Governance and the Korean (Re-)unification

Figure 2 Overview of thesis structure

Chapter 2. A Divided Nation: Rethinking and Rescaling Land Tenure in the Korean (Re-)unification*

* This chapter is based on a published paper as follows: Lee, C., & de Vries, W. T. (2018). A divided nation: Rethinking and rescaling land tenure in the Korean (re-) unification. *Land Use Policy*, 75, 127-136. DOI: <https://doi.org/10.1016/j.landusepol.2018.02.046>

S U M M A R Y

In the Korean (re-)unification discourse, limited attention is given to how the highly different systems of land tenure can be unified in a comprehensive land governance framework. Possible reasons include the uncertainty of (re-)unification itself, high sensitivity of the land issue as a territorial matter and limited access to North Korean data about land tenure. Moreover, there are insufficient theoretical foundations regarding the role and the significance of land tenure in the (re-)unification process. This paper identifies what (re-)unification is and describes how, where and when land tenure could be significant in a (re-)unification process. These questions are addressed using the Context-Intervention-Mechanisms-Outcomes-Constraints (CIMOC) framework. This systematic approach takes both the time sequence and a number of aspects based on patterns found in literature into account in order to identify and define what (re-)unification is and how it aligns, adapts or merges to land tenure relations. We find that during transformation processes, discussions on land tenure have both an instrumental and reforming function and land tenure resolution facilitate the peace-building in integration processes. In addition, land tenure institutions play significant role in a territorial development process. The key findings of the research synthesis rationalize the significance of land tenure in (re-)unification process. Amalgamation of (re-)unification and land tenure discourses derive intricate relationships to address the multi-dimensional problems in the Korean peninsula. Yet, the discussion of both concepts have so far focused on monolytical and pragmatic problem-solving rather than the start of a more fundamental discussion: how to re-shape land governance institutions. This study can be a starting point for policy-makers to discuss and comprehend an unsolved quandary of the Korean peninsula.

Keywords: land tenure; (re-)unification; transformation; integration; territorial development

Chapter 2. A Divided Nation: Rethinking and Rescaling Land Tenure in the Korean (Re-)unification

2.1 Introduction

Since the fall of the Soviet Union in the 1990s, the (re-)unification of the Korean peninsula has become a distinct possibility (Zang, 2016). Despite on-going tensions since the succession of Kim Jong-un in December 2011, while some argue North Korea has survived against all odds after periods of turmoil (Bennett, 2013); some critics in South Korea argue it is only a case of when not if the Northern regime collapses. Dialogues between the North and South have persisted over the decades and in 2014 South Korea formulated the Dresden initiative towards peaceful (re-)unification. Critical themes were trust-building processes, expansion of private-sector exchanges, spreading of social consensus on reunification, the launch of a Presidential Committee for Unification Preparation, and systematic preparation for reunification through sharing German reunification experiences (Ministry of Unification, 2016).

Over the past 70 years, the division of the Korean peninsula has produced significant divergence in the areas including politics, economy, society, and culture, raising existential questions for (re-)unification, such as re-defining territory, uniting people, and re-establishing sovereignty. Land and land tenure is a critical component of this (re-)unification process since it is fundamental to facilitating sociospatial identities revolving around symbolic and historical meaning of territories (Convery et al., 2014). (Re-)unification also poses significant costs for both North and South Korea reflected in spatial choices made both during and after a process of (re-)unification. Spatial integration needs development alongside integration of social and legal institutions, of which land is a notable feature. Hence, the reorganization of land tenure in a single Korea would also affect terms of economic and social integration. Thus, land tenure is important to social, political and economic restructuring in the Korea peninsula, bringing together sociotechnical, and economic, institutional, legal and political aspects often ignored (FAO, 2002).

The socio-spatial dimension within Korean institutions has been relatively under-researched with most studies focused on legal integration (Lee et al., 2014). Further, little research has been undertaken on the (re-)unification of organisations and organisational systems in relation to land. Instead, most studies primarily focus on the assimilation within South Korean organisational frameworks and have difficulty analysing how North Korean systems could merge while maintaining some of their functionality (Choi, 2013).

Studies on merging land systems point out that even within a single country significant organizational issues exist, and therefore merging two countries together may be more difficult (de Vries et al., 2015; de Vries et al., 2016).

Park (2012) notes that (re-)unification processes still need to consider methods and characteristics of a reunified Korea and North Korea. Moreover, North Korean land information has so far been gathered and managed individually by various institution, so there may be significant informational gaps to establishing and promoting effective land policies (Moon et al., 2016). Hence, (re-)unification is not just simply a source of potential new capital, but rather the establishment of a new range of production factors through which the future of the Korean peninsula can be created. Land issues are linked to areas including housing, industry, financial, tax, welfare, social conflict and distribution (Lee, 2016). Emergent land policies for (re-)unification therefore need to take integrative approaches that are currently rarely achieved (Lee et al., 2014).

The major problem is it remains difficult to predict and prepare for future possibilities and multi-dimensional problems. Therefore, only limited studies address these land issues. This highlights uncertainty of (re-)unification, high sensitivity to South Korean government (re-)unification policies and limited access to North Korean data. Due to these constraints, theoretical foundations for ascertaining linkages, between land tenure and (re-)unification processes, their inter-relationship and significance are insufficient. However, questions of how, where and when land tenure plays can play a role in Korean (re-)unification is crucial. Analysis starts with theoretical classification of (re-)unification processes, unpacking the concept of (re-)unification making it both workable and translatable to the Korean context. This translatability produces interpretations of how these classes relate to or include references to land tenure and differences between “unification” and “reunification” discourses. Notions of “integration”, “transformation” and “territorial development” frames through geographic, political, social and economic perspectives then frame the reconnection of land and reunification issues. The following research questions emerge as critical:

- RQ1. How has (re-)unification been identified and defined?
- RQ2. Under what conditions, and using which mechanisms, does land tenure influence the (re-)unification process?

The paper is structured through six main sections: first dealing with the paper’s methodology defining (re-)unification and analysis of process and conditions of (re-)unification, and introducing the Context-Intervention-Mechanisms-Outcomes-Constraints (CIMOC) framework. The subsequent section elaborates definitions of (re-)unification,

followed by the continuum of (re-)unification and descriptions of preconditions of reunification processes. The research synthesis rationalizes the significance of land tenure to (re-)unification, leading to discussions on possible consequences for land tenure relations, concluding by answering research questions and analysing implications for expected roles and impediments of land tenure both during and after Korean (re-)unification.

2.2 Methodology

Issues of methodology are essential to the framing issues in the Korean peninsula and the workable outcomes produced. While linear and single dimensional methodologies are often considered when looking at socio-political, economic and land issues, Denyer and Tranfield's (2009) "CIMO logic" often used to develop critical management and organisational perspectives was deployed in-order to develop and unpack research questions as well as define research scope. The adapted "Context-Intervention-Mechanisms-Outcomes-Constraints (CIMOC) framework" provides evidences through which to scrutinize land and land tenure issues in the Korean peninsula. Context refers to surrounding factors and human actors framing discourses, while interventions pertain to how behaviour is influenced by human actions. Mechanisms are the tools and means through which interventions are generated, while outcomes are consequences of specific mechanisms (Denyer et al., 2008).

In addition, constraints have been identified to recognise limitations of interventions and mechanisms. The literature review focused on the following terms: unification, reunification, transformation, integration and territorial development. In addition, articles were collected on land tenure-related concepts including property rights and land ownership. Further multi- and transdisciplinary literature crossing disciplinary boundaries (cf. politics, economics, international development, sociology, geography, public administration and spatial planning and land management etc.) helped combine land tenure transformations, Korean land tenure and intersecting literature related to produce new perspectives and was the raw material for further literature analysis.

Five types of documents were taken into account in review: (1) peer-reviewed journal articles, (2) thesis, (3) books, (4) technical reports, and (5) national land policy documents. All were part of well-known and accessible academic literature catalogues, scientific journals or working paper series embracing allied land tenure and (re-)unification subjects published in English and Korean. The following on-line electronic database were also considered: Elsevier, GEOBASE, GeoRef, Google Scholar, JSTOR, Networked Digital Library of Theses and Dissertations, OpenGrey, SCOPUS, Springer Link, Web of

Science, RISS (Korean) and DBpia (Korean), and libraries to which the researchers were subscribed. Literature regarding land tenure in Korean (re-)unification was reviewed through the Information Centre on North Korea (ICNK) in the Ministry of Unification (MoU).

Searches for grey literature via websites of leading institutions working on land tenure and Korean (re-)unification produced work from international (e.g. FAO, UN-HABITAT, and the World Bank), governmental (e.g. Ministry of Unification), non-governmental (e.g. International Land Coalition), national donor organizations (e.g. USAID, DFID and GIZ), university institutions (e.g. University of Wisconsin Land Tenure Centre) and think tanks (e.g. CSIS, RAND). In addition, bibliographic snowballing and hand searches of key journals were also employed to supplement as follows: Land Use Policy, Habitat International, Survey Review, Journal of Peace Studies, World Bank Research Observer, World Development.

Spatially the study area was not limited to the Korean peninsula. Post-Soviet, EU and German perspectives were analysed, as were the experiences of specific countries which had gone through a similar process of division and (re-)unification including, China, Vietnam, Cambodia, Laos and Mongolia (cf. defined by Henderson et al., 1974). These examples could be divided into CIS, CEE and ECA regions (cf. defined by Lerman et al., 2004). Definitions of (re-)unification were theoretically discussed from the emergence of literature on nationalist and political unification perspectives in the 1950s. This adds to aspects of transformation of land tenure systems in South and North Korea, enabled by extremely different political, social and economic conditions over the past 70 years.

This systematic approach enabled identification of what (re-)unification is and how land tenure-related systems merge, aligns or adapts to critical problems, issues and questions. Consequently, the CIMOC framework was used to derive a composite research question from the two main research questions, framing discussion: Under what conditions (C) does land tenure (I) influence the unification process (O), and what mechanisms operating under the influence of land tenure (M) frame the reunification process (O) with what constraints (C)?

2.3 Meaning of (Re-)unification: Unification or Re-unification

Since the liberation of the Korea peninsula from Japanese rule at the end of the Second World War and the subsequent division of Korea, the issue of “(re-)unification” has been a critical for successive South Korean government. It is the latest buzzword for politicians, government officials, journalists and scholars in South Korea although difficult

to define. Instead of conceptualizing “unification” within a larger discourses and agenda of sustainable development, public sector integration or societal transformation, the political discourses around unification focus on the security agenda (i.e. appeals to prevent danger). South Korea’s Ministry of Unification (2015, 2016) uses a geographic

lens to denote territorial and infrastructural reconnection of North and South Korea as a single nation. The idea of the “Korean peninsula” implies no barriers to living and travelling anywhere in the territory. Therefore, unification is not only about expanding total land mass but also relates to citizens’ rights.

In addition, the implicit assumption is the establishment of a single constitution, a single government and unitary state. This would consolidate two political systems into a single nation is framed as overcoming division. It also connotes economic integration between liberal marketization and communistic economic planning. Both Koreas have vastly different living standards and thus economic integration is an urgent part of unification. Finally, it also implies socio-cultural restoration of national homogeneity focused on linguistic, cultural and lifestyle choice. However, prolonged division has produced socio-cultural heterogeneity with a sense of Korean unity becoming weaker. Thus, unification signifies a political project to integrate and assimilate both North and South, creating a common consciousness, value system, and lifestyles emerging from an imagined historic past.

Critiques of this “national unification” project focus on the implicit preferable political norms of having a stable, effective and sustainable development, whereby the opposite, having two or more divided state and divided people in separated territories are seen as ineffective, and, perhaps more importantly, are seen as a temporary circumstance (Haas, 1984). Deutch (1954, p. 33) thus defines unification as a “[process] that create[s] unifying habits and institutions” and Etzioni (1962, p. 44) describes unification as “the formation of political communities composed of units with no or only a few previous political ties.” Therefore, arguably unification arises among countries without former relations, interdependence or common international system (Etzioni, 1962). Hass (1966, p. 94) further develops this definition of unification as “the process whereby political actors in several distinct national settings are persuaded to shift their loyalties, expectations [...] political activities toward a new and larger centre, whose institutions possess or demand jurisdiction over the pre-existing national states.” Together these definitions show unification to be forming political communities and dependent on nationalist perspectives.

However, there are distinct critiques of the term “unification” itself. Tara (2016, p. 135) posits that “unification” and “reunification” are often used interchangeably in the Korean context. In the Korean context, the Korean term “tong-il” is best translatable as

just “unification”. However, the division of Korea implies the use of (re-)unification rather than unification. The omission of “re” does not imply Koreans as being ignorant of the divide it is generally acknowledged that reunification is a different concept. Hence, the term “reunification” as a concept reflects a more accurate assessment of inter-Korean relations. Indeed, Wolf (2015) identifies reunification from a historical perspective as bringing together formerly united parts of a single country. This can be seen as follows:

“[Reunification is] when previously separated parts of an entity that was generally considered to be a whole are separated into two or more sovereign countries and are then brought together again whether by force or voluntary agreement into one single nation.” (Wolf, 2015: 171)

The contextual and historical evidence presented above with regard to the Korean peninsula justifies the term of (re-)unification over unification. Although it can be used almost interchangeably and derived from the same root “unification” defines the merging process forming a single state and territory, whereas (re-)unification puts greater emphasis on the process of reconnecting and reshaping the two Koreas and restoring “historical justice”. Thus, summarizing, (re-)unification can be understood as “a process, namely a merging process whereby at least two separate homogenous political communities merge into a single nation with heterogeneous political communities.”

From a political geography perspective, this signifies different types of political relations in post-division. Lebow (2007) distinguishes between “divided nations” and “partitioned countries”. While partitioned countries result from ethno-linguistic, religious or cultural conflict divided nations have the following characteristics: (1) ethnic homogeneity, (2) a common historical tradition, (3) experience of successful political union before being divided into two separate political units and (4) artificial division by external forces. This includes Germany, Korea, China, and Vietnam (division), Cambodia and Laos (de facto division) and Mongolia (division over a longer period). As discussed, Korea belongs to the ‘divided nations’ category since its division into South and North Korea is related to external forces despite cultural homogeneity. Therefore, processes of reunification need to reflect this “divided nations” perspective.

2.4 Process of (Re-)unification: From Divided to Unified Nation

Discussing why countries divide is important prior to explaining the process of (re-)unification since it rationalizes historical dimensions of (re-)unification. There are a wide range of the rationale behind nations such as political upheavals and ethnic conflicts (e.g. Yugoslavia), voluntary processes by political leadership (e.g. Czechoslovakia),

linguistic dissimilation (e.g. Belgium) and ethnic and religious oppositions (e.g. Ireland) for example. In the same vein, it can be categorized by chronological order: (1) product of decolonizing process (e.g. Ireland, India and Palestine); (2) product of the cold war (e.g. Germany, Korea, Vietnam, China and Taiwan); (3) product of a decisive neighbourhood power (e.g. Turkey in Cyprus and Kurdistan) and; (4) product of democratization processes in plurinational states (e.g. former USSR, the former Czechoslovakia, the former Yugoslavia, and Ethiopia) (Schaeffer, 1990, 1999; O'Leary, 2007).

In the German reunification process, for example, the “transfer of existing institutions” and “resolving the emerging conundrum” were key schemes and “land tenure security” has acknowledged as most important element in societal development (Hawerk, 2001; Dells, 2012; Kuchar and Gläsel, 2006, 2007). Due to the sharp increase in the claims for unresolved property, overlapping land ownership and knowledge gaps between East and West Germany, the federal government clarified legal provision on land restitution, compensation and investment (Kuchar and Gläsel, 2007; Thiel, 2010). “Backwards-looking-justice” and “free-market ideology of West Germany” is the philosophical justification for restitution to restore economic development (Tucker-Mohl and Kim, 2005). Cyprus has undergone (re-)unification dialogues for decades and the land tenure is one of the priority agendas in the settlement of the Cyprus dispute. Due to individual actions and claims against tenurial questions have led to more pricey, time-consuming and ineffective than comprehensive resolution. Since 2008, the divided Cyprus also have agreed in principle to reconcile the “property divide” through a mix of restitution, exchange and compensation and the “voluntary domestic remedies” (e.g. Turkish Cypriot property commission) have strongly encouraged. (International Crisis Group, 2010; Zetter, 2011). Land tenure issues in post-conflict Bosnia and Herzegovina (BiH) have also affected by a situation in which land was scarce but sought-after and the “property claims and restitution” policy has implemented based upon the Dayton Peace Accord in 1995. State-owned land allocated to people aiming at “humanitarian needs” and “demographic restructure”. This process, however, has confronted the political controversy as well as the legal and procedural complexity (Garlick, 2000; Zetter, 2011; Williams, 2013).

Looking at various (re-)unification experiences aforementioned, land tenure is a main building block of societal and economic development and managing land supported by clarified legal and institutional frameworks on land restitution, compensation and investment is necessary. Transforming land markets and privatization strategies should be associated with community agreements and political leadership considering humanitarian needs and political engineering.

Having defined (re-)unification as a merging process from divided nations to unified nations, the next question is how such a process with such which characteristics and attributes might take place. According to Lebow (2007), the relationship between divided nations depends on three key factors: degrees of stability and legitimacy of the divided states; relationships between each divided state and its corresponding “superpower” and, relations between the superpowers themselves. These factors contribute to a process described as a theoretical continuum of (re-)unification (see Fig.). In this continuum, the most intense form of cooperation between divided nations is mutual coordination. In Fig. 1, Integration is contrary to conflict, while independence is at the centre between integration and conflict. Both conflict and integration, however, indicate interaction (Lombaerde and Langenhove, 2005). Although it seems unilateral and normative, this forms a functional perspective of a sliding scale or spectrum. Division and unification are two slides of the dialectic, in which an actor’s ideology and perception tend to inform what division is and what unification is (Rankin, 2006). A continuum of (re-)unification thus consists of five stages: (1) pre-division; (2) initial division; (3) middle term division; (4) rapprochement and (5) unification.

According to Lebow (2007), all divided nations have three core characteristics at a pre-division stage: (1) ethnic homogeneity, (2) a common historical tradition and (3) a political unity. In the initial stage of division, the newly formed nations show intense hostility to each other highlighted by: (1) reciprocal non-recognition; (2) exclusive assertion of successorship status by at least one of the nations; (3) extreme ideological conflicts; (4) attempts to strengthen and seal borders by at least one nation; (5) endeavours to disrupt the opposing regime through propaganda and; (6) militarization of conflict. After a certain period, the subsequent stage of division is characterized by rapid change in the relations between the former united parts and declining hostility. This stage is marked by: (1) substantial consent of coexistence and a corresponding dilution against sole-successor (2) decrease of ideological conflicts; (3) détente between the borders; (4) decline in attempts to destroy the opposition regime; (5) reduction of likelihood of military confrontation. Finally, rapprochement has the following features: (1) close economic cooperation (e.g. tourism, trade and development); (2) political cooperation (e.g. foreign aid, cultural programs, diplomacy in neighbouring countries); (3) exchange of people and ideas through mitigation of tensions between borders and; (4) establishment of intergovernmental cooperation organizations dealing with all sectors.

Wolf (2015) describes the process of reunification, the final stage of the divided nations theory following rapprochement, as a voluntary process through which a new identity is created. Internal conflicts and contradictory foreign commitments remain crucial

obstacles to this unity, though may be positive if both states manage to gather substantial support. Federal systems are also an option as in the USA, Germany and Nigeria where regional nationalism was a solution to significant barriers. The free movement of people, enlargement of economic co-operation and symbolic expressions of unity such as an integrated national flag, anthem, athletic teams and cultural organizations are part of this new union. Reunified countries can agree on selecting a single president, but their authority may be limited to only ceremonial functions (Lebow, 2007). This reunification process implies common public administrative as well as social and territorial transformation. Yet, only under certain conditions can divided states become reunified.

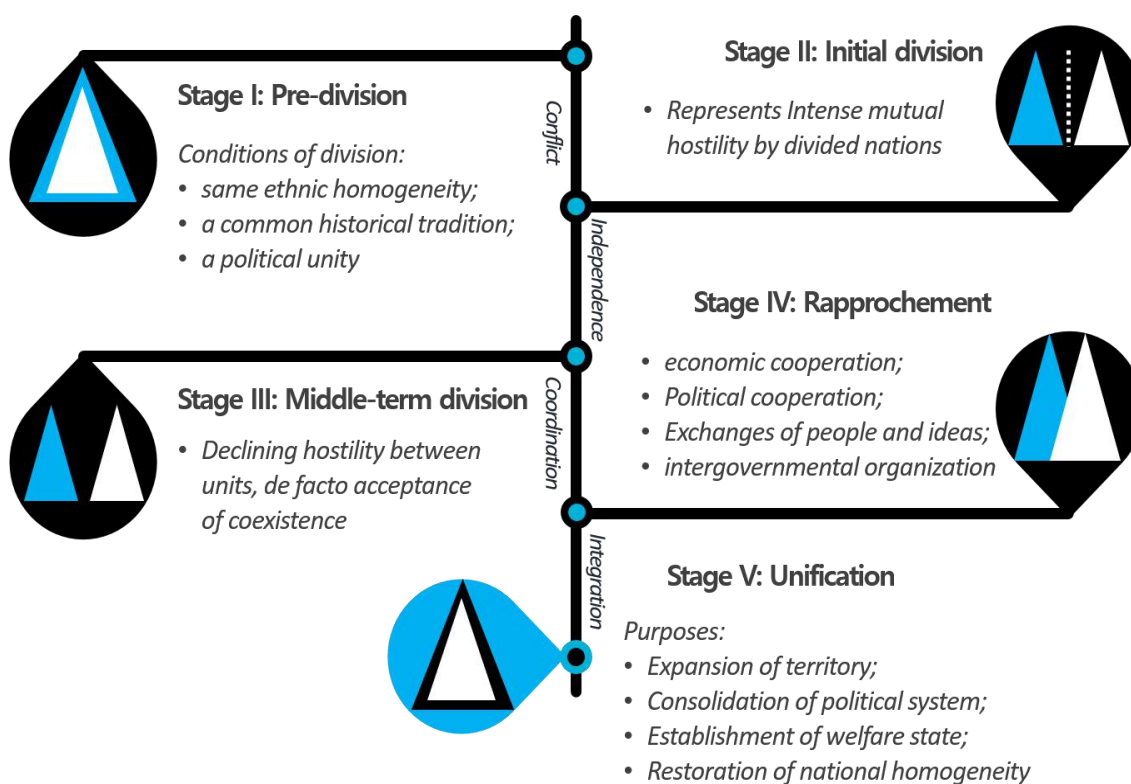


Figure 3 Continuum of (re-)unification (developed by authors based on Lebow, 2007; Lombaerde & Langenhove, 2005; and Rankin 2006)

2.5 Conditions of (Re-)unification: Transformation, Integration and Territorial Development Introduction

If (re-)unification is considered as a process of different phases or stages, the major question is which conditions, divided states must meet to achieve the status of a unitary state. Wrobel (2009) argues that, from the perspective of German reunification, the integration process has a significant impact on transformation, and the transformation process itself has noticeable effects on integration. In this manner, Korean (re-) unification could be understood as the simultaneous process of transformation and integration.

Diverse, fragmented and often contested terms often gradually become prominent

in various disciplines; in this case, “transformation” refers to an immense, radical and irreversible change (Brown et al., 2013; O’Neill and Fabricius, 2013). For example, during a number of crucial historical events societies radically transformed, such as during the Industrial Revolution in Europe, the fall of Berlin Wall, the collapse of ancient civilizations, and the Arab Spring. Since the fall of the Berlin wall in 1989, transformation especially stands for a particular form of social change that should be understood as an alternative method of structural change in comparison to conventional types such as construction of advanced democratic and capitalist societies (Kollmorgen, 2010). Moreover, transformation can be treated as both a cognitive and practical problem. The cognitive problem is associated with different stakeholder perspectives affecting their perception and problem-solving processes. The social participation of different actors in change processes therefore relates to practical problems that can be used to frame various solutions (Pickel, 2002).

What distinguishes transformation from other forms of structural change is its accompaniment to fundamental, systemically regulated and performed social change aimed at an enhancing economic, social and institutional modernization (Breisinger and Diao, 2008; Kollmorgen, 2010). Transformation is thus related to designing and implementing political and economic solutions focused on political problem-solving, socio-technological approaches, and forming common myths and ideologies (Pickel, 2002). More recently, Considine (2013) argues transformation is also about social networks since relations between different actors affect new types of solidarity and social strength.

(Re-)unification is theoretically deemed as a form of advanced integration (Haas, 1984). Integration therefore refers to (1) institutions and practices, (2) terminal conditions or end-states, (3) a processes of forming secure communities, (4) cooperation and collective decisionmaking systems and (5) stable and peaceful relationships between states (cf. Deutsch et al., 1957; Haas and Schmitter, 1964; Etzioni, 1965; Galtung, 1968; Lindberg, 1970; Haas, 1984). Political (re-)unification can thus also be associated with political integration, which hypothesizes that the reason for enhancing relations between states and people is primarily since high levels of economic integration cannot be upheld without significant political integration (Etzioni, 1962, 1965).

From a social integration perspective, integration means social unity that is broadly compatible with other terms including social inclusion, cohesion and capital (Jeannotte, 2008). Further, regional integration linking various disciplines including economic, political, sociological, governance, and international relations (Bolaños, 2016), shows as Balassa (1961, p. 1) notes integration at an economic level is “the abolition of discrimination between economic units belonging to different national states and refers to both a

process and a state of affairs.”

As Haas (1984) notes, attitudinal and material factors determine whether people or states accomplish diverse levels of integration and political unification. Firstly, attitudinal factors such as idealism are important to forming both elite and public opinion in the integration process. In contrast, material factor such as trade or the pursuit of power affect political formations. Nye (1971) adds attitudinal and nonattitudinal factors in the analysis of economic, social and political integration conducted concurrently. Likewise, Wallace (1992) argues, integration is a broken form of formal integration led by states such as the formation of institutions, policies or legislation, and informal integration without authoritative interventions.

According to Habermas (1992), modern societies operate in forms of structural integration divided into moral and system integration. Moral integration is not only based on social consensus and cooperation between members of society but also focuses on solidarity. On the other hand, system integration does not require moral solidarity, but instead requires standardized means of exchange, particularly money and power and functions as an anonymous form via institutions and organizations (Bosswick and Heckmann, 2006; Kreckel, 1999).

The concept of “territorial development” reflects changes in multidimensional phenomena, including interactions between geographical, institutional, economic factors and mechanisms within a territory (Modrego and Berdegué, 2015; Treakle and Krell, 2014). According to Romeo (2015), territorial development refers to spatial integration emphasizing multi-sectoral development of territory based upon long-term spatial vision and comprehensive development strategies. In a more geographic sense, this associates territorial scales of development by jurisdiction (e.g. urban, metropolitan, regional or rural etc.), area (e.g. watershed, coastal, mountainous, border areas etc.) or institutional (e.g. local, regional, national or transnational etc.). Although territorial development is not a new concept, it has become more popular among policy-makers, as it includes critical elements to deal with rapid urbanization, high social and political costs due to imbalanced development and limitations of top-down development approaches (Bilbao, 2015).

From an EU perspective, the logic of territorial development is influenced by national policies at different scales, social movements, technological advancement and economic forces. Policies of territorial development are significant mechanisms for reinforcing “territorial capital” in EU regions, which supports territorial cohesion (Damsgaard et al., 2011). Looking at the OECD’s definition of territorial development policies, it emphasizes adding value by integrating spatial, economic and social aspects. This involves

encouraging spatial development and creating spatial frameworks that affects economic growth and helps to pursue the reduction of environment problems and sustainability. It also embraces promoting economic development and improving potential for growth and capacity building focusing on entrepreneurship and business environments. However, while lastly territorial development policies can promote social development and strengthens social cohesion, critiques focus on the deepening social problems related economic change and regional segregation by socioeconomic inequalities (OECD, 2001).

Conditions	Transformation	Integration	Territorial development
Principles	Social proximity	Political and economic proximity	Spatial proximity
Definitions	(structural) Changes	Relationships (between people and states)	(spatial) Development
Factors affecting	Cognitive and practical factors	Attitudinal and material factors	Geographical, institutional and economic factors
Functions	(political / economic) Reforms	Functional cooperation	Territorial cohesion
Forms	Social transformation	Moral and system integration	Spatial, social and economic development
Implications	Enhancing modernization	Forming homogeneous political community	Reinforcing territorial capital

Table 1 The trajectory of conditions of unification (by authors)

Summarizing, (re-)unification can be described through three concepts (presented in Tables 1 and 2): transformation; integration; and territorial development. In the context of Korean (re-)unification, the transformation processes require enormous political and economic reforms. The belief systems, regimes and institutions at the state level in a single territory, especially countries in transition, needs to focus on the differentiation of political, social (e.g. communism versus democracy) and economic systems (e.g. socialist versus capitalist economy) over the decades. Social transformation in North Korea would be accompanied by radical structural changes, hence requires enormous efforts and careful planning to enhance modernisation. Implementing political and economic reforms to achieve (re-)unification processes depends on how communities or societies familiarize themselves with new political, social and economic institutions. If a transformation process does not function, it affects the integration process, especially political and economic integration in a reunified Korea.

Integration refers to institutional systems, and relationships between states and the terminal condition process by which secure communities are formed. Therefore, integration approaches to Korean reunification necessarily requires reunifying political

and economic systems and institutions and restoring national homogeneity. **Territorial development** refers to the spatial integration of development. Territorial development approaches to Korean (re-)unification provide a broader perspective in terms of spatial imagination of a reunified Korea where bottom-up approaches to development in a reunification process help resolve territorial disparities between South and North Korea.

2.6 Grasping Significance of Land Tenure in (Re-)unification processes

2.6.1 Land Tenure during Integration Processes: Focus on Legitimacy and Identity

The conversion of land policies in transition countries can be evaluated through attitudinal attributes towards private land ownership, transferability of property and use rights and tenure security. Despite differences in perceptions of land ownership and transferability in post-Soviet countries, use rights were determined by a high degree of formal security of tenure. In particular, security and transferability of tenure received considerable critical attention in comparison to legal ownership promoting productivity and efficiency in the transformation process (Lerman et al., 2004). Land reform is a key constituent in attaining tenure security, as it changes existing arrangements of land tenure systems and/or customs in society and profoundly links larger-scale collective changes to land tenure (Bagdai et al., 2012; Dekker, 2006). Indeed, it aims not only to transform rural societies but also to transform rural-urban and state-society relations (Ho and Spoor, 2006).

Changes in existing land tenure systems take place over long periods. Successful changes to land tenure require methods, which induce gradual changes before and during the transformation process. Nonetheless, time pressure is a critical aspect, as people expect quick outcomes of land reform. At the same time, when altering land tenure systems people need sufficient time to adjust to newly implemented rules for land tenure. In addition to time constraints, inadequate resources and economic consequences could also significantly hamper successful tenure reform, since most reform programmes are implemented without abundant discussions because of political pressure, imminent schedules, and bureaucratic barriers (Dekker, 2006).

If existing land tenure systems hinder free market development, interventions in existing land tenure systems can be rationalized through marketization. Looking at the experience of post-Soviet countries, changes toward new land tenure systems in the process of marketization do not always produce positive results (e.g. land grabbing; land

concentration). Moreover, another crucial justification for government-led interventions in existing land tenure systems is to enhance public food security. In this case, the primary goal of the reform would be to support farmers in their efforts to expand and improve agriculture (Dekker, 2006). Land tenure reform from this perspective combines redistribution of land rights with and supporting policies to accomplishing three goals: social justice, political health and agricultural output expansion (Ho and Spoor, 2006).

In processes of shifting from planned to market economies, land reform and land consolidation in former Soviet countries were the most important tools to attaining economic growth and food security. Communities struggled to adapt to rapid change, and the adaptation process took longer than anticipated. This had negative consequences on economic development due to poor budgeting, bureaucratic administrative procedures, lack of market information, and difficulties in forming reasonable market prices. Nevertheless, despite successful land reform implementation elsewhere, without consideration for local knowledge or discussions on impacts of land tenure change results in considerable disappointment (Dekker, 2006; Ho and Spoor, 2006).

Moreover, post-Soviet countries were faced with “uncertainty” and “ambiguity” in land tenure relations after transformation from planned (collectivized) to marketized (privatized) systems (Bagdai et al., 2012; Havel, 2014). The land tenure change allowed for full private, individual land ownership after decades of collectivism. Yet no adequate learning and adaptation period occurred with new landowners exposed to unprotected land-market transactions causing significant negative social consequences and land moratoriums, for example, in Kyrgyzstan and Ukraine. In countries, which did not place legal restrictions on land transfers, number of land transactions tended to be more limited than anticipated. The main restrictive factors were associated with high costs for registration, transfer taxes, complex administrative procedures (e.g. long document requirements; inaccessibility to land registry offices) or social policy restrictions (e.g. Poland). These obstacles apparently hampered development of land markets more than the legal reasons (Lerman et al., 2004). In the post-independence period, tensions between “unity and division”, “equivalence and hierarchy”, “inclusion and exclusion” have been represented through nation-building processes where physical and cultural geographies have been transformed. As Lefebvre (1991) argues, the transformation of space is a crucial component of rebellion and it therefore relates to spatial reconstruction of the nation (Stead, 2015).

Bringing this into the Korean (re-)unification context, land tenure problems in North Korea relate to systemic transformation. The rearrangement North Korean land tenure and land use under the communist economic system will be hard to adapt to free

market economy principles. Besides, societies with communal land tenure systems need transformations in legal and property regimes in-order to facilitate individual land tenure, interactions between owners and the state (Considine, 2013).

2.6.2 Land Tenure during Integration Processes: Focus on Legitimacy and Identity

Korean (re-)unification processes imply systemic integration of land use and tenure, the question is what might be the piece of this land tenure puzzle? This can be derived from experiences gained in the context of the accession of EU candidate-members and cases of peacebuilding processes of post-conflict countries. During integration processes, land tenure determines security, legitimacy and restoration of identity. Since society is fundamental to democratic decision-making and resilience the focus is on legitimacy rather than legality (Bodansky, 1999; Cosens, 2013; Payne, 2002). In addition, memory and identity are significant to ensuring land tenure processes and coping with social and historical trauma (de Vries, 2016).

Experiences of EU accession countries in 2004 (e.g. the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland and Slovakia), highlight four key criteria with regard to converging land tenure institutions of accession countries to European standards (Bogaerts et al., 2002; Grover, 2006; Swinnen and Vranken, 2009). These involve: (1) linking land tenure rights to protection of human rights; (2) envisioning land tenure adaptation in context to the adoption of EU requirements; (3) constructing institutions based on land tenure information management and institution building; and (4) the establishment of free market economies.

The most justification for the foundation of the EU was to avoid tragedies such as World War II. The fratricidal war in the Korean peninsula resulted in division of the territory so Korean (re-)unification can be seen through the same lens as EU accession. Civil rights are important since every person can own, use and dispose possessions including land. In particular, land tenure is the relationship through which private ownership is protected by government in terms of human rights. Thus, the government through the integration process legitimizes land tenure.

To support countries entering the EU in 2004, PHARE (Poland and Hungary Assistance for Restructuring of Economy) implemented as an “accession-driven” programme. The overarching principle was to improve pace, effectiveness, and transparency of government institutions and capacity building, providing technical assistance and paring institutions and administrations according EU regulations (European Parliament, 1998). Indeed, the Common Agricultural Policy (CAP) evolved significantly from simply

promoting production to wider ecological benefits and social-cultural functions in agriculture (Oppermann et al., 2012). These programmes reflect land tenure adaptation agendas integrating scattered land tenure regimes and patterns into a single internal land market. Newly adopted and implemented land tenure institutions in these EU accession processes, therefore can be seen as guarantying flexibility, efficiency and transparency especially agricultural sectors of EU.

Building and consolidating institutional and administrative capacity of EU candidate-members was a prerequisite for the EU's expansion (Bogaerts et al., 2002). In this regard, Grover (2006) emphasizes the significance of information management as having a direct bearing on land tenure. Firstly, EU member states must provide data to the Farm Accountancy Data Network (FADN) including revenue, costs, inputs, outputs and employment-related sources at the holding level. In addition, conducting an agricultural census once every decade is an obligation for EU member states including land tenure-related information on structure and typology of agricultural holdings. Lastly, the Integrated Administration and Control System (IACS) developed to enable gathering of not only parcel-level information also has an increased value for spatial planning.

EU accession countries allowed the most productive farmers who own less to access and exchange land. Moreover, it facilitates land use as collateral to accessing credit markets. These insights highlight how integrating and enlarging the EU has taken place through consolidating candidate-members into a single free market, with regard to land ownership and tenure (Swinnen and Vranken, 2009).

According to Stead (2015), land is homeland, territory and property. Land as property addresses the matter of unity and homogeneity within nation-states, positing that all inhabitants have common rights offering a foundation for co-identification with each other. The homeland, conceptualized as a socio-political space, is interpreted into a collection of distinctive, bounded parcels of land distributed to comparable, compatible, and interchangeable citizens. Moreover, post-independence nation-states continue to promote unity, coherence, equality, and inclusivity. People's hope for independence and unity equates inclusion and experiences of independence and division, hierarchy and exclusion engendering a dichotomy of opinion. For example, Timor-Leste reflects peculiarities of complex and traumatic histories and expresses land as property, territory and homeland.

Managing land tenure is problematic in peacebuilding processes. Land and property rights do not only provide peace for those suffering from war, but also longer-term betterments in terms of living conditions, governance and economy (Unruh and Williams, 2013). Land and land tenure is also the building block of post-conflict development and

the bottom line for reconciliation, economic rehabilitation, rural livelihoods, stability, and access to land after conflicts (Pritchard, 2013, 2016). Durand-Lasserve and Royston (2002, p. 9) emphasize tenure security as a “fundamental requirement for the progressive integration of the urban poor and basic components of the right to housing.” This implies tenure security as the most important facilitator in stabilizing communities, upgrading residential environments and encouraging investment in poverty alleviation, mitigating social exclusion, and improving access to urban services.

Theoretical and practical land tenure-related questions focus on land administration (e.g. Augustinus et al., 2007; Jossam et al., 2015), land management (e.g. Augustinus and Barry, 2006) and humanitarian engagement (e.g. Pantuliano, 2009; Unruh and Williams, 2013) in postconflict contexts. The effort to conceptualizing and address “post-conflict land institution-building” and related issues relates to how underlying problems in relation to land tenure can be solved during reintegration processes.

When considering the re-access to land and tenure security in post-conflict environments, land administration is a functional tool to creating “administrative justice” during the peace-building process (Augustinus et al., 2007). In addition, post-conflict governments have a vital role with regards to tenure questions such as land claimants and disputes where solutions depend on the nature of the emergency (administrative disorder), early (policy adaptation) and reconstruction (problem-solving) periods (Jossam et al., 2015). Strategic action planning on land management in post-conflict societies also plays a pivotal role in strengthening human and technical resources, institutional structures, and socio-technical processes during a peace-building (Augustinus and Barry, 2006).

The complex history of housing, land and property (HLP), provides a focus on the critical issues arising from post-conflict tenure security including: legal ambiguity; legal pluralism; land recovery; land disputes; land policy reform; capacity building; and land allocation (for these details, see Pantuliano, 2009; Unruh and Williams, 2013). The overall effect of different approaches to land is a major cause of tenure insecurity and conflicts. In addition, there are serious consequences for the initial peace process. Land tenure arrangements are difficult to deal with, have greater impact on agricultural recovery, food security, and political issues related to territorial, ethnic, and local ideologies. Four dominant influences affecting rights and obligations in land tenure are as follows: changing population patterns; reduced state power; identity change and; legitimacy. In addition, these influences have great impact in explaining the development of “tenurial pluralism” in the context of post-conflict regimes (Unruh, 2003).

Territory, land or home area also has a significant role in forming and maintaining national and/or individual identity since territory is symbolically important as a specific

geographic location, linked to social, cultural, educational, and political aspects of identity (Ali, 1996). The post-recovery period and re-establishment of land tenure regimes requires embracing conceptions of land tenure security, tenure dispute resolution and land allocation, which has critical influences on changing identities to reconstruct livelihoods, communities, and social relations. Land tenure security is thus significant in relation to identity since such security represents recognition by others of the legitimacy of land tenure within a community, and therefore legitimates membership of that community (Unruh, 1998). Taken together peace processes cannot be explained without understanding the complex relationship between territory, legitimacy and identity.

2.6.3 Land Tenure in Territorial Development: People-centred and Process-oriented

The notion of territory identifies land as a bounded space, where institutional power is configured spatially, politically, culturally and socially, recognizing identity from geographical and anthropological lenses and production plus markets from an economic perspective (Quan and Nelson, 2005). Based upon the FAO's efforts in territorial development, the significance of land tenure emphasizes the focus on land tenure security, customary land tenure, and sustainable land management through rural development initiatives. These territorial development approaches to land tenure speak about land security, unequal distribution of land and social conflicts. The FAO's framework on territorial development considers bottom-approach to development as more flexible and adaptive to local contexts. Territorial development, thus, defines "people-centered" and "process-oriented" approaches to deal with land tenure policies at the national level (Treakle and Krell, 2014).

The significance of land tenure as interventions in territorial development can be explained from spatial, economic or social perspectives (OECD, 2001, pp. 136–142). Firstly, spatial approaches to territorial development involve preparing territories to encourage economic and social activities, geographical redistribution of infrastructure and public services across the territory, as well as management of natural and cultural resources embedded in each part of the territory. Land tenure does not only provide optimal land use for human settlements, economic and social activities but also reduces excessive disparities through public investment in spatial infrastructure, which helps reconnect access to natural resources.

Secondly, economic development policies aim to increase productivity, improve functioning markets and enhance business environments. Land tenure security can be strengthened through utilization of new socio-technical systems including Spatial Data

Infrastructures (SDI) and Un-named Ariel Vehicles (UAVs) and land transactions within land markets based on marketization. Effective land market infrastructure prevents inequitable distribution of land and restricts foreign investment in land. Lastly, social development approaches implement the following actions: education, employment and training, economic development, improvement of housing, physical environment and community development. For instance, this includes using capacity building within land administration, development of land evaluation, investment schemes, social-political movements with regard to land tenure (e.g. land grabbing), and social engagement such as utilizing cognitive mapping and social cartography programs.

Policies on territorial development are significant mechanisms, which reinforce “territorial capital”. This is determined by “regional attributes” that may include geographical location, size, production endowment, climate, traditions, natural resources, quality of life and even agglomeration economies. In addition, it also results from “untraced interdependencies” such as understanding, customs, and informal rules enabling actors to work together under certain conditions. There is “intangible factor”, which is called “environment”, which is the outcome of combining institutions, rules, practices, producers, researchers and policymakers making things possible (Damsgaard et al., 2011). When considering land tenure as territorial capital, regional, untraced interdependencies and intangible criteria all affect land tenure security, customary or statutory land tenure, sustainable land management and land use, and the equitability of distribution of land and social disputes.

Bottom-up approaches to territorial development relate to notions of “democratic land governance” since relations between society and land tenure systems are affected by constant interactions between different stakeholders within society and state including policy makers, powerful regional elites and the poor. Democratic land governance contains three critical ingredients: “from below”; “from above” and; “reciprocal relation”. From below highlights people’s autonomous proreform mobilizations, from above criteria relates to state-led reformist initiatives, while reciprocal relation indicates mutually reinforcing interactions between these streams embedded through democratic values (Borras and Franco, 2010). Deininger (2003) further emphasizes the significance of land governance for sustainable economic development and social justice with regard to land tenure. Community-led approaches imply state actions solidly attached to “bottom-up” or “from below”, namely “community” political initiatives, land tenure structures and authority relations. The following are some important considerations for successful settlement of community-led strategies: responsiveness to local livelihoods; connections with broader dynamics of authority; interactions with social inequalities; and

environmental repercussion (Sikor and Müller, 2009).

Contexts (C)	Transformation process	Integration process	Territorial development
Interventions (I)	Land tenure as reforming instruments	Land tenure as peace-building facilitator	Land tenure as territorial capital
Mechanisms (M)	Improving security of land tenure Improving transferability of land tenure	Improving security of land tenure Establishing legitimacy of land tenure Forming and maintaining national and/or community individual identity	People-centred (bottom-up or from below) Process oriented (governance)
Outcomes (O)	achieving market economy paradigm; enhancing food security; securing social justice; forming political health; increasing agricultural production; spatial construction of the nation	protection of human rights; adoption of integration requirements; land tenure information management; establishment of free-market economy; promotion of unity, coherence, equality and inclusivity; encouraging investment in poverty alleviation, mitigating social exclusion, and improving access to urban services; reshaping administrative justice; strengthening human and technical resources, institutional structures and social and technical processes	encouraging economic and social activities; geographical (re)distribution of infrastructure; sustainable management of natural resource; increasing productivity in economy; improving functions of market; responsiveness to local livelihoods; connections with broader dynamic of authority; interactions with social inequalities; environmental repercussion
Constraints (C)	uncertainty and ambiguity in land tenure relations; political pressure; imminent schedules; complex and bureaucratic administrative procedure; lack of market information; poor budgeting; difficulties in forming reasonable market price; high transaction costs; social policy restrictions	legal ambiguity; legal pluralism; land recovery; land disputes; land policy reform; capacity building; land allocation; changes in population patterns; reduction in state power; identity change; issue of legitimacy	regional attributes (e.g. geographical and economic setting); untraced interdependencies (e.g. customs, informal rules); intangible factors (e.g. outcomes of cooperation in institutions)

Table 2 Summary of land tenure in (re-)unification process using 'CIMOC framework' (by authors)

* 'CIMOC framework' has operationally defined to be able to clearly represent abstract concepts on land tenure and be empirically measurable in (re-)unification process as follows:

Contexts (C): the nature of (re-)unification to affect land tenure-related interventions

Interventions (I): (re-)unification context-specific interventions that provide strategic attitudes to influence land tenure-related mechanisms

Mechanisms (M): the entities and activities designed and generated by the land tenure-related interventions based upon conditions of (re-)unification

Outcomes (O): the particular consequences or outcomes caused by generative land tenure-related interventions

Constraints (C): the factors that impede or inhibit implementing land tenure interventions and mechanisms during the (re-)unification processes

2.7 Conclusion

Recent changes in North Korea may have implications for the possibilities and perceptions on Korean (re-)unification and the manner in which land is managed in a reunited country. Therefore, this paper, frames what (re-)unification is, and addresses how (re-)unification processes align, adapt or merge with changes in land tenure relations.

(Re-)unification is labelled as a formation process by which homogenous political communities merge from a previously divided country to a unitary nation. This process is not immediate. (Re-)unification will only occur as part of a continuum of consisting of five stages from pre-division, initial division and medium-term division and rapprochement to unification. Within this continuum, various interactions occur, ranging from conflict, independence, coordination and integration. Thus, it can be inferring that the transformation of North and South Korea requires a fundamental change in societal thinking. Moreover, the integration processes during the Korean (re-)unification require unifying political and economic systems and institutions and restoring national homogeneity. Lastly, (re-)unification denotes the territorial reconnection providing the country with a physical basis for infrastructural development in the reunified nation. To sum this up, the condition of (re-) unification ultimately means the transformation of North and South Korea; integration of politics, economy and national identity of a single Korea and territorial development.

In this transformation process, land tenure interventions are a reforming instrument and land tenure functions part of the peacebuilding and integration process. In addition, land tenure plays a critical role through territorial capital in the territorial development process. The key findings of the research synthesis rationalize the significance of land tenure in the (re-)unification process, especially emphasizing security and transferability in transforming, legitimacy and identity in the integration process and creating a people-oriented process mechanism in with territorial development. The possible outcomes and consequences in the (re-)unification process can be identified as follows:

- Land tenure in a transformation reflects the market economy paradigm: increasing food security, awareness of social justice, promoting political health and high productivity in agriculture as well as spatial reconstruction of the nation.
- Land tenure through integration requires the protection of human rights, institution building, creating of greater marketization, poverty alleviation, mitigation of social exclusion, easy access to urban services, reshaping administrative justice and the strengthening human and technical resources, institutional structures and social and technical processes.

- Land tenure in territorial development denotes an economic productivity gain, improving market functions, increasing responsiveness to local livelihoods, connecting with broader dynamic authority, dealing with social inequality and environmental repercussions.

Having defined (re-)unification as a gradual process with different stages, different characteristics, future research should extend from these theoretical findings to a set of methodological recommendations for policy design and policy implementation. Such an investigation should include the present contextual constraints and windows of opportunities on the one hand, as well as the development of a normative framework to assess, monitor and foster an acceptable and responsible land management system prior, during and after the reunification process. There are also some limitations of the research that it does not discuss the state structures after (re-)unified Korea (e.g. unitary state; federal state) and (re-)unification mechanisms (e.g. civilization-state; nation-state) and the competing (re-)unification formulas (e.g. one country, one system; one country two systems). Based upon the limitations aforementioned, there is a need for in-depth analysis of post-conflicts and (re-)unification case studies that how they have resolved or struggled land tenure and its governance issues. Moreover, a further research may suggest the concrete implementation measures of land tenure transformation according to possible (re-)unification formulas beyond the policy scenario mapping.

Chapter 3. Land Governance Re-Arrangements: The One-Country One-System (OCOS) Versus One-Country Two-System (OCTS) Approach*

* This chapter is based on a published paper as follows: Lee, C., de Vries, W. T., & Chigbu, U. E. (2019). *Land Governance Re-Arrangements: The One-Country One-System (OCOS) versus One-Country Two-System (OCTS) Approach*. *Administrative Sciences*, 9(1), 21. DOI: <https://doi.org/10.3390/admsci9010021>

S U M M A R Y

This paper evaluates how land governance is re-arranged in a state re-structuring process. We compare the cases of the (re-)unification of China with Hong Kong with that of West and East Germany. The division and (re-)unification of these states mark different land governance re-arrangements. The China-Hong Kong (re-)unification relied on a one-country two-system (OCTS) approach, while in West and East Germany, (re-)unification resulted in the creation of a one-country one-system (OCOS). Our key interest is to identify similarities and differences in both cases and the implications of the differences. To support the analysis, we view land governance and (re-)unification from theoretical to practical lenses—structuration theory and the government tools-based approach. This supports the construction of a conceptual and analytical framework, with which we conduct an in-depth exploration to evaluate land governance re-arrangements. We find that the conceptual and analytical framework proves effective for countries, with entirely different land governance regimes, to decide whether to merge or adapt. We do not conclude which approaches for (re-)unification are appropriate to land governance re-arrangements since all countries have different historical contexts and institutional arrangements. Instead, we recommend that governments consider adaptive land governance in signification structures and focus on hierarchical enforcement in legitimation structures. While multi-level land governance in the domination structure phase is strongly required, issue-and-project-based land governance has a pivotal role in providing cross-boundary infrastructures. Nevertheless, further empirical analysis is recommended to verify how and where the re-arrangement processes are initiated and structured.

Keywords: land governance; (re-)unification; transformation; structuration theory; tools of government

Chapter 3. Land Governance Re-Arrangements: The One-Country One-System (OCOS) Versus One-Country Two-System (OCTS) Approach

3.1 Introduction

‘(Re-)unification’ is the process by which at least two separate homogenous political communities merge into a single nation with heterogeneous political communities (Lee and de Vries 2018). While the trend and pressures tend towards ‘fragmentation’ and ‘separation’ (e.g., Sudan; Yugoslavia; and Spain/Catalonia etc.), the paper explores the issues raised by (re-)unification¹. Over the past century, various states have (re-)unified, which forced them to adapt their governance systems. If these systems differed vis-à-vis the ideological role of the state, this raised challenges during and after the (re-)unification process.

Land governance has been critical to this transforming institutional form and function (Augustinus 2009; Borrás and Franco 2010; Deininger and Feder 2009; Enemark 2012). According to Palmer et al. (2009), land governance ruminates more intensely on the matter of the rules, processes and structures about land and its use and concern about who made decisions and how implemented and enforced. As the product of open-ended interactions within structures and agency, land governance can differ significantly depending on the state structures (e.g., unitary state; federal state) and the (re-)unification mechanisms (e.g., civilization-state; nation-state).

We divide competing approaches for (re-)unification, based upon fundamentally different institutional frameworks, into one-country one-system (OCOS) and one-country two-systems (OCTS) or multiple systems. These two models—OCOS and OCTS—were the result of two modes of thought on the nature of governance. The concepts of the civilization-state and nation-state focus on the relationship between social production, political organization, and transformation (Kumar 2002). Particularly, China and Germany are examples of states with experiences of division and (re-)unification². The China-Hong

¹ The North and South Korean (re-)unification quagmire is not new in the world. There are many divided countries in need of reunification and there are others that were once divided but finally became reunified. Countries like Cyprus (Turkish and Greek Cypriots), Sudan (Sudan and South Sudan), and Yemen (South and North Yemen) are some countries in need of reunification. China, Vietnam and Germany are examples of countries that were once divided and then became reunified.

² According to Kumar (2002), a civilisation rests upon a mode of social production characterized by a specific set of social and political institutions and texture of moral values. The OCTS model mirrors the

Kong (re-)unification resulted in the OCTS model; while in Germany (re-)unification resulted in the OCOS model. In both cases, it is empirically proven that (re-)unification has a different impact on land governance (Blacksell and Born 2002; Jiang and Yeh 2009; Kuchar and Gläsel 2006; Li et al. 2000; Ng and Tang 1999; Wolz 2012).

The debate on the existing literature, however, still provides little evidence to gain effective insights into how the government (agency) interacts in response to transforming people-to-land relationship (structures) and which governmental tools (resources) were deployed within different institutional (re-)unification contexts (OCOS and OCTS). Furthermore, these scholarly contributions only empirically generalized in each case study respectively (Germany and China-Hong Kong) and do not reflect the institutional extractions from the theoretical parameters of the analysis. The main objective of this paper, thus, is to evaluate how land governance is re-arranged in a state restructuring process, exploring land governance and (re-)unification through theoretical and practical lenses—structuration theory and the government tools-based approach. We compare OCOS with OCTS with the research questions:

1. What are the similarities and differences in the two cases and why is this so?
2. What are the implications of these differences for land governance re-arrangements?

We first present the theoretical foundations for describing and connecting different aspects of land governance and (re-)unification. The next section explains the methodology, followed by research findings on how land governance is re-arranged. The subsequent discussion section addresses the implications of the findings in relation to the expected land governance transformation in state restructuring processes. The final section draws conclusions.

3.2 Institutional and Instrumental Approaches to Land Governance

Theoretically, understanding institutional re-arrangements require an understanding of how and why institutions are transformed, and how their action can be qualified and measured. Structuration theory posits that institutional re-arrangements can be

civilisation-state, which is a logical justification for the China-Hong Kong (re-)unification. It rests upon the notions that certain parts of the state, which previously had different values or systems, can retain those values if they accept the wider sovereignty of the civilization. This relationship is clear in the role that China has played in Hong Kong after (re-)unification occurred. In contrast, the nation-state rests upon a single centralized political institution. This forms the basis for the OCOS model. An example is the merger of East and West Germany in 1990.

‘observed’ by looking at operant changes in structure and agency. ‘The tools of government’ describe the resources of transformations.

3.2.1 Structuration Theory

The usefulness of structuration theory has widely been debated and demonstrated in various disciplines. Giddens’ structuration theory (Giddens 1984) provides useful analytical skeletons, which bring together structure and agency. According to Stones (2005), the core of the structuration theory emphasizes both structures and agents, rather than merely observing structures or agents respectively, or assigning priority to either one. Giddens (Giddens 1976, 1979, 1984) defines ‘structure’ as the “properties [which allow] the ‘binding’ of time-space in social systems” and argues that the structure is recursively implicated in systems through the ‘rules’ and ‘resources’ (Giddens 1984). Following Giddens’ thought, ‘Agency’ arises as a constant stream of actions and intervenes to affect and modify structures rather than simply responding to them (Macintosh and Scapens 1990). Thus, the central argument is that structure is a both significant ‘medium’ and the ‘outcome’ of the practices of agents (Stones 2005). Poole and DeSanctis (2004) also highlight Giddens’s dynamic interpretation that conceptualizes structures as (re)production and modification processes over time. Furthermore, Orlikowski (2000) illustrates that structuration presents the answer to the quandary of choice between subjectivist and objectivist accounts of social practices.

Meanwhile, structuration theory has also faced substantive criticisms on how the theoretical accounts on structures can be demonstrated in practice. Jones and Karsten (2008) criticize that structuration theory frames social phenomena at a high level of abstraction and philosophy, which makes it difficult to substantiate empirically within specific contexts. Accordingly, Layder (2005) argues that structuration theory tends not only to exaggerate the significance of reasons, motivations and activity but also to devalue the degree of coercion and restraint in social life. Archer (1995) has perpetually criticized the methodological conflation of structure and agency that eliminates analytical distinctions of where structures initiate and agencies finish or vice versa. Nevertheless, the theory has been modified—‘adaptive structuration theory’ (Poole and DeSanctis 2004), addressing the mutual influence of technology and social processes and ‘strong structuration theory’ (Stones 2005) reflecting a sense of ontology-in-situ have contributed to the advancement of structuration theory. These demands for a meta-theoretical approach of structuration theory also allow purposively investigating social setting with other theories (Pozzebon et al. 2014).

From an analytical standpoint, we pay more attention to Giddens' three-structural dimensions that influence social actions and interactions in social institutions: signification, legitimation and domination (Giddens 1984). Structural dimensions are associated with 'interactions' (communication, power and sanction) and expressed in 'action' (interpretive scheme, facility and norm). Signification indicates a system's discursive and symbolic order; legitimation deals with the rules of authoritative institutions; and domination refers to material and allocative resources (Whittington 2015). Thus, it is noteworthy that stressing different schematic dimensions of structures offers an analytical foundation for classification of institutions (e.g., discourse; political; economic; and law/regulations). Furthermore, this overarching theoretical perspective from structuration theory enables us to grasp a 'sociological institutional approach' to governance transformation processes.

3.2.2 Tools of Government

Answering what governments do is difficult yet important. Hood and Margetts (2007) describe it with three branches: what happens 'inside' government; the 'subject(s)' governments are interested in; and, the 'tools' that governments use. Focusing on the 'tools' of government, Carmona (2017) argues that it includes an array of instruments, approaches, and actions that policy-makers implement towards public policy outcomes. In other words, the tools of government approach highlights 'means', where policy goals can be achieved, rather than 'scope', wherein a spectrum of intervention can be determined (Henstra 2016).

Many scholars have discussed an 'instrumental approach' to public policy and administration from different theoretical lenses. Hood and Margetts (2007) have underlined the significance of both the 'role of government' and its 'resources available'. They differentiate between government tools for both detecting information and effecting behavior. In addition, he adds basic governmental resources: nodality, authority, treasure, and organization (Hood and Margetts 2007). In the same vein, Vedung (1998) suggests a threefold arrangement of government tools, including regulations, economic means and information. Expressions of these tools are described as sticks, carrots and sermons, respectively. On the other hand, other scholars argue against resource-based approaches to policy instruments aforementioned. For instance, McDonnell and Elmore (1987) emphasize the 'techniques' of intervention as the tools of government actions including mandates, inducements, capacity building and system changing. Furthermore, Schneider and Ingram (1990) highlight 'behavioral characteristics' of government policy tools to change, such as authority, incentive, capacity, symbolic (hortatory) and learning.

To ‘measure’ the tools within a wider analytical frame, Salamon (2000) developed governmental tools for measuring degrees of coerciveness (the extent which tools impede the agency’s behavior to encourage or discourage), directness (the extent to which tools are involved in implementation), automaticity (the extent to which tools utilize existing administrative structures), and visibility (the resource use in the policy review process). Lascoumes and Gales (2007) emphasize types of ‘political relations’ in reformulating tools of government as legislative and regulatory, economic and fiscal, agreement-based and incentive-based, information-based and communication-based, *de facto* and *de jure* standards best practices. Vabo and Røiseland (2012) identify governmental tools in a ‘governance network’ setting. Government instruments including legislation and budgeting can directly affect society, but governments can also influence society by using different intermediaries in indirect ways through networks. Carmona (2017) also argues that a multi-levelled typology of government focusing on the degree of ‘intervention’ may be needed: formal (guidance, incentives and control), informal (evidence, knowledge, promotion, evaluation and assistance).

Thus, these different angles from ‘toolkit perspectives’ denote that there is no simple definition and classification and even generic features of their policy tools or instruments. For analytical purpose, however, systematically identifying governmental tools enables us to understand the institutional effectiveness of public actions and new modes of governance. In addition, it provides the most practical lenses to not only reveal similarities, differences, strengths and weaknesses of selected tools of government, but also distinguish the socio-political nature of instrumental choices.

3.2.3 Land Governance

While the land governance literature has not yet fully engaged with a constellation of structural dimensions of institutions and instrumental choices, addressing different theoretical (structuration theory) and practical (tools of government approach) standpoints of land governance is meaningful to underpin arguments for the architecture of people-to-land relationships.

Borras and Franco (2010) argue that land governance is a set of political process, involving multiple states and societal actors at different levels of the polity (e.g., national, local and even international) to intervene in the attributes, speeds, scopes and directions of land use, control, and access to it. In other words, land governance incorporates an administrative and technical process (e.g., land recordation and land titling) that required dynamic interactions between diverse states and societal actors, bringing desired land policy outcomes (e.g., land reforms, land laws). Similarly, Enemark (2012) assumes

that land agencies prepare and execute land policies in line with the mandates given through democratic processes. This assumes an uncontested relation between what institutions prepare and what they do. Structure and agency are thus aligned. Institutional re-arrangements should then be visible by closely watching how governments formulate policy and translate them into concrete responsibilities and activities for dedicated staff members. In contrast, Deininger and Feder (2009) found that institutional structures of land governance and its interactions have a far-reaching effect upon the distribution of power and economic productivity within the society. Furthermore, Augustinus (2009) supposes that land governance results from economic dependencies and economic trade-offs. Hereby multiple actors influence how land is used and transferred. Each choice on use, transfer and claim depends upon the mutual benefit which one actor receives from the transaction. Land governance re-arrangements should, therefore, be observed by evaluating transactions and trade-offs between individual actors. This is a very different way of understanding land governance re-arrangements.

The 'toolbox approach' to land governance has been broadly accepted in practices that provides a systematic view for choosing appropriate land tools when considering administrative inefficiencies and transaction complexities of land institutions as well as reflecting the evolution of people-to-land relationships (Bennett et al. 2008; Palmer et al. 2009; Wehrmann 2010; Williamson et al. 2010; Zevenbergen et al. 2015). Based upon land administration theory, Williamson et al. (2010) comprehensively identify tools of land governance as: general tools for supporting basic infrastructure; professional tools for system design and implementation; and emerging tools for responding new societal changes. They emphasize that the range of tools that need to be chosen can be different in every jurisdiction since states have varying strategies according to their particular needs and development capacity, influenced by historical contexts and institutional arrangements. According to Zevenbergen (2012), 'land tools' refer to the principles, policies and legislations and these covers different mechanisms and these tools might complement and enhance their own operations or develop effective alternatives for addressing cross-cutting issues (e.g., pro-poor land tools; gender-responsive land tools etc.). However, these toolbox approaches seem to employ more systematic classifications of land governance tools based upon a comprehensive account of socio-economic and political variables for land governance.

3.3 Methodology

This section discusses how we develop fundamental assumptions and a methodology to reflect and connect different analytical lenses for land governance re-arrangements in

a (re-)unification setting from aforementioned structuration theory (focusing on structural dimensions) and tools of government approach (focusing on developing extended tools of land governance).

We assume that land governance is a key element *during and after* (re-)unification. However, the notion of land governance in (re-)unification processes is justified only in the context of the signification and legitimation structures involved in land governance practices. Governments detect information and affect behavior using different policy instruments, while land governance interacts with signification, legitimation and domination structures. Governments are for example both active and recipient agents of land governance re-arrangements that rely on different sets of experience and available or accumulated knowledge. Without these processes, actions and decisions themselves influence, reproduce and create land governance and (re-)unification processes. Thus, conceptual frameworks need to represent the interaction and recursiveness between land governance in social structures and government actions and decisions using governmental resources.

Based on the aforementioned underlying assumptions, structuration is a complex process. It relies on ‘culture’ and ‘traditions’ actors are involved in (Binder 2007) and a ‘discursive’ and ‘symbolic’ order, which predominates their interactions (Whittington 2015). Such signification structures provide ‘meaning’, and facilitate communication and provide legitimation of actions (Binder 2007; Jesse et al. 2004; Whittington 2015). Relating this to land governance, one can thus ask, “*What informs the interpretation of land governance in the reunification context?*” Regarding the legitimization, one could ask: “*What defines the legitimacy of land governance and what tools of government and which rules are chosen to transform land governance?*” Domination structures concern allocative and authoritative resources including political and economic institutions, which relates to the power axis to control and mobilize resources. A third and final question is, therefore: “*Which structures and capacities do government possess in transforming land governance?*”

Given theoretical classifications of government tools, our approach departs from the classical ‘NATO scheme’ (Hood 1983; Hood and Margetts 2007) and the resources of governance: nodality, authority, treasure, and organization. Nodality relates to how the governing process collects and distributes information. Authority describes how governance actors acquire and utilize legitimate forms of power. Treasure refers to the economic tools of governance to enforce or direct certain types of behavior. Lastly, organization relates to capacities, resources capabilities in executing governance policies. (Cf. see further details in Hood 1983; Hood and Margetts 2007; Howlett 2009; Vabo and Røiseland

2012; Vedung 1998). By adopting tools of government approach, we developed tools of land governance: Nodality-based, authority-based, treasure-based, and organization-based tools. The analytical descriptions on tools of land governance have been purposively defined and resulted in customized classifications of tools in alignment with structural dimensions of land governance (Figure 4).



Figure 4 Thematic networks for structural dimensions and tools of land governance (devised by author)

The methodological flow consists of three key steps of case study research: Designing, selecting, and analyzing (Figure 5). To reiterate, land governance re-arrangements need to be systematically scrutinized through structuration theory and tools of government approach within contrasting (re-)unification contexts. This paper considers an ‘embedded multiple-cases study design’ developed by Yin (2003) that is useful for applying multiple methods for data synthesis (Scholz and Tietje 2002). These methods provide rigorous evidence through integrating viewpoints from the ‘sociological institutional’ and ‘public policy’ perspectives, addressing critical research questions as well as drawing empirically valid inferences regarding land governance re-arrangements. Criteria for selecting case studies are grouped according to the three questions: (1) Are case studies areas ‘representative’ of (re-)unification? (2) How can similarities and differences of land governance re-arrangements be predicted through the ‘opposite institutional frameworks’ of (re-)unification? (3) Do case studies areas have an analogous set of historical facts or circumstances that surround the (re-)unification? In a given context, we narrowed the regional scope from the ‘divided nations perspectives’ and then selected Germany (OCOS) and China (OCTS) among six countries—Germany, Korea, China, Vietnam, Cambodia and Laos, and Mongolia (Lebow 2007; Lee and Vries 2018). Using a network visualization technique, we identify tools of land governance and its interactions between the tools

in each case study and analyze the similarity and differences between case studies. Then, we synopsize the implications of land governance re-arrangements in (re-) unification contexts.

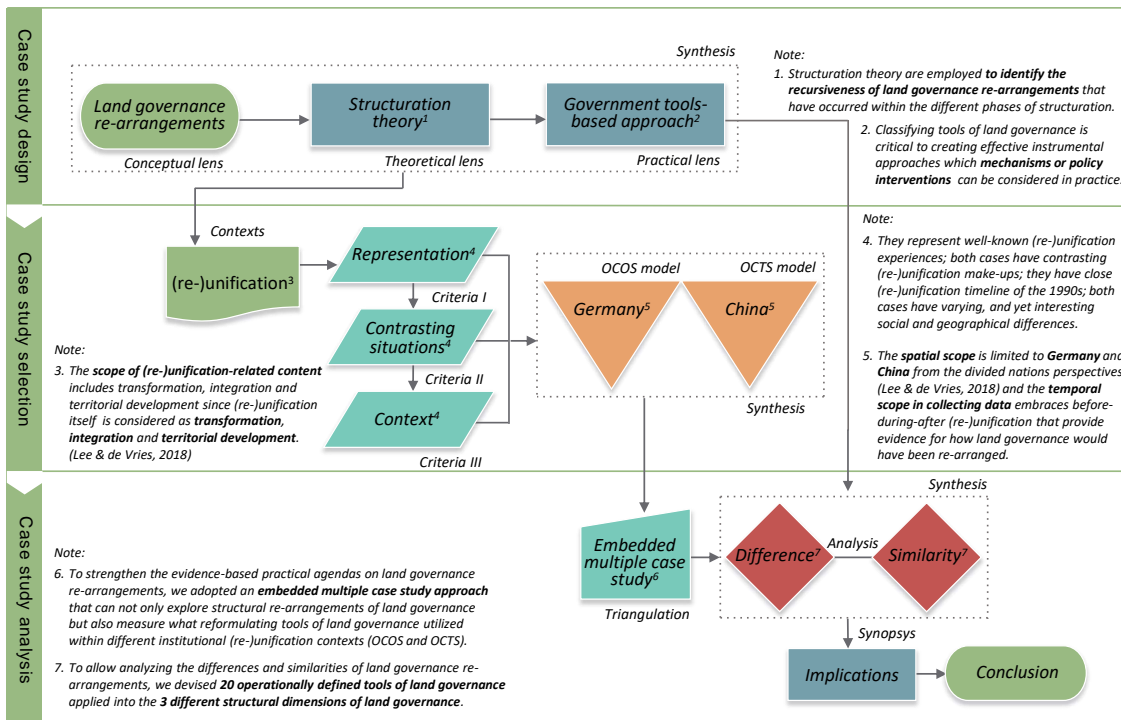


Figure 5 The analytical framework for land governance transformation (devised by author)

3.4 Case Study 1: Land Governance Re-Arrangements in Germany as OCOS

Land governance was transformed during German (re-)unification with an OCOS approach. (Re-)unification needed to restructure land governance in both urban and rural areas. The German experience highlights how restitution, land consolidation and privatization transformed land ownership structures in the former GDR.

3.4.1 Significance Structure

N1: Restitution is the process of returning land ownership to an original owner. According to Blacksell et al. (1996), a complication for the restitution process was that a number of land registers had been destroyed during the ‘Socialist Occupation Zone (SOZ) period’ and the GDR regime neglected to maintain up-to-date land records. The point hereby was not to neglect land administration as such, but to avoid maintaining a land administration system, which would legitimize the perceived bourgeois concept of private property in the East German state apparatus. (Re-)unification required, however, certain types of restitution. The federal government relies hereby on land information collected by claimants. These new registers lead to ‘ad-hoc information bureaucracies’.

When restitution claims were honoured, the government issued appropriate compensations, and proceeded with land registration into a land registry, such that the claimant becomes legal owner. Wilsch (2012) describes how German (re-)unification also reshaped land registration and increased the conversion from a paper-based to digital land registration.

N2: One of the aims—yet not the only one—of the reunification was rooted in economic logic. A unified nation with for example a single currency (the “Deutschmark”) was considered not only symbolic but also a condition to unify completely different economic systems and transactions. The transaction costs of having to convert from one system to the other could thus be avoided. At the same time, the political window of opportunity was however also narrow and strongly time-bound. The unification process as it has happened—by absorbing the GDR into West Germany—was not considered from the beginning as the only possible way. Another possibility—unifying Germany under entirely new terms and rewriting the constitution—was also considered, but quickly discarded. In other words, despite political and historical rhetoric about German (re-)unification, the varying means to achieve political and economic transformation, integration, and territorial development have been employed by the West German government with abundant allocative (e.g., rapid introduction of the West-German currency, the “Deutschmark”) and authoritative resources (e.g., dictated decision-making power). The conversion can be characterized as a ‘social market economy’ model, which has features of capitalism that include private property ownership (Ortmann 1998). Moreover, conceptions of ‘market value’ within an open-market economy aimed to deliver good land governance and transparency (Thiel 2010). He assumes, in the (re-)unification process, that Germany’s transformation from a state-owned land system into a private one was anticipated as a ‘long-term project’. Market orientation and shaping investment opportunities were a priority at the time so agencies such as THA/BVVG were under tremendous political pressure to resolve land disputes efficiently.

N3: Although most land expropriations occurred after Nazism (e.g., for Jewish citizens and political opponents), land restitution continued in the GDR after (re-)unification (e.g., for no specific social or political groups). Tucker-Mohl and Kim (2005) note that the German notion of ‘coming-to-terms with the past’ and ‘backwards-looking justice’ was an important factor influencing why and how land restitution was accepted in German re-unification, even though expropriation under the Nazi regime and GDR rule are regarded as fundamentally different institutions. This also meant, however, making restitution as efficient as possible such that it could promote economic revitalization. It was not obvious what role land restitution would play during (re-)unification. However,

restitution and recognition of private ownership were perceived as consistent with the ‘free-market ideology’ of West Germany. Compensation was not based on a right to property but on principles of ‘fairness’, ‘justice’, and ‘the social state’ (Kuti 2009).

N4: With Germany’s long history of land registration, the federal government has an advanced cadastral system to ensure ‘land tenure security’. This was recognized as integral to societal development during German (re-)unification. Especially, the automated cadastral map (Li et al. 2000) and automated property register (ALB) from West Germany newly introduced to East Germany, which is a basis of integrated land information system in a (re-)unified Germany (Hawerk 2001).

N5: The impulsive movement for socio-economic transformation in Germany occurred in the move towards German (re-)unification, transplanting existing social, economic, administrative, and legal infrastructure from West Germany to the GDR. This is characteristic of OCOS examples, where the ‘durable intellectual import’ relates to the restructuring of ‘ownership of land’ and the ‘role of the state’ (Blacksell et al. 1996). For instance, former GDR states were affiliated with their respective West German counterparts in supporting re-structuring state administration services in the early 1990s (Wolz 2012). Sharing knowledge and experience shaped the implementation of land readjustment in the GDR. A vast number of seminars, short- and long-term transfer of personnel to the GDR (i.e., survey engineers) and capacity development in university education (i.e., setting up the first institute of land management at the University of Dresden) were included (Müller-Jökel 2001).

3.4.2 Legitimation Structure

A1: Privatization of property commenced under the last GDR government, which ratified the Trusteeship Law, followed by the establishment of the THA. The equitable reallocation of ownership by the THA was the main goal of this transformation during (re-)unification. The THA was responsible for managing and privatizing publicly owned agricultural and forest assets on behalf of the Federal Treasury (Hüttel et al. 2016; Ortman 1998; Wolz 2013). Nearly 25% of the arable land in GDR was acquired, equivalent to approximately 1.5 million hectares (Dells 2008; Huettel et al. 2013; Koester and Brooks 1997). After the THA, the BVVG also played a role in privatizing all land, except for farms owned by the state. In 1994, about 1.2 million hectares of land had been privatized, approximately 20% of all farmland in the former GDR. In 2016, 156,000 hectares of land remained, which will be privatized by 2030 (BVVG 2016). By mid-1994, however, THA and BVVG had not fully estimated how much of the land they had to return to previous owners. Uncertainty about the accuracy of land status has had a significant impact

on privatization processes. For example, many land registers have been lost and therefore reference points had disappeared, affecting land returns and compensation (see Figure 6). The OSDPC (Offices for the Settlement of Disputed Property Claims) has been the fundamental administrative system dealing with the conundrum of land and property restitution after (re-)unification. It operates through a three-tier system: The Federal (BARoV), the provincial (LARoV), and the district (ARoV) level (Blacksell and Born 2002).

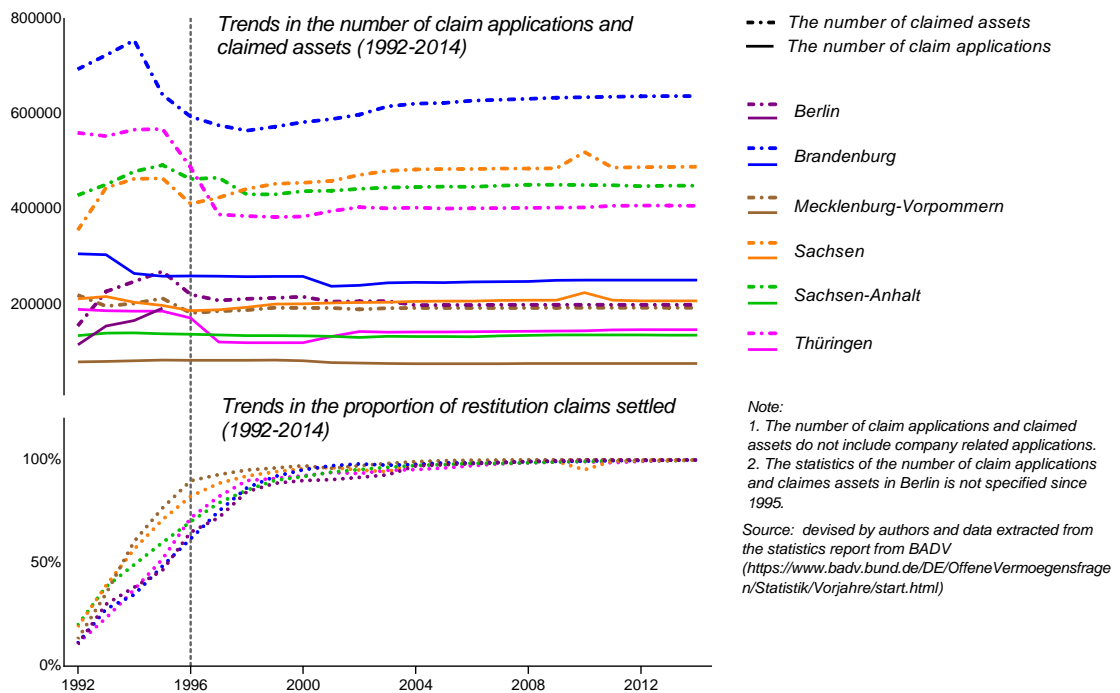


Figure 6 Trends in the number of claim applications and claimed assets and trends in the proportion of restitution claims settled (1992-2014)

A2: According to Kuchar and Gläsel (2006), the committees for valuation experts (CVE) under the Federal Building Code is responsible for both collecting and preparing data on the land market and make this available to the public. The municipalities or the public land surveyors’ institutions set up these committees. In particular, CVE is in charge of gathering data on purchase prices, which is average values for a standard land parcel.

A3: As shown in Table 3, legal issues surrounding property, expropriation, and restitution became controversial during (re-)unification. Although Article 14 of Germany’s constitution specifies the protection of land ownership, this has only been applied since the end of (re-)unification. Land governance in Germany was transformed between 1989 and 1992 due to the regulatory agenda. Before 1989, overlapping land ownership and uncertain legal provisions regarding restitution and investment existed. Therefore, the

federal government revised both the Property Law and Allocation of Ownership Act, applying the ‘opening clauses’ set out in the legislation by agreement, to speed up the transformation process and reduce national costs of reckless land claims in the courts (Kuchar and Gläsel 2007; Thiel 2010).

Authority-based tools	Main description	Focal arenas	Remarks
German Basic Law (Article 14)	Property and the right of inheritance shall be guaranteed.	(Private) property right	(Thiel 2010)
Unification Treaty (Article 41 including Annex III)	States social equilibrium between the competing interests to protect the property right	Property restitution	(Blacksell et al. 1996; Blacksell and Born 2002; Kuti 2009)
German Civil Code (Article 233-237; Articles 585-597)	Contains rules regarding the transformation of property; stipulates legal procedures for land leasing	Property; land transaction	(Blacksell et al. 1996; Dells 2012)
The German Land Register Code; Act for Acceleration of Register Processes	Initiates transformation from a paper to digital land register	Land registration	(Wilsch 2012)
The Federal Regional Planning Act; Federal Building Code	Transform land-use planning and development and introduce spatial planning	Land & regional development; spatial planning	(Tan et al. 2009)
Real Property Transaction Act; Land Lease Transaction Act; Empire Settlement Act	Supports setting up transparent (re-)unified land market	Land market	(Dells 2012)
The Investment Acceleration Law; Investment Priority Law	elaborated procedures to support sales of land and encouraged new investment	Economic development; restitution	(Blacksell and Born 2002; Tucker-Mohl and Kim 2005)
Property Restitution Law	Highlights land and property expropriated illegally was to be returned to the former owners	Property restitution	(Blacksell and Born 2002)
Property Law; Allocation of Ownership Act	Set out the opening clauses by agreement for speeding up the transformation process and reducing the administrative costs	Property restitution	(Kuchar Gläsel 2007; Thiel 2010)
Trusteeship Law	Stipulates establishment of the THA	Property restitution	(Ortmann 1998)
the Law on Adjustment of Agriculture; the Federal Land Consolidation Act	Specify rearrangement and adjustment of land in rural areas	Rural development; restitution	(Koester and Brooks 1997; Thomas 2006)
the Indemnification and Compensation Act; Land Purchase Implementing Regulation	Eastern German farmers were given the first chance to amplify spatial resources by obtaining previous state-owned land through special conditions	Privatization; Land purchase; rural development	(Thiel 2010)
The Valuation Ordinance	Determines the market value of land through standardized valuation methods	Land valuation	(Kuchar Gläsel 2007)

Table 3 Summary of authority-based tools in legitimation structures in a (re-)unified Germany (compiled and devised by author)

The Federal Government enacted two significant legislations, which delayed restitution yet increased government land sales in the ‘public interest’, showing potential for

significant economic growth. The initial Investment Acceleration Law (1991) elaborated procedures through which the THA could distribute an “investment priority authorization certificate” to support land sales. Furthermore, the Investment Priority Law (1992) reinforced previous law expanding local authority powers to confer certificates and fortify what ‘special purpose’ would rationalize an investment priority (Tucker-Mohl and Kim 2005). Dells (2012) explains how legal frameworks helped to set up transparent land markets in a (re-)unified Germany. This included legal preferences on state aid, regional planning and development, land register, land valuation, expropriation and restriction on the use of private property. Articles 585–597 of the German Civil Code stipulate legal procedures for land leasing as prerequisites for changing or terminating land leases not added unnecessarily and lease contracts not registered with the land registry. In addition, the Valuation Ordinance (WertV) determines market land value through standardized valuation methods (see further details in Kuchar and Gläsel 2007). In addition, Tan et al. (2009) further highlight the Federal Regional Planning Act and Federal Building Code (BauGB) focusing on land planning and development.

Privatization of ‘agricultural land’ was already controversial prior to (re-)unification, and thus regulations were prepared accordingly. Since (re-)unification in 1990, the Law on Adjustment of Agriculture in 1990 and the Federal Land Consolidation Act supported the transition of land governance towards a market economy. These special laws enabled readjustment of land in rural areas when claims for land restitution were made, adapted former land use, and ownership of building (Koester and Brooks 1997; Thomas 2006). In the second privatization stage, GDR farmers were given the first chance to amplify spatial resources by obtaining previously state-owned land through special conditions such as federal land purchase programs, part of the Indemnification and Compensation Act (EALG) and Land Purchase Implementing Regulation (FIERwV) (Thiel 2010).

A4: The BVVG—successor of THA—is both a ‘limited liability company’ and a ‘state agency’ (Kuchar and Gläsel 2006, 2007). It is subject to all general legal regulation mechanisms and principles applying to ‘large stock companies’. As a ‘state agency’, however, the BVVG is also subject to external financial controls and can be audited at any time by the Federal Court of Audit (BRH) (Kuchar and Gläsel 2007).

A5: The knowledge mobilization enabled efficient land management under a market economy, especially in accordance with the Common Agriculture Policy of EU (Wolz 2012). CAP adjusted land values in West Germany and the agricultural sector in GDR consented to adopt EU land prices at one swoop following (re-)unification. Although it is regulated by CAP and functioned within the same legal and institutional framework, land

markets in West Germany and GDR have remained unchanged since the GDR has lowered the value of both land lease and sale than the West, and the lease-to-sale value ratio is higher in the GDR (Koester and Brooks 1997).

A6: A joint declaration effective on 15 June 1990 contained principles for resolving disputes related to unresolved land and property. Adopted as separate appendices to the Unification Treaty, entering into force on 31 August 1990 (Blacksell et al. 1996), a key aspect of the joint declaration was “find[ing] a socially acceptable balance between the competing interests, while taking into account the need for legal certainty and clarity and to protect the right of property” (Kuti 2009). More importantly, it created three major policy instruments for coping with land governance tools: compensation, privatization and restitution (Blacksell and Born 2002).

3.4.3 Domination Structure

T1: The federal government provided various agriculture-support financial tools in an early stage of state re-structuring process including grants (i.e., Starting Aid, Grant for Pasture and Resettlement Grant), interest subsidies (i.e., Subsidized Bank Credit) and credit subsidies (i.e., for general, disadvantaged regions and young farmers) as well as public credit. These were guaranteed by the states and adjustment aid was possible for agriculture development (Koester and Brooks 1997). The ‘farm readjustment’, thus, significantly contributed to land governance transformation after (re-)unification.

T2: THA possessed far-reaching regulatory powers and controls in transforming land governance and many interest groups were, therefore, fostering privatization of land (Czada 1996). Indeed, Rentenbank (Germany’s development agency for agribusiness and rural areas), federal state banks, regional cooperatives and the regional state farmer’s association have been involved in funding for rural development project through the Land Administration Companies (LGSA).

T3: THA and BVVG prefer to lease land. This is because a large volume of land sales causes a sharp drop in land prices, an increase in the wealth of large-scale landowners only (Koester and Brooks 1997). Due to the sharp increase in claims for unresolved property, the federal government adopted legal provisions on land restitution and compensation. The privatization strategies were: short- and long-term land lease (1992–1996); implementation of a Land Purchase Program under the Indemnification and Compensation Act (1996–2010); land sales awarding to the full market value (2005) and options for long-term lease since 2010 (Dells 2012; Kuchar and Gläsel 2006, 2007).

T4: Restructuring agricultural production cooperatives (LPGs) was a significant effect of re-establishing private ownership, creating a sustainable agricultural structure

and balancing farm businesses. To overcome the economic crisis of LPGs, the federal government launched a 'debt relief scheme' and approximately 1400 LPGs received partial debt remission. Moreover, a 'balance sheet discharge scheme' removed the obligation to repayments from the profit and capital tax of LPG successor business (1530 LPGs) (Wilson and Wilson 2001).

T5: BVVG sold land on favorable or discounted terms under the EALG scheme (391,000 ha) and more than half of the agricultural land was sold through lease agreements (393,000 ha). Large-scale farmers and investors could also buy land under preferential conditions (Herre 2013). LGSAs utilize a 'first-price sealed-bid auctions with public tenders' approach and intends to lease land for a relatively short period and reinforces 'regional ownership-based agriculture and rural areas'. Moreover, LGSAs recognizes 'pre-emption rights' through which current tenants are entitled to purchase land if they are willing to pay the highest bid without having to participate in an auction (Forstner 2011; Huettel et al. 2013).

O1: When it comes to land governance, THA was an 'information-provider' to the new states (and their respective ministries). For example, they provide information on what land policy instruments were taken and how much land they owned (Czada 1996). BVVG as 'privatization-facilitator' provides professional training, supervision and guidelines for the regional branches, and collaborating with federal ministries on finances, food and agriculture. Moreover, four decentrally-organized branches are responsible for selling and leasing land with no direct interventions by the states and local governments. Instead, it implements a staff rotation system, cross-checking procedures and 'four-eyes-rule' principles (Kresse et al. 2004)

O2: In 1995, the THA was 'administratively and functionally' reorganized into a new government institution: Federal Agency for Special Tasks Related to Unification (BVS) (Czada 1996). Under the BVS, BVVG was an affiliate of the THA in 1992 and was allocated the long-term task of managing and privatizing these assets (Dells 2008). BVVG is thus the 'executive agency' of the land governance (Kresse et al. 2004).

O3: In line with BVVG, Land Administration Companies (LGSA) were established in 2000 to preserve and develop rural areas as a rural non-profit on behalf of the Federal state. LGSAs operate as joint State enterprises where the German States are major shareholders. According to the Federal Association of non-profit making Land Companies (BLG), the main tasks and services of LGSAs are as follows: land procurement, land utilization and land management; improvement of agricultural business organization; execution of measures for re-organization of land holding and re-organizing of property

ownership; village planning and renewal, land and community development as project management (BLG 2015).

O4: BVVG contributed to establishing land markets given the 54rivatization process after (re-)unification, relying on five guiding principles: uniformity, independence, transparency, turnover-orientation, and social responsibility. BVVG implemented privatization under federal legal frameworks and its dual governance structure ensures administrative independence. In addition, the lease and sales information and the results of privatization are publicly available. BVVG operates with their budgets and income from land privatization and has a social responsibility for balanced rural development (Kresse et al. 2004). The Tools of land governance in a German (re-)unification case and its interactions between tools of land governance can be summarized as Figure 7.

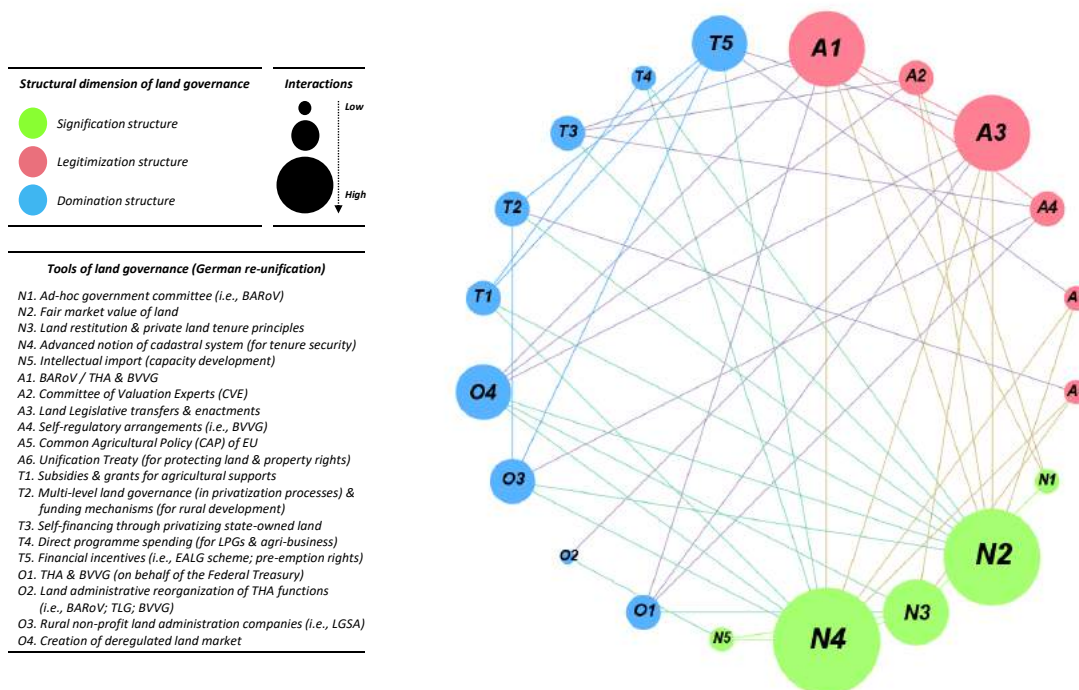


Figure 7 Tools of land governance in a German (re-)unification case and its interactions between tools of land governance (devised by author)

3.5 Case Study 2: Land Governance Re-Arrangements in China-Hong Kong as OCTS

On 1 July 1997, Hong Kong and Mainland China (re-)unified as one country. However, China agreed to maintain Hong Kong's capitalist system for the next 50 years. Under the OCTS approach, they have operated 'dual land governance' for the past two decades, encouraging economic development in China-Hong Kong.

3.5.1 Significance Structure

N1: The Guangdong-Hong Kong Co-operation Joint Conference (GHKCJC) framework was established in 1998. Given its ineffectiveness between 1997 and 2001, it was restructured in 2003 to strengthen horizontal coordination between the Pearl River Delta (PRD) and the Hong Kong Special Administrative Region (HKSAR). Additionally, 22 intergovernmental expert groups (IEG) under GHKCJC were formed by 2012, responsible for land mobilization for infrastructure, innovation, economic development, planning, regional cooperation, environment, and sustainability (Tommy 2015).

N2: Despite British administration, Hong Kong adopted essentially a ‘socialist’ policy, granting only leasehold estates for state-owned land. In Mainland China, the land was put under public ownership when the Chinese Communist Party (CCP) took power in 1949. Guided by ‘egalitarianism’ and a ‘centrally planned economy’, land use rights (LURs) were allocated by the government through administrative and political procedures instead of by the market, and the transfer of LURs was strictly limited (Li et al. 2000). The economic reforms of 1978 started to allow certain market transactions (Deng 1993). Since then Chinese land tenure regulation were gradually adapted. The ‘leasehold system’ applies market economy mechanisms and ‘administrative allocation’ supplying land to the state enterprises and agencies free of charge coexists and functions simultaneously (Wu et al. 2006).

N3: The principles of (re-)unification of the OCTS approach include ‘high degree of autonomy’ and ‘Hong Kong people ruling Hong Kong’ (Zhu 2012). ‘Hong Kong people ruling Hong Kong’ meant setting up a ruling coalition between the HKSAR government and the business sector (Fong 2014). ‘High degree of autonomy’ has meant HKSAR has been recognized as a ‘city-state’ with authority in monetary and social affairs, and international economic cooperation under Chinese sovereignty (Cheung 2014; Tommy 2015). HKSAR will maintain its own land governance until 2047. The two systems are expected to merge naturally (Li et al. 2000).

N4: Throughout Chinese’s history, ‘land tenure’ has always been a significant political issue, with advocates supporting either public or private land ownership. With each new dynasty, public land ownership became an issue and policy-makers tended to reintroduce new systems. Once the dynasty stabilized its power, the land allocation would gradually be public again. This phenomenon caused serious social unrest for various dynasties. Thus, the land has had a pronounced influence on state re-formation, as has the aim of achieving an equal distribution of land. Mainland China and Hong Kong share these common roots of land governance—with authorities recognizing private land

ownership should be strictly controlled to limit the power of the landed class for centuries—until colonial rule (Li et al. 2000; Li 1999).

N5: Despite China's opposition to the occupation of Hong Kong, ironically it was British administration of Hong Kong, which delivered the new land tenure system based upon 'the philosophy of land ownership without consideration of equality' (Li et al. 2000). The principles behind Hong Kong's leasehold system were a key driver in shaping how the commodification of land could work under 'socialist public land ownership' in Mainland China (Zhang 2012) at a time when it was unclear whether commodification was compatible with China's socialist system. Mainland China and HKSAR have established 'intergovernmental interactions' to manage cross-boundary policy issues since 1997 based on a 'give-and-take' and 'adjustment of mutual demands' system (Cheung 2014; Vogel et al. 2010).

3.5.2 Legitimation Structure

A1: Land management has been a fundamental part of the five-tiered government system of Mainland China since (re-)unification. Since (re-)unification, a prominent aspect of China's state re-structuring has been how central government recentralizes divergent regulatory measures in order to strengthen regional land governance. Decentralization processes have promoted an assortment of land policy instruments derived from hierarchical control of land governance using top-down vertical relations to handle the intricacies of land development (Jiang and Yeh 2009). On the other hand, the Lands Department (LandsD) enforces and controls all HKSAR land administration. Its major function is 'local land governance' in the context of economic development, community benefits and cultural transparency, technological advances, and human resources. LandsD deals with the acquisition of private land for public projects, renewal of land leases, and administers applications for lease modifications and land exchanges due to boundary adjustments of land parcels and implementation of urban (re-)development schemes (Ho 2001; Nissim 2012).

A2: The Ministry of Land and Resources (MLR) has mainly operated land governance in Mainland China based on policy directions under the State Council of PRC (SCPRC). The Ministry of Commerce (MOC) in Mainland China and the Financial Secretary of HKSAR co-organize a joint steering committee (JSC) for supervising implementation, dispute resolution and modifying the content of the Closer Economic Partnership Arrangement (CEPA), in handling working groups.

A3: In 1986, the Land Administration Law officially adopted Hong Kong's leasehold system for the first time, stipulating the conversion of private LURs to state-owned land,

providing the legal foundation for land transfers (Wong 2014; World Bank 2014; Wu et al. 2006). After (re-)unification, the Land Administration Law, amended in 1998, stipulated the duration for a contract in ‘collective ownership’ to protect rural land and specified the land expropriation procedures. In addition, local governments were granted urban land rights underlining the legal basis for municipal authority (Wu et al. 2006). Since (re-)unification, most existing laws in HKSAR have remained, except those that the Standing Committee of the National People’s Congress (SCNPC) rejected as incompatible with China’s Basic Law. However, constitutional changes have been mainly terminological. Following the Adaptation of Laws (Crown Land) Ordinance No. 29 of 1998, China mandated amendment of a number of ordinances associated with ‘Crown Land’ and all references to the word ‘Crown’ usually substituted with the word ‘Government’ (Cottrell 1997; Nissim 2012).

The Basic Law of HKSAR, which replaced Hong Kong’s colonial constitution, has worked as a new constitution coming into effect on 1 July 1997, providing the legal basis for land governance in post-reunification (So 2011). The Hong Kong Reunification Ordinance (1997) was ratified to guarantee a unified legal and administrative transfer from the old to the new administration. Regarding land governance, Sections 27 and 32 of this ordinance are particularly pertinent (Nissim 2012). Section 27 stipulates ‘delegations relating to land’ and emphasized on ‘lease or grant of land and natural resources’ in Section 32. Based on Article 7 of the Basic Law of HKSAR, it states:

“The land and natural resources within the HKSAR shall be state property. The Government of the HKSAR shall be responsible for their management, use and development and for their lease or grant to individuals, legal persons or organizations for use or development.”

A4: Long before (re-)unification, Hong Kong’s investment was pivotal in enabling housing and land market development on the mainland (Ng and Tang 1999). Both ‘vertical and horizontal economic collaboration’, especially in the PRD have prospered since 1997. Nevertheless, the different administrative structure between PRD and HKSAR made co-operation complex under OCTS. In particular, land governance from the planning and development perspective has been discrete. The ‘issue- or project-based collaboration’ is the foremost mechanism used between PRD and HKSAR and cooperation is exceedingly dynamic in the arena of infrastructural projects and economic development (Figure 8) (Cheung 2014; OECD 2010).

A5: The HKSAR government requested its inclusion in ‘the 11th National Five-Year Plan (FYP)’ in 2006 for the first time (Vogel et al. 2010). This strengthened economic

cooperation and integration between PRD and HKSAR through ‘the Outline of the Plan for the Reform and Development of the PRD 2008–2020 (the Outline Plan)’ in 2008. Meanwhile, ‘the 12th FYP’ promulgated in March 2011 demonstrates how Hong Kong and Macao are intensifying economic integration with Mainland China (Tommy 2015). The 13th FYP, recently announced in 2016, further enumerates mutual economic cooperation and common growth for further integration.

A6: Institutional integration through the CEPA concluded by the central government and HKSAR in 2003 stimulated regional integration and facilitated ‘mutual trust and understanding’ between the PRD and HKSAR (Cheung 2014; OECD 2010). The HKSAR government initiated ‘regional planning’ in 2004, bringing up the agenda at GHKCJC (Vogel et al. 2010). In 2008, HKSAR and Shenzhen established a co-operative relationship in terms of ‘spatial governance’—creating a business-friendly environment in border areas. This has substantially improved transport infrastructure (Fong 2017; OECD 2010). ‘A Framework Agreement on Hong Kong/Guangdong Co-operation’ (FAHGC) in 2010 has deepened co-operation in the GPRD (Greater Pearl River Delta), promoting joint economic development and environmental co-operation (OECD 2010).

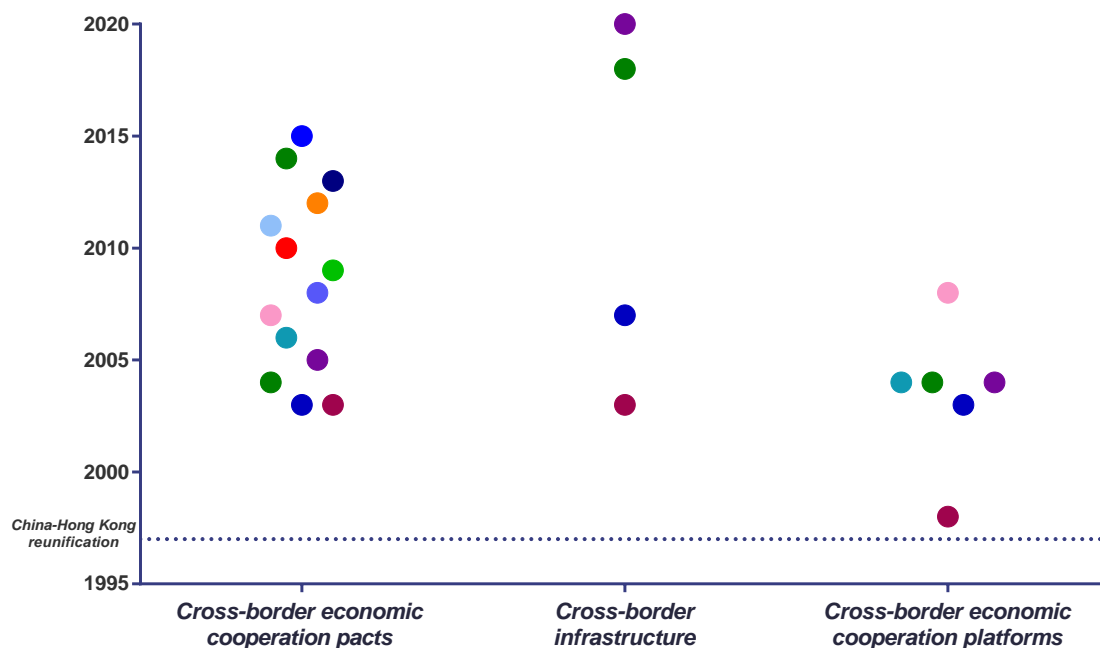


Figure 8 Issue- and project-based land governance between PRD and HKSAR (devised by author based on Fong 2017)

3.5.3 Domination Structure

T1: The local governments in China offered industrial land at subsidized prices and infrastructure without costs to investors to grab both economic growth and tax incomes. Moreover, the land administration law enforced ‘resettlement subsidy’ to compensate for

losses during land expropriations and to restore rural areas (OECD 2010; World Bank 2014). Meanwhile, LandsD in HKSAR formulates and implements all land lease policies regarding long-term dispositions of government-owned land through ‘public auction’, ‘public tender’ and ‘private treaty grants’ (PTGs). In particular, NGOs are eligible for substantial tax exemptions at subsidized rates for PTGs (Nissim 2012).

Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(h):(a)
1999	559,487	31,257	5906	-	3303	-	51,433	91,899	16.4%
2000	640,606	34,896	6476	-	3532	-	59,558	104,462	16.3%
2001	780,330	38,062	6615	-	3833	-	129,589	178,099	22.8%
2002	851,500	46,711	7683	-	5734	-	241,679	301,807	35.4%
2003	984,998	54,671	9157	-	3990	-	542,131	609,949	61.9%
2004	1,189,337	66,974	10,623	-	12,008	-	641,218	730,823	61.4%
2005	1,510,076	79,102	13,734	-	14,185	-	588,382	695,403	46.1%
2006	1,830,358	93,343	93,343	-	17,112	-	807,764	1,011,562	55.3%
2007	2,357,262	114,870	38,549	-	18,504	-	1,221,672	1,393,595	59.1%
2008	2,864,979	133,630	81,690	53,743	31,441	68,034	1,025,980	1,394,518	48.7%
2009	3,260,259	141,992	92,098	71,956	63,307	80,366	1,717,953	2,167,672	66.5%
2010	4,061,304	173,627	100,401	127,829	88,864	89,407	2,746,448	3,326,576	81.9%
2011	5,254,711	277,929	122,226	206,261	107,546	110,239	3,212,608	4,036,809	76.8%
2012	6,107,829	312,563	154,172	271,906	162,071	137,249	2,804,228	3,842,189	62.9%
2013	6,901,116	341,990	171,877	329,391	180,823	158,150	3,907,299	5,089,530	73.7%
2014	7,587,658	364,461	199,262	391,468	205,905	185,164	4,038,586	5,384,846	71.0%
2015	8,300,204	388,632	214,204	383,218	209,721	205,090	3,078,380	4,479,245	54.0%
2016	8,485,000	403,360	225,574	421,219	202,889	222,091	3,563,969	5,039,102	59.4%

Table 4 Land and property-related revenue in Mainland China, 1999-2016 (Million RMB, data extracted from the China Land and Resources Yearbook from Ministry of Land and Resources and China Finance Yearbook from the Ministry of Finance (1999-2016)

Note: (a) Local level government revenue; (b) urban maintenance & development tax; (c) urban land use tax; (d) land appreciation tax; (e) tax on the use of arable land; (f) house property tax; (g) total land-related revenue; (h) land-related versus budgetary revenue.

T2: Central government agencies, including the Liaison Office of the Central People’s Government (LOCPG) and the Trade Office of the Economic Affairs Department (TOEAD), support the economic governance of Mainland China and HKSAR (Tommy 2015). Land governance in HKSAR operates under the Financial Secretary and especially belongs to the Secretary for Development and its Bureaus. For instance, the Buildings Department (BUILD) provides services to owners and occupants in both existing and new buildings through its Building Ordinance. The Civil Engineering and Development

Department (CEDD) undertakes mainly infrastructure planning and implementation of development projects spanning the territory. Furthermore, the Land Registry (Koester and Brooks) is in charge of providing secure land registration and information service. With increasing cooperation with Mainland China, the Planning Department (PlanD) continues to keep close contact with neighbouring cities on cross-boundary planning and development matters (Nissim 2012).

T3: ‘Land fiscalization’ through LUR sales has been recognized as a major revenue source for local governments in Mainland China (Table 4). Rithmire (2017) proves that by 2010, local government revenues from land development were almost equal to those generated from tax. Huang et al. (2017) also argue this result from China’s ‘urban-rural land system’. As local governments monopolized land transactions in cities, they tend to acquire land inexpensively from farming collectives and then sell them back to developers at higher prices. These land revenues then enable local governments to foster urban development and finance infrastructure provision, which leads to rapid urbanization in rural areas.

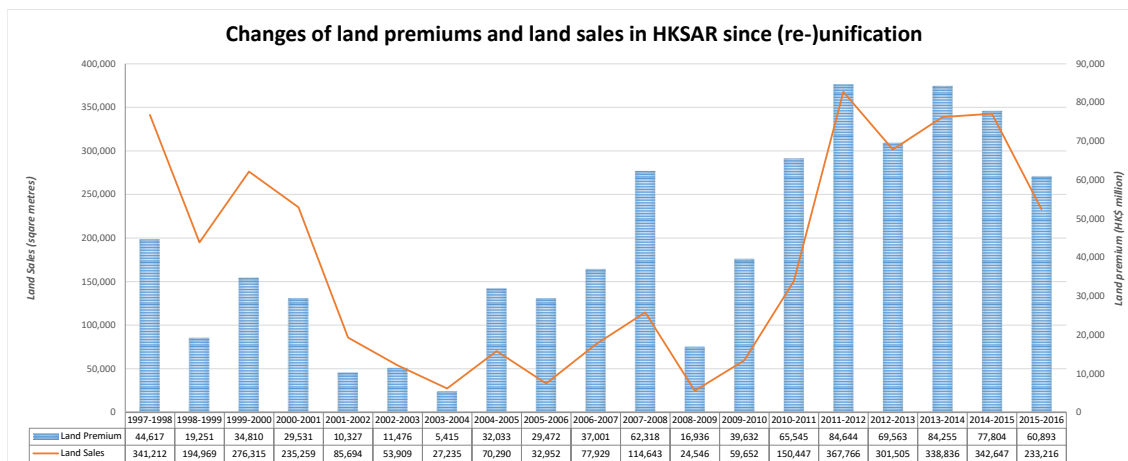


Figure 9 Changes of land premium and land sales in Hong Kong SAR since (re-)unification (devised by author and data extracted from the HKSAR government, Census and Statics Department and the Lands Department)

Prior to (re-)unification, the Sino-British Land Commission (SBLC) was formed in 1985 and disbanded on 30 June 1997, under the provisions of Annex III of the Joint Declaration. How to provide land leases was specified in the clause of the Joint Declaration indicating that, the government prefers to extend a ‘non-renewable lease’ or grant ‘new leases’ as a source of sustainable government revenue in company with land premium (Ho 2001). ‘Land premiums’ were a major source of government revenue in HKSAR in the years leading up to (re-)unification (Figure 9). Land premiums consisted of two major parts: ‘proceeds from land sales’ and ‘revenue from lease modifications’. Transforming land governance began in 1986 with the setting up of the “HKSAR Land Fund”. This Land Fund received 50% of proceeds from the sale of land by the British Hong Kong

Government from 1985 to 1997, transferring the money to the HKSAR Government after (re-)unification (Liu 2015).

T4: A huge amount of indirect programme spending has been invested in spatial development, especially in the transport infrastructure sector. ‘Cross-boundary co-operation’ initiatives accelerate economic integration through ‘issue-and-project-based land governance’ focusing on urban development, spatial planning, and environmental sustainability between PRD and HKSAR. The Guangdong-Hong Kong-Macao Close Co-operation Zone (GHKMCCZ), proposed in 2008, implies that the Guangdong provincial government may secure the right to establish a ‘sub-regional cooperation mechanism’ through the implementation of a new CEPA. This initiative enhances economic and administrative integration between cross-border regions with land governance being the focal point for accelerating ‘integrative territorial development’.

T5: Based on CEPA, the initiative provides consequential financial incentives for provinces in Mainland China to open up land markets. However, it is only possible with mutual recognition of professionals regarding land governance (e.g., real estate appraisers and land surveyors).

O1: In addition to the national MLR in Mainland China, the Department of Land and Resources (DLR) at the provincial level, the Bureau of Land and Housing (BLH) at prefecture- and county-levels, and the Division of Land and Housing Office (DLHO) at the township-level all play pivotal roles in land governance (Jiang and Yeh 2009). Moreover, a wide range of regional agencies coping with housing and urban-rural development, environmental protection and agriculture have been involved in formulating local land governance and implementing local land policies. LandsD of HKSAR encompasses three functional offices: The Legal Advisory (LACO) and Conveyancing Office, the Survey and Mapping Office (SMO), and the Lands Administration Office (LAO) (Ho 2001).

O2: The MLR—set up in 1998—amalgamated all the previous land-related state bureaus and ministries. It has been responsible for planning, management, conservation and utilization of natural resources, and focused on ‘managing uncontrollable conversions of rural land’ and ‘investment in urban development’ (Rithmire 2017). This institutional transformation, in conjunction with the amendment of the Land Administration Law in 1998, has helped to spur China’s transformation (Wu et al. 2006). The third-stage of land administration reform occurred in 2003 when the State Council of PRC (SCPRC) announced a ‘Hierarchical Land Management System (HLMS)’ for all governments below the provincial level. Consequentially, provincial land authorities have become ‘regional agencies’, keeping an eye over local land-use activities (Jiang and Yeh 2009). The

central and provincial government carries out the main tasks of land administration in Mainland China. However, HKSAR land governance remains unchanged.

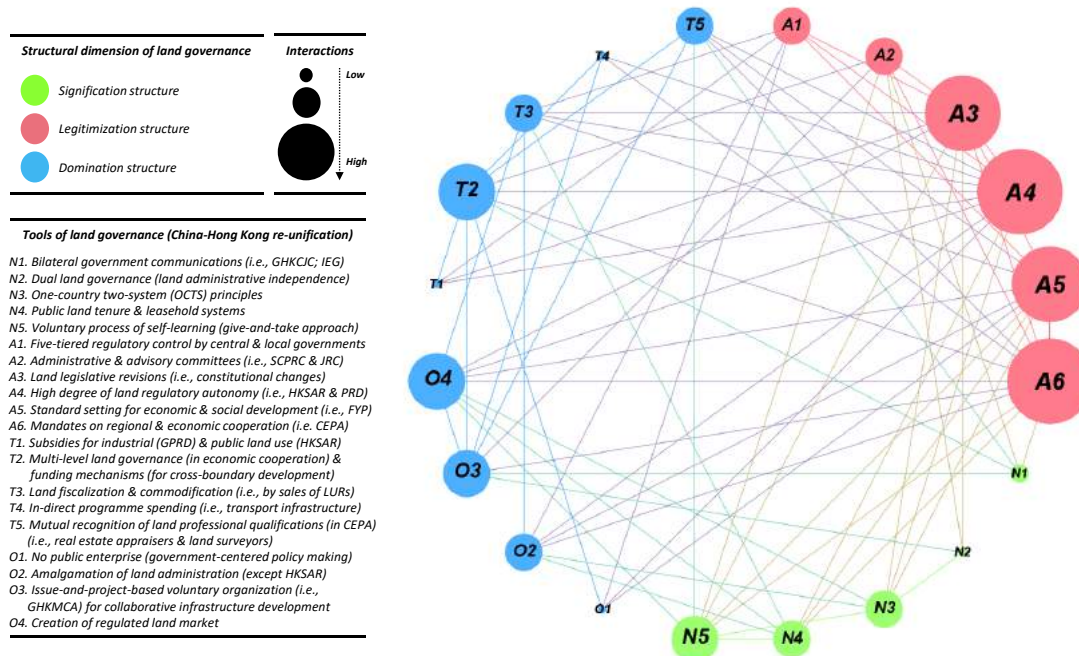


Figure 10 Tools of land governance in a China-Hong Kong (re-)unification case and its interactions between tools of land governance (devised by author).

O3: It is not common to use community-based voluntary organizations relating to land governance transformation, but NGOs such as the Guangdong-Hong Kong-Macao Cooperation Association and the GPRD Business Council are platforms that have been established to implement infrastructure development projects and encourage market transformation among interest groups involved in collaboration (GPHURD 2011).

O4: The experiment of ‘socialist market economy’ began in the Shenzhen Special Economic Zone (SEZ), where the first ‘land auction’ in the history of China was conducted. It allowed LURs to be transferred for a fee while the public ownership of land remained unchanged. This land governance transformation was considered a huge success, which not only contributed to increasing government revenue but also allowed rapid urban development (Xu 2008). This model was then adopted in other cities and spread over China and finally “Shenzhen is HongKongized, Guangzhou is Shenzhenized, and the whole country is Guangdongized” (Cartier 2001). The Tools of land governance in a China-Hong Kong (re-)unification case and its interactions between tools of land governance can be summarized as Figure 10.

3.6 Synopsis of Results

This section evaluates the key results following the key analytical questions of this paper.

3.6.1 What Informs the Interpretation of Land Governance in the (Re-)unification Context?

The analysis demonstrates that the nature of (re-)unification itself has affected the tools of land governance and its institutional arrangements in both Germany and China-Hong Kong. In German re-unification experiences, the advanced notion of a cadastral system for tenure security (N4) and fair market value of land (N2) in the signification structure are the most important tools of land governance. ‘Land tenure security’ has re-emerged during and after (re-)unification based upon advanced ‘cultures’ and ‘traditions’ of cadastral systems in the federal German government. Moreover, ‘fair market value’ within a social market economy played a major role in achieving good land governance as well as facilitating investments. The fundamental difference between China and Hong Kong was the ‘political agenda’ in shaping ‘dual land governance’ under OCTS (N3). Indeed, both already shared similar ‘ideas and values’ over land governance due to ‘public land ownership’ and ‘leasehold system’, modelled on Hong Kong (N5). Yet, China and Hong Kong also shared common historical roots recognizing ‘tenure security’ and ‘control over land resources’ (N4).

For both, other tools, including ‘information collection and release (N1)’ seemed relatively less effective than nodality-based tools during and after (re-)unification. In Germany, the federal government detected information on unresolved land and property through its special committee, but it is uncertain how government affects behaviors and perception of land governance transformation. In the same vein, Chinese and HKSAR governments established a bilateral government communication tool to collect information on territorial capital. Detecting or sharing information is only partially accomplished to manage cross-boundary territorial issues since (re-)unification. Characteristics of nodality-based tools in a signification structure in Germany were particularly requested ‘post-reunification’ to enhance ‘democratic and transparent land governance’. Yet, China-Hong Kong already pursued and chose governmental nodalities ‘pre-reunification’ in a political manner to help formulate ‘dual land governance’ and further gradual integration of land governance.

3.6.2 What Defines the Legitimacy of Land Governance and Which Rules are Chosen to Rearrange Land Governance?

Authority-based tools in the legitimation structures of Germany and China-Hong Kong were regarded as foremost concerns of land governance re-arrangements in being socially and geographically balanced and acceptable. In Germany, 'BAROV' and 'THA & BVVG' as independent regulatory agencies (A1) were used to cope with land restitution and privatization, respectively. Yet, China-Hong Kong emphasized the regulatory role of central and local government using five-tiered 'vertical land governance' (A1). SCPRC has functioned to elaborate policy directions of land governance at the superior level and local land authorities becoming 'regional agencies' in Mainland China. Furthermore, LandsD enforces and controls all HKSAR land governance.

Germany's federal government endeavours 'adaptive land governance' for efficient transfer of existing land-related institutions in setting up transparent land markets to narrow land-knowledge gaps post-reunification using 're-versioning legal frameworks' (A3). In addition, CAP restrained land value increases in West Germany and made land prices in GDR comply with EU standards (A5). 'Unification Treaty' highlights legal certainty and clarity to protect land rights in Germany but also stimulate economic co-operation and regional integration (e.g., CEPA) in China-Hong Kong (A6). Evidence from China-Hong Kong shows that authority-based tools have remained significant due to legal incoherence and incompatibility. However, many documents from SCPRC provide 'comprehensive land governance' frameworks. Moreover, central government delegates rule-making, land governance to HKSAR based on its Basic Law. PRD and HKSAR have a high degree of autonomy in strengthening 'local land governance' and utilize 'self-regulation' and 'delegated regulation' (A4; A5).

In both cases, authority-based land governance tools have been widely implemented in legitimation structures, showing necessary institutional re-arrangements, respectively, following particular demands since (re-)unification. The main difference between the cases is Germany re-distributed authority and responsibility to 'independent regulatory agencies' speeding up land governance transformations, reducing considerable administrative costs of reckless land claims. In China-Hong Kong, 'the right to command and control of local governments' has been further granted and strengthened under legal frameworks, catalyzing 'local land governance' in China (A1).

3.6.3 What Structures and Capacities Do Government Possess in Transforming Land Governance?

Treasure-based tools in domination structures have less influence in re-producing and re-creating land governance than other types of tools. However, organization-based tools are regarded as significant policy instruments in land governance re-arrangements. Germany and China-Hong Kong have approached these issues with different financial and re-structural mechanisms.

Most treasure-based tools in Germany are ‘agriculture-oriented’, especially in the former GDR. The federal government provides special funding for agriculture, including grants, subsidies and public credit (T1). In terms of funding, various stakeholders have all been involved in privatization processes as well as rural developments (T2). Meanwhile, most state and non-profit making agencies are self-financed through privatized state-owned land resources (T3). The federal government also introduced a scheme to prevent a financial crisis in LPGs and to develop agri-businesses (T4). After (re-)unification, both BVVG and LGSAs aim to secure the land rights of existing tenants (T5). The China-Hong Kong case reveals only limited engagement with treasure-based tools based upon ‘mutual demands’ and ‘regional cooperation strategies’. For example, local governments in Mainland China and GPRD offered industrial land at subsidized prices to promote economic growth, tax revenues, and public interests (T1). To support economic-focused land governance between China and HKSAR, financial ministries and departments are involved (T2). ‘Land premiums’ by sales of LURs have been recognized as a major source of local government revenue in both Mainland China and HKSAR (T3). Based on CEPA, these provide consequential financial incentives for provinces in Mainland China to open up land markets. However, it is only possible with the mutual recognition of ‘land professionals’ (T5).

In Germany, public enterprises (e.g., THA & BVVG) helped transport land governance on behalf of the Federal Treasury, managing and privatizing land resources (O1). Former GDR states were affiliated with West German counterparts to support land governance restructuring (O2). The ‘multi-level governance’ using of community and voluntary organizations, for example, LGAs, preserved development of rural areas with regional ownership-based agriculture and land administration (O3). Moreover, land markets were created by privatizing and redistributing state-owned agricultural land based upon the principles of uniformity, independence, transparency, and turnover-orientation and social responsibility (O4). In comparison, there was no public enterprise in China-Hong Kong for land governance transformation since ‘the central and local governments’ in Mainland China and HKSAR government carry out land governance based

on public land ownership and leasehold system (O1). MLR amalgamated land governance functions and local land authorities emphasize monitoring land use activities under HLMS in Mainland China. HKSAR's land governance has remained unchanged, except for the replacement of terminology from 'crown' to 'government' (O2). 'Issue-and-project-based land governance' between PRD and HKSAR focusing on spatial development, especially in the transport infrastructure sector, has promoted (O3). By imitating HKSAR land governance, SEZ was first 'land auction' in the history of Mainland China and the model adopted by other cities and then land markets were gradually established (O4).

3.7 Conclusion

Returning to the research questions posed at the beginning of this paper, it is now possible to state that land governance has a pivotal role in transforming institutional forms and functions during and after (re-)unification processes. Despite its explanatory nature of methodology and analysis, this work contributes to existing knowledge of land governance re-arrangements by providing an analytical foundation for a systematic classification of institutions and its tools based upon a comprehensive account of socio-economic and political variables for land governance. The investigation of land governance re-arrangements in the German case as OCOS has shown that nodality-based tools (especially N4; N2; and N3) in signification structures and authority-based tools (especially A1 and A3) in legitimization structures are widely implemented that have shown necessary transformation respectively following particular demands during and after (re-)unification. On the other hand, the most obvious finding to emerge from the China-Hong Kong case as OCTS is that authority-based tools (especially A4; A6; A3; and A5) in legitimization structures were more likely to be considered than other land governance tools.

The reasons for difference between OCOS and OCTS are clearly supported by the findings. Germany utilized 'adaptive land governance', aiming for fast-track transformation during and after the state restructuring process, and using ad-hoc administration to tackle new land governance problems. In contrast, the China-Hong Kong (re-)unification used hierarchical enforcement in re-arranging land governance, whereby central and local governments (including HKSAR) has the right to establish public land ownership combined with a leasehold system. This leads to a more gradual transformation of land governance. Moreover, concerning domination structures, the federal government in Germany established 'multi-level' land governance systems, involving government from both federal and local level, independent state agencies, to community-based voluntary organizations and regional cooperatives of former landowners and existing tenants. This enhanced rural development and created transparent land markets in

particular. Instead, the China-Hong Kong transformation emphasizes ‘land fiscalization’ more, given that land has gradually become recognized as a main source of revenue for local governments in both China and HKSAR. In addition, ‘issue-and-project-based land governance’, i.e., addressing cross-boundary territorial problems in GPRD for accelerating ‘integrative territorial development’, was promoted.

The evidence from this paper suggests that:

- When adopting adaptive land governance, governments should monitor and identify formidable obstacles in (re-)unification processes and then proactively or reactively manage them using authority-based tools in legitimation structures.
- When relying on hierarchical enforcement, legitimation structures require strong political leadership at different administrative levels, which gradually transform land governance as a long-term project.
- When adopting multi-level land governance, the government should endeavour to establish transparent land markets and land tenure security at the domination structure phase, include rural development as a priority of land governance transformation, and build multi-layer check-and-balance mechanisms through which various stakeholders can contribute.
- Adopting issue-and-project-based land governance only works when fundamentally different institutional contexts and frameworks exist prior to (re-)unification. It is important to cope with cross-boundary infrastructure and economic development before changing land governance.

This is the first time that structuration theory aligned with tools of government approach has been used to explore land governance re-arrangements in cases of (re-)unification. The methods we used for this paper may be applied to other researches that focus on institutional approaches to land governance and its instrumental choices, where the countries tend towards fragmentation and separation or integration and (re-)unification in the world. Whilst this paper did not confirm with empirical data analysis, it did partially substantiate how the government (agency) interacts in response to transforming people-to-land relationship (structures) and which governmental tools (resources) were deployed within different institutional (re-)unification contexts (OCOS and OCTS) by reflecting the institutional extractions from the theoretical and practical parameters of the analysis. The generalizability of these implications is subject to certain limitations. For instance, we do not conclude which approaches for (re-)unification are appropriate for land governance re-arrangements, since all countries have different historical contexts and institutional arrangements. Thus, the next step would be to conduct a more

empirical qualitative analysis using in-depth interviews with key agencies and actors who were involved in the institutional re-arrangement processes. Therefore, further empirical analysis is recommended to verify how and where the transformation processes are initiated and structured

Chapter 4. Bridging the Semantic Gap between Land Tenure and EO Data: Conceptual and Methodological Underpinnings for a Geospatially Informed Analysis*

* This chapter is based on a published paper as follows: Lee, C., & de Vries, W. T. (2020). Bridging the Semantic Gap between Land Tenure and EO Data: Conceptual and Methodological Underpinnings for a Geospatially Informed Analysis. *Remote Sensing*, 12(2), 255. DOI: <https://doi.org/10.3390/rs12020255>

SUMMARY

When spatial land tenure relations are not available, the only effective alternative data method is to rely on the agricultural census at the regional or national scale, based on household surveys and a participatory mapping at the local scale. However, what if even these are not available, which is typical for conflict-affected countries, administrations suffering from a lack of data and resources, or agencies that produce a sub-standard quality. Would it, under such circumstances, be possible to rely on remotely sensed Earth Observation (EO) data? We hypothesize that it is possible to qualify and quantify certain types of unknown land tenure relations based on EO data. Therefore, this study aims to standardize the identification and categorization of certain objects, environments, and semantics visible in EO data that can (re-)interpret land tenure relations. The context of this study is the opportunity to mine data on North Korean land tenure, which would be needed in case of a Korean (re-)unification. Synthesizing land tenure data in conjunction with EO data would align land administration practices in the respective parts and could also derive reliable land tenure and governance variables. There are still many unanswered questions about workable EO data proxies, which can derive information about land tenure relations. However, this first exploration provides a relevant contribution to bridging the semantic gap between land tenure and EO data.

Keywords: land administration; geospatially informed analysis; land tenure; land tenure relations; remote sensing; earth observation (EO) data

Chapter 4. Bridging the Semantic Gap between Land Tenure and EO Data: Conceptual and Methodological Underpinnings for a Geospatially Informed Analysis

4.1 Introduction

Land tenure data contain geospatial, anthropological and socioeconomic attributes since it builds on both the physical delineation of land and the identification of social relations governing land use, land access and land ownership (Payne & Durand-Lasserve, 2012; Robinson, Holland, & Naughton-Treves, 2014). Collecting land tenure data is however neither administratively straightforward nor always technically feasible or financially affordable. There are even many challenges which make collecting land tenure data complex, such as data availability and data accessibility (Chaturvedi, Shelar, & Singh, 2018; Petersen & Stevens, 2014). However, new data collection technologies, including amongst others voluntary geographic information in connection to social media technologies, Unmanned Aerial Vehicles (UAVs) and big data mining may overcome some of these barriers. Yet, there is a dearth of the methodological reflections in how such geospatial technologies can identify and formalize land tenure relations. What these technologies are currently able to do includes: (1) underpinning land tenure-enabling environments; (2) mining land tenure data; (3) transforming land tenure relations (Biscaye et al., 2017). However, the quality of all these heavily depends on the completeness and full access of the terrain and the data sources. In many cases these basic criteria cannot be guaranteed, leaving the land tenure information scarce (Robinson et al., 2014, pp. 277-278).

A promising and yet unexplored technology to derive socio-legal land tenure information is Earth Observation technology. The utilization of EO data has increased significantly in many disciplines. Literature shows applications ranging from environmental and regional studies to economics, and peace and conflict research, for example (Donaldson & Storeygard, 2016; Hall, 2010; Patino & Duque, 2013; Schweik & Thomas, 2002). More specific to the interest of this paper, there is growing body of literature on methods to extract and map cadastral boundaries using EO data (Crommelinck et al., 2016; Crommelinck, Bennett, Gerke, Yang, & Vosselman, 2017; Crommelinck, Koeva, Yang, & Vosselman, 2019; Fetai, Oštir, Kosmatin Fras, & Lisec, 2019; Konecny, 2009; Luo, Bennett, Koeva, Lemmen, & Quadros, 2017; Luo, Bennett, Koeva, & Lemmen, 2017; Nyandwi, Koeva, Kohli, & Bennett, 2019; Wassie, Koeva, Bennett, & Lemmen, 2018; Xia,

Persello, & Koeva, 2019). However, this literature rarely effectively bridges the knowledge gap between social land tenure and spatial descriptions of boundaries. In other words, the (even automated / machine-learning based) spatial descriptions do not identify the underlying social or legal relations to land, such as effective land ownership, private or communal land use or land access rights or presumed land claims.

The methods in detecting, extracting and identifying land tenure relations always require both geometric or topographic characteristics and ground-truth information of land tenure. However, spatially explicit land tenure relations through EO data remains one of the foremost challenges. As a societal institution, land tenure has a great influence on how people decide on land use. Such decisions are observable in land cover changes and spatio-temporal patterns of land use (inducted from similarities, differences, repetitions or sudden changes in space and time). The dynamics of landscape changes are this intrinsically linked to land tenure relations and decisions (Cumming & Barnes, 2007; Donnelly & Evans, 2008; Lambin et al., 2001). Detecting and extracting physical features is possible by connecting spectral reflectance values, shapes, and texture features of ground components to be pre-defined. By sampling and generalizing these connections, one can construct algorithms, which detect and predict spatio-temporal patterns with EO data, such as the (rate of) land fragmentation, land ceiling and urban encroachment. (Council, 1998; Liu et al., 2017; Luo, Bennett, Koeva, & Lemmen, 2017). Such spatio-temporal processes could be connected to land tenure information if these are aligned with automated identification and reconstruction of cadastral boundaries. For example, the morphology of a cadastral boundary is associated with the spatial nature of land tenure on the aspects of, physical realm of land interests, temporal practices of land use rights and legal nature of boundaries (Bennett, Kitchingman, & Leach, 2010).

Then, how do we derive the features or characteristics of land tenure if we only have access to the physical objects or spectral changes in objects in time and in space? According to Whittal (2014), land tenure aspects may cross multiple spatially observable boundaries in a given landscape. Additionally, tenure and land right boundaries are also not always visible through specific elements in the landscape or through specific spectral reflectance values. One still needs to combine the location of specific landscape elements to alternative data source, such as agricultural census data at the regional or national scale, and/or household surveys and a participatory mapping at the local scale (Herrera, 2005; Robinson et al., 2014, p. 287). Nevertheless, what if these locally collated datasets are not available? Is it in such cases still possible to rely on EO data only, combined with a set of basic assumptions about the spatial nature of land tenure. We hypothesize that this is possible; however, this requires a set of fundamental proxies connected to specific

documented knowledge on land tenure. This article will describe how this is possible and under which conditions this is possible.

The first challenge to overcome this problem is to address the degree of semantic information connected to spatial information. When it comes to extracting socio-spatial aspects of land tenure using EO data, the formalized and proven semantic rules do not yet exist. Or more precisely, the rules and assumptions, which induce a land tenure relation type, do not yet exist. EO data only distinguishes “low-level semantic features” of land cover information such as physical features, spatial objects and configuration of ground components. In contrast, land tenure information requires “high-level semantic features” connected to knowledge-based information, and reflecting institutionalized human-land relationships and based upon the varying human socio-economic activities on land such as land use and ownership trajectories. In other words, the low-level semantic features provided by direct EO data acquisition methods are insufficient for the derivation of land tenure relations. One needs some sort of socialization of the pixels, i.e. a high-level semantic data collection and interpretation procedure which represents knowledge epitomized by indirect access to EO data. In practice, there is a discrepancy between the levels of detected low and high-level semantic features and it is labelled as the “semantic gap” (Bratasanu, Nedelcu, & Datcu, 2011; Liu et al., 2017; Yang, Fu, Smith, & Yu, 2017). Therefore, it is important see how the process of socialization of pixels can take place and how EO data can be (re-)interpreted into semantic land tenure relations with a rational and rigorous methodology. Only then, it is possible to identify, bridge and close the semantic gap.

Hence, this paper makes a review of the challenges posed by the identification of land tenure relations from Earth Observation data. In order to overcome some of these challenges, we propose to use a mix of methods and information fusion to identify proxies that may help derive unknown land tenure relations. This illustrate our approach by constructing proxies for land tenure relations over North Korea. The research questions are:

- Which kind of land tenure-related data can one derive and acquire when information access is limited?
- Which proxies can help to derive currently unknown land tenure relations in conjunction with EO data?

We first present the conceptual foundations of EO data applications for identifying land tenure relations. The next section addresses substantive and methodological

considerations. Then, we explore a set of proxies in relation to five land tenure related questions. Finally, the conclusion gives brief summary and provides recommendation on how to proceed with this research.

4.2 Fundamentals of EO Data Application for Identifying Land Tenure Relations

4.2.1 The Conceptual Models of Semantic Land Tenure Relations

Table 5 lists a number of key models and concepts capturing land tenure relations. Henssen (1995) depicts land tenure as institutionalized people-to-land relationships with his “Subject-Right-Object model” (J. A. Zevenbergen, Frank, & Stubkjaer, 2007). This basic model of land administration has been further modified by for example highlighting the dynamics of land tenure (Van der Molen, 2003). The “Land Administration Domain Model (LADM)” is to a large degree an extended and more sophisticated model of the basic model, and has become both a conceptual and descriptive standard (ISO 19152). The LADM covers all land tenure-related data components including parties, legal/administrative units, spatial objects, and data on surveying and spatial representation. The LADM can bridge the gap between land policies and information management opportunities and is adaptable to local situations (C. Lemmen, van Oosterom, & Bennett, 2015; C. H. J. Lemmen, 2012).

Furthermore, the “Continuum of Land Rights” approach emphasizes that land tenure arrangements vary along a continuum of land rights. Not only documented formal land rights are legitimate, but also undocumented informal land rights may exist and society may accept or condone these alongside formal rights. The continuum of land rights approach is useful in describing de facto land tenure, which is much more fluid and flexible than the static and unchanging (spatio-temporal) description of land rights. It allows more flexibility to define and recognize land tenure based on evidence from the field (UN-Habitat, 2008).

The “Fit-For-Purpose land administration” approach mainly focuses on building geospatial data framework of large-scale mapping that can address emerging land tenure issues where no reliable land information exists. This framework highlights following constituent principles in order to not only improve recognition of “value-of information” and maximize “cost-effectiveness”, but also decrease “capacity-demanding”: (1) general boundaries rather than fixed boundaries; (2) aerial imageries rather than field surveys; (3) accuracy relates to the purpose rather than technical standards and; (4) opportunities for upgrading and improvement (Enemark, Bell, Lemmen, & McLaren, 2014).

Semantic land tenure relations	Land tenure data specification	EO data application
Subject-Right-Object Model (Henssen, 1995)	The model only distinct three categories: “subject-rights-objects”. Subjects are persons, groups, firms or States. Rights are ownership, use, control, access and transfer rights. Objects are physical features. The model puts in principle the accent on the relation “subject-right (who and how)”, and on the relation on “right-object (where and how much)”.	Scalability: currently EO data only looks at physical objects. This includes identifying cadastral (parcel and building) boundary-mapping approaches and land use attributes. However, other attributes can be derived using technical advances of Earth Observation (EO).
Land Administration Domain Model (LADM)	The Land Administration Domain Model (LADM) facilitates the management of different tenures in “one environment”; it covers all land tenure-related data components including parties (person or organization), legal/administrative units (right, responsibility and restrictions), spatial objects (parcel, buildings and utility networks), and data on surveying and spatial representation (geometric/topological data).	Inter-operability: to capture semantics of the land administration and data-related components, a range of data acquisition methods is emphasized (e.g. satellite images, Unmanned Aerial Vehicles (UAVs) and automatic feature extraction).
Continuum of Land Rights	It refers to recognizing, recording, administering a variety of appropriate and legitimate land tenure data. It, thus, focuses on the “tenurial pluralism” (diversity of tenure arrangements) and duality in subjects.	Flexibility: underlining importance of data robustness and accuracies using more sophisticated technologies to systemically accumulate land tenure data
Fit-For-Purpose Land Administration	Capturing spatial land tenure data should be “flexible and participatory” that covers all tenure data in scope. Moreover, acquired land tenure data is used affordable technologies and needs to provide adequate reliability within a limited time and resources. All land tenure data should be kept up-to-date.	Accuracy: application of general boundary mapping (rural); the use of high resolution satellite imagery (urban); high accuracy of information; on-going updating, sporadic upgrading and incremental improvement
Responsible Land Administration (J. Zevenbergen et al., 2015)	It addresses changes in people to land relations based on “socio-technical and institutional advances”. New geolCT-driven and thought-restructuring land data capture, visualization, and sharing techniques with a clear understanding of a legal, organizational, and governance context can acquire specific characteristics of land tenure.	Legitimacy: emerging geospatial technologies including high-resolution satellite imagery for data collection and management offers new insights on legitimizing land rights and documentation as well as acknowledging different forms of land tenure.

Table 5 The conceptual models of semantic land tenure relations

“Responsible land administration” expands the conventional notions of land administration with a normative framework. What is distinctive about this concept is that it takes the following aspects into account: the requirement for any land administration system to ensure the representation of multi-stakeholders in order to foster institutional innovation and inclusion; the incorporation of a broad array of scholarly disciplines into the methodological repertoire, in particular, connecting from technical and information sciences to the social sciences and humanities; the need for a proactive stance in laying

the foundation of cutting-edge land administration systems design; connecting the global context to the local and vice versa; the continued need to transfer knowledge into the practice, and vice versa (J. Zevenbergen, De Vries, & Bennett, 2015). Technical and operational designs of land information systems can only be innovative if particular societal needs embedded in the design process and in the manner in which land administration is based on shared responsibilities.

4.2.2 Advancement of EO and AI Applications in Identifying Land Tenure Relations

One of the significant discussion in EO applications for land tenure relations is to provide the institutional and spatial aspects of cadastral boundaries by identifying relationships between physical objects and visual boundaries based on the notion of cadastral morphology (Luo, Bennett, Koeva, Lemmen, et al., 2017; Luo, Bennett, Koeva, & Lemmen, 2017) and cadastral intelligence (Nyandwi et al., 2019). The early experiment demonstrates that over 80% of cadastral boundaries coincide with visible physical objects (Luo, Bennett, Koeva, Lemmen, et al., 2017). In line with a previous endeavor, more tailored object-based workflows using extraction algorithms delineate about 50% of parcel boundaries successfully (Luo, Bennett, Koeva, & Lemmen, 2017). Investigating technically transferable workflows is a continuing concern within UAV-based cadastral mapping. For instance, both the *gPb* contour detection method and the ENVI feature extraction (FX) module has proven accurate results of visible object delineation that coincide with cadastral boundaries at completeness and correctness of up to 80% (Crommelinck et al., 2017; Fetai et al., 2019). To extract visible cadastral boundaries within Object-Based Image Analysis (OBIA) environment from High Resolution Satellite Imagery (HRSI), the (semi-)automatic feature extraction methods have been employed and tested in rural areas: mean-shift segmentation with the buffer overlay method (Wassie et al., 2018), and both multi-resolution segmentation (MRS) and estimation of scale parameter (ESP) (only able to automatically extract 47.4%) (Nyandwi et al., 2019).

In light of state-of-the-art methods in land administration, a deep-learning is becoming highly prominent for the detection of cadastral boundaries (Crommelinck et al., 2019; Xia et al., 2019). Recent evidence suggests that deep fully convolutional networks (FCNs) ensures the high accuracy rather than *gPb* and MRS – with results of 0.79 in precision, 0.37 in recall and 0.50 in F-score (Xia et al., 2019). For optimizing image segmentation, one study by (Crommelinck et al., 2019) not only introduced the interactive boundary delineation workflow, but also examined the better suitability of the deep learning in cadastral mapping with convolutional neural networks (CNNs) by comparing

random forest (RF) in machine learning: RF-derived boundary likelihoods (accuracy: 41%, precision: 49%), CNN-derived boundary likelihoods (accuracy: 52%, precision: 76%).

Technologies			Techniques	Sources
EO	AI			
	CV	DL		
Aerial imagery (Orthophoto)	No	No	Cadastral morphology investigation: visual interpretation from the overlay of the cadastral map over orthophotos	(Luo, Bennett, Koeva, Lemmen, et al., 2017)
Airborne Laser Scanning (ALS)	✓		Semi-automatic boundary extraction: Alpha shape (α -shapes), Canny, and Skeleton algorithm	(Luo, Bennett, Koeva, & Lemmen, 2017)
Unmanned Aerial Vehicles (UAVs)	✓		Automatic feature extraction: Globalized Probability of Boundary (<i>gPb</i>) contour detections	(Crommelinck et al., 2017)
High Resolution Satellite Imagery (HRSI)	✓		Semi-automatic boundary feature extraction: mean-shift segmentation plug-in QGIS, the buffer overlay methods	(Wassie et al., 2018)
Unmanned Aerial Vehicles (UAVs)	✓		Automatic boundary extraction: ENVI feature extraction (FX) module	(Fetai et al., 2019)
High Resolution Satellite Imagery (HRSI)	✓		Automatic boundary extraction: Multi-Resolution Segmentation (MRS), estimation of scale parameter (ESP)	(Nyandwi et al., 2019)
Unmanned Aerial Vehicles (UAVs)		✓	Automatic cadastral boundary detection: deep Fully Convolutional Networks (FCNs)	(Xia et al., 2019)
Aerial imagery and UAVs		✓	Automatic boundary classification: Random Forest (RF), Convolutional Neural Networks (CNN)	(Crommelinck et al., 2019)

Table 6 Combining Earth Observation (EO) data and Artificial Intelligence (AI) delves deeper into the future of land administration and the advanced techniques substitute to a certain extent the feature and boundary extraction for cadastral mapping. However, a number of critical questions remain about the interpretation of semantic land tenure relations using both EO and AI

Several attempts make to extract, classify and quantify cadastral boundaries using EO data in association with AI technologies (see Table 6). Along with these varying workflows and its image segmentation techniques that employed, however, there is increasing concern over further investigating deep-learning driven image analysis in land administration including image fusion, image registration, scene classification and retrieval and object detection. For remote-sensing image interpretation, the most applicable deep-learning models in remote sensing are: supervised CNN, recurrent neural network

(RNN), unsupervised autoencoders (AE), deep belief networks (DBN), and generative adversarial networks (GAN) (Ma et al., 2019). Although research on effective use of spatial contextual information in remote sensing for land administration is still in infancy, it can substitute the interpreter to a certain extent (not completely) by delving deeply into AI technologies with computer-vision and deep-learning algorithms.

4.3 Methodological Considerations

4.3.1 A Difficult-to-Access Region: North Korea in the Contexts of Fragile and Conflict-Affected Areas

There is increasing concern that remotely obtained data using disruptive technologies in fragile and conflict-affected areas (See Figure 11), where has been named hard-to-reach areas, is more worthwhile in optimal decision-making rather than a limited groundtruthing provided by direct observation (For example, Gbanie, Griffin, & Thornton, 2018; Levin, Ali, & Crandall, 2018; Schoepfer et al., 2017). According to (Bank), some countries such as Somalia, North Korea, and some Caribbean and Pacific island economies do not consistently render an account of internal data owing to conflict, lack of data capacity, or other reasons including quality of sources. An additional encounter with data scarcity and reliability is associated with national security issues in any contexts of fragile and conflict-affected regions worldwide.

Gathering and establishing reliable information for policy-making in pursuing Korean (re-)unification is more significant than ever during a peace-building process. In this process, re-shaping land governance are a fundamental question focusing on land tenure security, transferability, legitimacy and identity in (re-)unification setting (C. Lee & de Vries, 2018; C. Lee, de Vries, & Chigbu, 2019). Despite the passive attitude of the North Korean government to disclose information, it is possible to obtain data in a direct or indirect manner, such as (Gyeon & Lee, 2006): official government reports (e.g., Korean Central News Agency: KCNA and Rodong Sinmun); materials from international organizations dealing with humanitarian aid (e.g., FAO, UNDP, UNFPA, WFP, WHO, UNICEF (For the resources, Nations) etc.); information from external agencies or observers in cooperation with local authorities or residents (e.g., Hanns Seidel Foundation for EU-funded project on sustainable forestry in North Korea etc.); data acquired through the joint projects (e.g., the North Korean Ministry of Land and Environment Protection: MoLEP, Swiss Agency of Development and Cooperation: SDC, World Agroforestry Centre's East and Central Asia Office for the Sloping Land Management Program (See further details for the project, He & Xu, 2017) etc.).

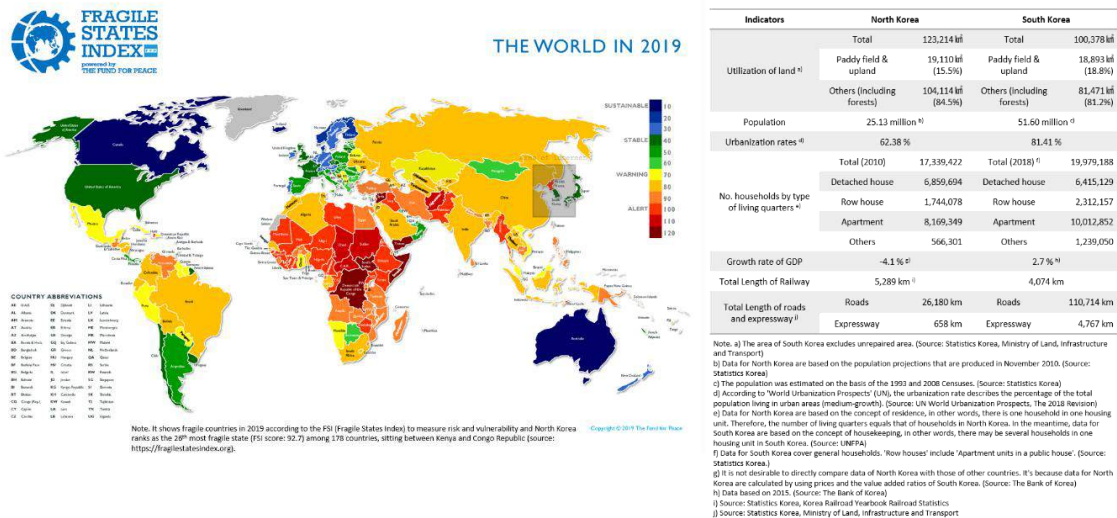


Figure 11 Contextualization of Area of Interest (left: Fragile States Index 2019 (<https://fragilestatesindex.org>), right: background information of South and North Korea based on Major Statistics Indicators of North Korea 2019 (<https://kosis.kr/bukhan/index/index.do>) (devised by author)

However, there are still great difficulties in collecting land tenure-related information in North Korea since the government rarely discloses or distributes any policy-related documents, data and statistics. The scope of current research on mapping land tenure relations has been very limited such as restoring historical cadastral maps (N. Kim, Lee, Lee, & Seo, 2014; Ko & Yun, 2016; H. Lee, Lee, Kim, & Seo, 2012) that include both geographical and textual land information. However, most research is still highly dependent on secondary data sources. Many studies using EO data for North Korea have been proposed for monitoring land use and land cover (LULC) over the past several decades (for example, Ernst & Jurowetzki, 2016; J. Lim & Lee, 2017, 2018; Um & Um, 2017; Yu, Lim, & Lee, 2018). Furthermore, a number of government institutes and think-tanks have already established different types of thematic maps in North Korea area using EO data (e.g. agricultural maps; deforestation maps; land cover maps etc.). More internationally, a platform called 38 NORTH (<https://www.38north.org>), provides informed analysis of events in and around North Korea using HRSI, as well as develops the digital atlas that was built in the Google Earth platform. Nevertheless, researchers and policy-makers still have faced with difficulties in incorporating land tenure-related data with EO data due to: (1) levels of accessibility: the limited access to North Korean data; (2) methodological levels: complexity of integrating land tenure attributes with EO data; (3) analytical levels: its lower reliability and validity of acquired information.

4.3.2 Existing Rules for Defining Land Tenure Relations and LULC Classifications

This section provides an overview of the existing rules for land tenure relations in South and North Korea that can identify the data gap between them. The classification methods of land tenure relations are based on diverse land trajectories: by land ownership, land (use) categories, 3Rs, land characteristics and urban planning facilities (See Table 7).

In South Korea (SK), land is divided into private land, government-owned land including state, province and county land, land owned by corporation or judicial person and land owned by non-judicial person, according to the land ownership trajectories. Contrastingly, the Constitution and the Land Law in North Korea (NK) does not tolerate private transactions with land. The state, collective farms, institutions, enterprises and organizations only govern land and local residents have land use rights (LURs). According to the Constitution (Article 21; 22) and the Civil Law (Article 45; 53) in NK, there is no restrictions on the subject of state ownership and only the state can own land. The cooperative entity refers to the form of collective ownership in which cooperatives assume the ultimate authorities for the land that are restricted by the state.

According to the Act on the Establishment and Management of Spatial data in SK (Article 2), a land category means a type of land that is classified under its primary use, and registered in the cadastral record. Land is currently classified into 28 categories to represent the nature, purpose and status of the land. Meanwhile, in NK the Land Law (Article 7) distinguishes six categories of land use classes: Agricultural-purpose land; settlement land; forestry land; industry land; waterstock land; and special-purpose land. However, it is not yet clear whether these land use categories correspond to the zoning system or land category system in SK (H.-T. Lim, Yang, Lee, Shin, & Ahn, 2015). Based upon the Civil Law and LADM (focusing on 3Rs), the right type in SK includes co-ownership, servitude, lease, ownership, partitioned ownership, superficies, sectional superficies, tenancy, usufruct, and fishing. The responsibility types include keeping a snow free pavement and cleaning a ditch, and the restriction type includes servitude and servitude partly (B.-M. Lee, Kim, Kwak, Lee, & Choi, 2015). For NK, we assume that there is no land use regulation through the restriction of private rights (3Rs), since NK does not recognize private land ownership.

A land characteristics survey investigates land-related data from physical, spatial and socio-economic conditions in SK (J.-H. Choi, Kim, & Shim, 2015). The 45 types of land use indicators are basic data for the land classification aforementioned. Moreover, land infrastructure (urban planning facilities) refers to facilities determined by urban management plan among infrastructures. The legal grounds is the National Land Planning and Utilization Act (Article 2) (Ministry of Land, 2012). In NK, land use

classifications are different. It follows the land characteristics in the same way as the six types of land prescribed in the Land Law. The diversity of land use appears to be very simple when compared to that in SK, although the Urban Management Law in NK does not explicitly stipulate land infrastructure, it identifies buildings and facilities, which need to be managed. These include residential and factory buildings, water and sewage and heating operation, urban roads and river arrangements, landscaping and urban beautification. Roughly, one can distinct 29 types of land infrastructure elements in NK.

Earth observation (EO) is one of the most essential methods for monitoring the earth's surface and its dynamics at regional to global scales (Yang et al., 2017). The term land use defines how a certain portion of the surface is being utilized. In other words, a particular land use label identifies the purpose for which humans exploit the land cover (Jensen & Cowen, 1999; Ramankutty et al., 2006). The land cover denotes to the biophysical appearance on the land and determined by the elements of the Earth's (sub) surface. For example, a state park may be used for recreation but have a deciduous forest cover (Jensen & Cowen, 1999; Ramankutty et al., 2006). In some countries, a formal / government LULC classification system exists which can easily describe the actual condition and changes of spatial structures of the land and its attached attributes: the U.S. National Land Cover Database (NLCD, USA, Wickham, Stehman, & Homer, 2018), the national Dynamic Land Cover Dataset (DLCD, Australia, Lymburner et al., 2011), the European CORINE land cover (CLC, EU, Büttner, 2014), the Land Cover Map (LCM, Korea), and the National Land Use/Cover Database of China (NLUD-C, China, Zhang et al., 2014)). Although these datasets have been developed with different mapping methodologies and criteria (e.g., variations in the classes and thresholds applied, time of data collection, sensor types, classification techniques, use of in situ data etc.) (Zhang et al., 2014), one can utilize it as basic spatial data to support the design of scientific and efficient policies.

Land Tenure and EO Data

Categories	Existing rules for identifying land tenure relations in SK	Existing rules for identifying land tenure relations in NK	Legal grounds
3Rs (rights, responsibility & restrictions)	Private land; state land; province land; county land; land owned by corporation (judicial person); land owned by a clan; land owned by a religious group; land owned by other groups; others (9 types) Common ownership; lease; ownership; partitioned ownership; tenancy; superficies; partitioned superficies; usufruct; easement; fishing; keeping a snow-free pavement; cleaning a ditch; servitude; servitude partly (14 types)	State land; collective farm land (2 types) (cf. Since North Korea does not recognize private ownership; there is no land use regulation through the restriction of private rights. Although all land belongs to the State, both the State and the individual or collective can restrict the use by restricting the access. Nature reserves, military sites, public heritage are typically locations where the State wants to restrict access, use and control through such restrictions.)	The Constitution (NK) The Civil Law (NK) The Civil Act (SK) LADM (SK);
Land (use) categories	Building site; dry paddy-field; paddy-field; orchard; forestry; pasture site; mineral spring site; saltern; factory site; school site; parking lot; gas station site; warehouse site; road; railway site; water supply site; river; ditch; fish-farm; park; historic site; gymnasium site; recreation area; religious site; graveyard; miscellaneous land (28 types)	Agricultural-purpose land (arable land); settlement land (construction land and its attached land in local labour areas as well as public land); forestry land (land used in the hills and fields); industry land (sites of industrial facilities such as mine, factories, and the land pertaining to it); waterstock land (land for coast, territorial waters, river and streams, lake, reservoir and irrigation ditch); special-purpose land (cultural heritage sites, historical landmarks, sanctuary and military) (6 types)	The Act on the Establishment, Management, etc. of Spatial data (SK); The Land Law (NK)
Land (use) characteristics	detached-house lot, row-house lot, multiplex-house lot, apartment lot, residential vacant lot, other residential lots; commercial lot, office lot, commercial/office lot, other commercial/office lots; mixed-use lot, mixed-use vacant lot, other mixed-used lots; industrial lot, industrial vacant lot, other industrial lots; dry paddy-field, orchard, other dry paddy-fields; paddy-field, other paddy-fields; afforestation, natural forest, forest land, pasture, other forestry; mineral spring site, mining site, saltern site, recreation area, cemetery park, golf course, racecourse, passenger transport terminal, condominium, other special-purpose lands; roads etc., rivers etc., parks etc., playgrounds etc., parking lot etc., high-risk establishments, obnoxious facilities and Others (45 types)	Agricultural-purpose land (arable land); settlement land (construction land and its attached land in local labour areas as well as public land); forestry land (land used in the hills and fields); industry land (sites of industrial facilities such as mine, factories, and the land pertaining to it); waterstock land (land for coast, territorial waters, river and streams, lake, reservoir and irrigation ditch); special-purpose land (cultural heritage sites, historical landmarks, sanctuary and military) (6 types)	The Act on the Public Announcement of Values and Appraisal of Real Estate (SK); The Land Law (NK)
Land (use) infrastructure	Road; park; railway; (public) open space; waste treatment facilities and water-pollution preventive facilities; heat/gas/oil supplying and storing installations; electric supplying installations; slaughterhouse; graveyards; markets and distribution facilities; recreation area; parking lot; car stations; square; playground and sport facilities; water supplying instalments; public buildings (e.g. school and library); communication facilities; cultural, research, social welfare, public vocational training, youth training facilities, others (21 types)	Dwelling house; public buildings; production buildings; water supplying instalments; heat/gas/oil supplying facilities; road; street green; footpath; streetlight; bridge; tunnel; underground passage; road safety facilities; road markings; bus/tram station; car washing facilities; river (stream); park; recreation area; open space; urban forest; protection forest; zoo/botanical gardens; greenhouse; tree nursery; flower garden; cultural facilities; sanitation facilities; cremation facilities (assumed 29 types)	The National Land Planning And Utilization Act (SK); The Urban Management Law (NK)

Table 7 Existing rules for defining land tenure relations in the context of Korean (re-)unification (functional classifications)

4.3.3 Adopting a New Methodology: Mixed Methods Design and Information Fusion Approaches

A number of image segmentation techniques and workflows have been developed to detect visible land tenure relations with EO data. Each has its advantages (e.g., automation, coverage, up-to-date, cost-effective etc.) and drawbacks (e.g., technological bias, methodological rationale, lacks of social sensing etc.). To especially overcome these constraints, a further advancement with more focus on the idea of “triangulation” is therefore considered which is particularly associated with methods of investigation and sources of data (Bryman, 2016). A triangulation logic is chosen because land tenure relations are unknown in a given context and monoscopic EO data interpretation without valid inferences would misguide to identify transferrable and applicable proxies. Data integration is at the heart of discerning epistemological assumptions from multiple sources to attain narrative illustration, convergent validation and analytic density (Fielding, 2012). In this regard, this study makes an original contribution to when land tenure and EO data integration occurs, what types of EO data are integrated and how we integrate them.

In aiming to derive informative land tenure relations from EO data, one has to rely on both the characteristics of tenure itself and a number of proxies derived from EO data and spatio-temporal combinations of EO that may capture a particular land tenure characteristic. Our research started by adopting the subjects (e.g., who is the right holder?), rights (e.g., what is included in a certain right?), and objects (what physical extension of a right has?) model of land administration (Larsson, 1997). In parallel with ownership, rights may embrace complex set of rules related to the access, use, develop or transfer (Payne, 2004). In other words, a household can be associated with a particular land parcel where people can live, own, rent or have the right to use (Fox, Rindfuss, Walsh, & Mishra, 2003). Thus, the analytical premise has been questioned on the basis of underlying assumptions: (1) Is it possible to distinguish collective farmland from State land?; (2) Can one see land use rights (LURs)?; (3) Is there a use right that can be linked to an individual or group?; (4) Is there land transfer rights (LTRs)?; (5) Is there a land access rights (LARs) and restrictions?

However, methodological difficulties, using EO data in accurately conjoining a household and physical extension of a right over land parcels and measuring the quality of linking information, have existed. There have been only few empirical investigations into decision-making what proxies shall be operationalized based on both theoretical and practical grounds. In terms of using terms ‘proxy’ rather than similar terminologies such as ‘interpretation key’, ‘index’, ‘indicator’ or ‘variable’, we follow a definition labelled by

(Ghaffarian, Kerle, & Filatova, 2018) that refers to “use of observable physical features or directly measurable variables to understand and extract what actually exists on the ground, but what is not directly observable or measurable from remote sensing data.”

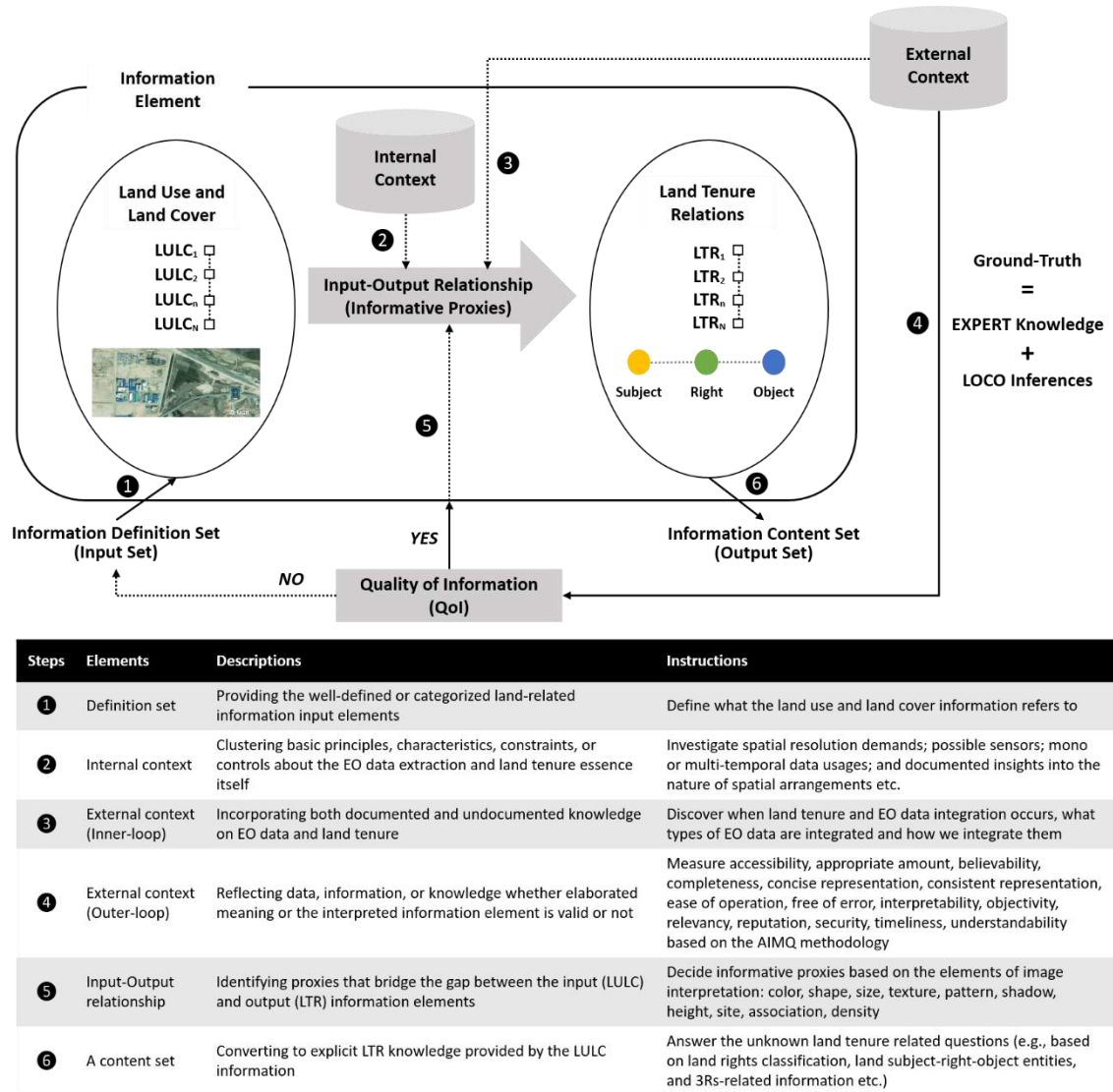


Figure 12 The general structure of an Information element and its processes for the interpretation of the semantic land tenure relations (devised by authors)

Our approach comes from multiple sources, namely EO data, especially focusing on LULC information, prior (expert) and contextual knowledge on land tenure relations acquired through previous experiences and perceptions. In view of all that has been mentioned so far, one may suppose that ‘information fusion’ approach must be considered in order to extract and conciliate significant elements for the semantic (re-)interpretation and, subsequently, for decision-making (Ghazouani, Farah, & Solaiman, 2018). Generally accepted disciplines for the notion of information fusion include: psychology, human factors, knowledge representation, artificial intelligence, mathematical logic, and signal

processing (Bosse, Roy, & Wark, 2007). It has been noted that transforming data into knowledge is most striking feature of information fusion and must be converted into a certain language or presented by other means such as visualization techniques (Bosse et al., 2007). Moreover, this method emphasizes that a wide range of structured/unstructured or primary/secondary data sources address semantic relationships and co-occurrence between them (Altaweel, Alessa, Kliskey, & Bone, 2010).

According to Bossé & Solaiman (2016), an information element is regarded as “an entity composed of a definition set and a content set linked by a functional relationship called informative relation, associated with internal and external contexts.” This highlights that one given single data set do not qualify or quantify to make it informative. When answering the research questions or testing relationship between proposed proxies and ground-truth, it is important to quantify recurring spatial attributes and uniformity or distinctiveness in qualitative data allowing rigorous analysis and to determine rational and optimal proxies. It is therefore considered that triangulation logic and information fusion approach would usefully supplement and extend the methodological and epistemological assumptions of semantic land tenure relations through EO data interpretation. Having defined what EO data proxies and information element meant, different types of information element, thus, should be included that enable the EO data proxies to identify land tenure relations logically. Figure 12 depicts the workflow and the main components of the information acquisition and interpretation process of the semantic land tenure relations.

4.4 Deriving Workable EO Data Proxies for Interpreting Land Tenure Relations

This section explores a number of workable proxies based on the land related categories defined in Table 7, whereby the proxies are derived from the existing EO data. We, then, discuss hereunder how one can evaluate the five key land tenure-related questions defined in Section 3.3. The exact spatial information and point of interest (POI) in this section were pre-identified from the openly accessible platform.

4.4.1 Is It Possible to Distinguish Collective Farmland from State Land?

A characteristic and distinctive feature of collective land (as compared to State land) is both the type and number of buildings/dwellings adjacent to the land and the spatial distribution of buildings/dwellings. Another characteristic is the state and density of infrastructure. Clusters of buildings suggest the presence of a collective only if: buildings look similar and simultaneous changes in structures occur. If spatial patterns of

buildings and farm sizes and shapes re-occur in different places, it is probably part of a joint collective spatial planning strategy, so it is more likely collective land than State land. (See figure 13(b) and (c)).

It has commonly been stated that North Korea (NK) collective farmland plays a pivotal role in major food production (approximately 85~90% of total production), such as rice, corn, beans, and potatoes (Y.-H. Kim, 2010). In this regard, most collective farmlands are utilized as a (dry) paddy-field, so it can therefore be assumed that the collective farmland can be confirmed through the presence of (dry) paddy-fields. An area linked to or surrounded by a substantial portion of (dry) paddy-fields can be considered as a collective farmland, which is following the association element of the image interpretation (See figure 13(a)). According to Kosztra, Büttner, Hazeu, & Arnold (2017), rice fields include periodically flooded flat surfaces with the rice plant, open water surfaces on fields, stubble or rice, irrigation channels between land parcels and embankments between rice fields. These can be interpreted with the rough (or coarse) image texture caused by variation in tonal values of an image that helps to identify single objects (See figure 13(d)).



Figure 13 Spatial characteristics of cooperative farmlands extracted from high-resolution EO data. (a) stands for the Unha collective farmlands surrounded by (dry) paddy-fields (georeferenced: Onchon county, South Pyeongan). (b) represents planned spatial arrangements and a centralized cluster of buildings and dwellings. (c) highlights buildings and houses utilize homogeneous materials and retains its similar physical shapes and simple roof structures. (d) includes textures of irrigation channels and features of rice (dry) paddy-fields. (Image sources: Google Earth, date of access: 9 October 2019)

The collective farmlands include ranging between 80 and 300 households and operates on a large-scale from approximately 1,300,000 to 5,000,000 m² (Y.-H. Kim, 2010). Thus, the relative size and high density or compactness of the settlement helps to distinguish when compared with state (farm) lands. Collective farmlands accompany a

farming equipment, materials, and production facilities from the State and benefit from all the new building construction including rural dwellings (See figure 13(c)). The characteristics of rural dwellings in collective farmlands are homogenous building colors in grey scales, a signature line of the tiled roof, and densely built-up block structure with single-story detached houses. This indicates a need to understand physically detectable proxies that the farming-related objects will be more captured on the ground (in spring/summer) or stored in warehouses (autumn/winter) rather than state farmlands. In addition, since agricultural production are mainly concentrated in the springtime, changes of agricultural activities and its densification, which implies collective farmlands, may be compared using time-series analysis. However, these proxies tend to be unreliable unless used with other complementary sets of proxies. It, thus, requires a rigorous image interpretation of EO data in combination with other interpretation elements as well as secondary data.



Figure 14 Spatial characteristics of state farmlands extracted from high-resolution EO data. (a) describes whole region of the No. 5 state farmland in Taehongdan county in Ryanggang. (b) shows key spatial arrangements of state farmlands embracing: agriculture-based infrastructures (e.g., fertilizer and processing factories and colleges and research institutes etc.); monumental buildings (e.g., revolutionary museums etc.); welfare facilities (e.g., house of culture, markets and shop, and kindergarten etc.). (c) is a site of microbial compound fertilizer factory (upper) and agricultural testbed or greenhouses (middle); (d) a site for potato processing factory. (Image sources: Google Earth, date of access: 9 October 2019)

On the other hand, state-owned (farm) land in NK refers to nationalized (farm)land in the process of land reforms in the past, consisting of agricultural testbed, farms for the seed-production and livestock (Y.-H. Kim, 2010). As far as this assumption is concerned, the combination of the geometric properties of an object such as shape and (building and roof) size, orientation, density, height as well as (building and roof) colors/tones that identifies agriculture-based patches or infrastructures can be considered as workable

proxies. These include small dot-shaped (for orchards) and smooth (for pastures) textures, out-buildings (sheds), dispersion value (low building density), irregularly shaped object boundaries, complex, elongated or irregular building shapes, and distinctive roof colors (e.g., blue, green, yellow and red as well as brightness etc.) and the association with agriculture-based infrastructures, monumental buildings, and welfare facilities (See figure 14). However, the association elements should be synthesized with documented or local knowledge as the exact points of information has not yet clarified.

4.4.2 Can One See Land Use Rights (LURs)?

A typical feature of LURs is that it usually relates to consistent patterns in space and there exists regularity in time such as seasons. The right itself must be inducted or assumed if such patterns and consistencies exist. Reversely, finding such consistencies is an indication of the right. This implies that from EO data over a number of years one can see similarities each similar season. If all indicate the same type of land use, at the same points in time over a number of years, then one may assume consistent land use, and LURs. If conversely there is a large variation in this, one has to assume that the LURs are not consistent, or do not belong to a single person or group. The variations in land use itself suggests an allocation of what the land may be used for over a longer period of time, yet in a specific time of the year. This suggest the presence of a consistent LUR of single land user. Any land use, which is not observed, suggests a restriction in land use, or a specific allocation of land use.

The LULC in most areas between 1990 and 2000 are remains unchanged that assume existing consistent LURs due to strict land use restrictions for nature reserves, military sites, and public heritages or unplanned and poor land management (see Figure 15). However, (a) reveals more intensely developed lands (red color) are shown in POI and we note that the development is mostly associated with constructing new dwellings (with LURs) in follow land. Moreover, (b) highlights the land for agricultural uses (yellow color) have significantly increased in POI. This is due to the increase of farmlands to cultivate, especially with collective farmlands, and hence the State provide new houses for the farmer households that grants LURs. In addition, (c) shows more intense LULC changes in an urban area with the development of water bodies (blue color) and these provide additional evidence with respect to LURs. It demands sufficient quantity and quality of water resources for increasing urban households, and it can be inferred that developing water bodies is correlated with LURs since the increased number of urban households represents an increase in granting LURs. Lastly, (d) underlines LULC changes have more occurred in a border region than inland areas. This is because we assume that border in

NK started allowing LURs to be sold, transferred, and leased for foreign corporations in Special Economic Zones (SEZs) by modifying socialist land tenure system for economic recovery.

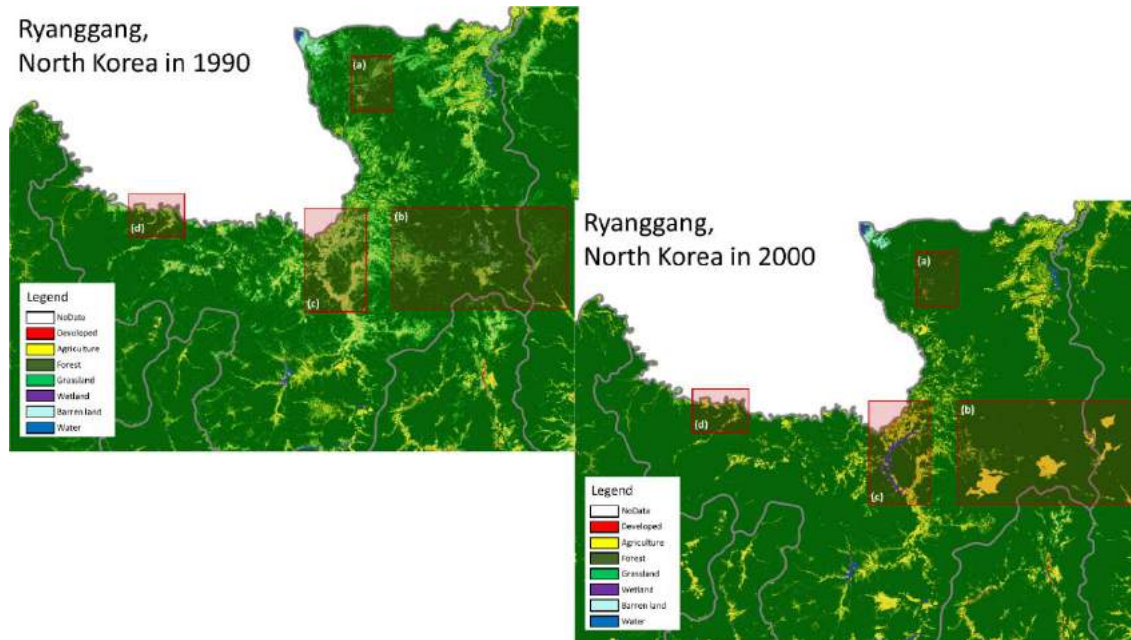


Figure 15 The example of land use and cover changes in Ryanggang between 1990 (upper) and 2000 (lower) with currently available data set produced by Ministry of Environment (MoE) using Landsat TM imagery (1991-1999) and Landsat 7 ETM+ imagery (2008-2010). (Image sources: (W. Choi et al., 2017) and revised by authors)

All the means of production and socio-cultural facilities, including land, are jointly used in NK. Meanwhile, housing and the allotment with average size from 60 to 130 m² are owned by the State (Y.-H. Kim, Kwon, Lim, & Choi, 2013), but LURs are granted to individuals, and the product is allowed to belong to them. We, therefore, assume that the presence of all types of houses and its accompanying allotments can be chosen to confirm the existence of LURs. To identify the (semi-) detached houses, it includes following proxies: low building density, 1 or 2 storied houses, uniformly shaped settlement, proximity to roads, low to intermediate imperviousness. In terms of condominium-related proxies, we consider large rectangular simple form buildings, regular alignment, more than 3 stories, and low to intermediate imperviousness and shadow silhouettes (see figure 16). When it comes to the workable proxies for allotments, the following “if” statement is considered: if the land (or site) has detached small-sized buildings; if it is low built-up land, if it is low imperviousness, if it has plants or vegetation; if it is used as buffer between houses (see figure 16(b), 17, and 18(b)).

Before 1998, a new housing reverted to the State, and only the right to use was given to individual households by permission. However, after the amendment of the Constitution, the building was excluded from collective ownership, enabling the possession of a

new housing. For the sake of legal certainty, the form of housing is divided into the State-owned, cooperative-owned and individual-owned, but its ownership is very limited regarding use and transaction. According to (C. S. Kim, 2009), three types of housing have investigated that a semidetached house (or row house) has the highest proportion at 43.9%, a detached house (or single-family house) has been estimated as 33.8%, and apartments (or condominium) account for nearly one-fifth (21.4%) of them (S.-H. Choi, Choi, Lee, & Hong, 2015).



Figure 16 Different types of housing and its morphological features. (a) condominium or residential block buildings; (b) detached houses; (c) (semi-)detached houses; (d) showing different forms of housing shapes (e.g., linear, curved, rectangular patterns and different colors of roofs etc.) (Image sources: Google Earth, date of access: 16 October 2019)

More specifically, in the rural areas of North Korea, the ‘harmonica houses’ have often observed where two or three households, and even five to six or more households living together in a detached house. A variety of identifiable proxies such as a small roof with slate materials, chimneys on rooftops (small dot-shaped objects or a light shadow Silhouette) and a fence (with line-shaped objects) installed to distinguish garden plots has been detected on the images. The evidence reviewed here seems to suggest proxies that probing the physical attributes of varying forms of dwellings through EO data acquisition have significant correlations with the granting LURs. Moreover, the growing new construction/extension of residential building and expansion of construction activities in certain regions over time may confirm the significant increases in authorities’ awareness on LURs. As shown in Figure 16, (a) shows varying geometrical attributes of apartments along the Ryomyong Street in Pyongyang in 2019. While (b) provides a typical example of detached houses that displays the roofing, chimneys and a fence for defining

spatial boundaries between neighborhoods. Furthermore, (c) presents a normative sample of semidetached houses and the building shadows that determine building heights. In addition, (d) demonstrates different forms of residential building shapes such as linear, curved, rectangular fit and different colors of roofing.

4.4.3 Is There a Use Right that Can be Linked to an Individual or Group?

Another possible explanation for the linkage of individual or group-based LURs might be which land use is homogenous between adjacent land parcels and buildings. A characteristic feature of an individual right as compared to a group right is that there is a large variety in land use between neighboring parcels. In a group land tenure, people tend to converge to similar crops or building and housing types. The observed land use can be connected to an observed set of combined proxies on the land rights: Similarity or dissimilarity of neighboring land use in space and over time; changes in the adjacent buildings or houses; changes in the road infrastructure; number of buildings in a certain vicinity.

Cooperative farms in NK are based on collective ownership. Along with economic activities, cooperative farms function as a rural community that manages collective socio-cultural activities. However, property rights are exercised by the State, and households only have exclusive LURs. Therefore, all the means of production and socio-cultural facilities, including land, are entitled to group-based LURs. The multiple objects of socio-cultural facilities incorporate 'cultural houses' (rural houses with welfare facilities), various community amenities, and nurseries and kindergartens. These possible proxies could define multiple LURs of group over the same piece of land with specific characteristics such as building geometry, arrangement pattern, roofing color, and site characteristics with EO data.

Figure 17 presents an amalgamation of diverse community amenities: government offices (e.g., a cooperative farm management committee and a party committee), educational institutions (e.g., a middle school and a kindergarten), medical facilities (e.g., hospital), and socio-cultural facilities (e.g., station, a park and a skate park and restaurant and hotel, revolutionary museum, monuments) (See figure 17(a) and (b)). These regular arrangement patterns of building objects are a common feature that appears in collective farms, thus representing group-based LURs. As (c) indicated, we found that significant land use changes from the cultivated farmlands to residential areas (confirmed by the presence of multiple building objects with similar looking, a high density of settlement, simple rectangular forms and same roof colors in red scales) occurred. The objects with similar appearance are perceived as a group figure or shape and thus the

similarity/dissimilarity of neighboring land use in space and over time with other contextual knowledge (such as relationship, adjacency, inclusion, composition, and neighborhood) can be regarded as workable proxies for defining group LURs.



Figure 17 Morphology and urban structures of Socialist lifestyle are discovered in the cooperative farmland in 2002 (a) and 2018 (b). (c) Changes in land use from farmland to residential areas; (d) changes in land use with more community-oriented development; (e) showing newly-built agricultural facilities; (f) changes of residential development at higher densities (Image sources: Google Earth, date of access: 17 October 2019)

Indeed, the site, situation and structure of objects in the urban/rural landscape on the image helps identify their significance and (d) depicts changes of former settlements as a newly built community asset (for a skate park) in line with improved access to roads (types: paved road and wider widths) surrounded areas. Therefore, the (re-)construction/extension of community buildings or infrastructure by the existing building removal could become proxies for LURs linked to group tenure. In the same vein, (e) indicates that agriculture infrastructure is not newly located where it was land in fallow or barren land, but also adjacent to the residential dwellings. With acquired EO data, (viny) greenhouses as a particular form of non-irrigated arable land has been identified with some elements of image interpretation: building materials (plastic or glass), roof colors (white or grey), brightness (light), and texture (rough). Hence, the changes of association elements with the close proximity or adjacency to the agriculture-related objects or neighborhood and specific characteristics of the objects might quantify group-based LURs. Then, (f) interprets the increase of the number of houses (high building density) in a certain vicinity over time. While this phenomenon can be seen as an increase in individuals' LUR, it can also be regarded as an increase in the group-based LUR, as the NK's

housing supply is mainly carried out on cooperative farms to improve agricultural productivity. Therefore, there have to be more proxies to make this argument complete.

The existence of undivided shared areas of the common property or public infrastructures between the roads or buildings can be regarded as a proxy that can be related to the collective LURs. Under the socialist urban planning system in NK, the arrangement standards for housing and neighboring residential structures are based on the sub-district plan that housing and production facilities should be located adjacent and in the vicinity of the planned area. Within the sub-district, diverse socio-cultural facilities are located and observed relatively low building density in scope. This is a proxy that emphasizes straightforward approach and characterizes socialist lifestyle based on community unit rather than individual (S.-H. Choi et al., 2015).

4.4.4 Are There Land Transfer Rights (LTRs)?

When selling, mortgaging, conveying the land to others, it exhibits a considerable variation in transfer of land. However, what is actually transferred is not the land or building, but rather a bundle of rights pertaining to it (Reenberg & Lund, 1998) and this could be interpreted as land transfer rights (LTRs). A characteristic feature of when land or houses are being bought or sold is that the LTRs are accompanied by changes in the objects, which are not occurring in the neighboring objects. One can think of constructing a new roof, painting the house, construction of fences, construction of new objects or infrastructural works on the land. Moreover, the changes in structure, type and shape of the object are occurring in a relatively short time span. We would then assume that their might have been a LTR related to these objects.

According to (Hettig, Lay, & Sipangule, 2016), there is a tendency for households or farmers, those who suffered from tenure insecurity, to utilize tools of land conversion or reclamation as a way of building informal LTRs. In the same vein, in the mid-1990s, as a result of the massive food insecurity in the NK, unauthorized households reclaimed and cultivated vacant land as well as cleared the forests, and occupied so-called ‘small-land (sotoji)’. ‘Sotoji’ is located in the mountain slope and its transactions are being made publicly among the households. Three types of ‘sotoji’ are existed: garden plot (GP); side-job plot (SJP); and tiny patch of land (TPL) (S. H. Lim, 2008). In principle, the law prohibits the sale of land in NK. Among them in reality, GP, having a large share to produce their foods, is explicitly recognized by the Constitution, the Civil Law and the Land Law (article 13). GP was originally allowed to use on individual households within the collective farmlands and was common to situate at the front yard of houses or on an empty space between them. The size of GP is approximately 66 to 100 m², but, in fact, it covers

about 100 to 165 m². In addition, if the house is sparse and the vacant land is immense in size, it is reported that even larger-sized GP is allowed. Likewise, since mid-1990s, the GP was built in a vacant land attached to a detached house or a balcony of an apartment in urban areas.

SJP was developed from the early 1980s to cultivate the barren land, which has not cultivated by the farmers of collective farmlands. If the GP is individual farming units, the SJP is group units (cf. the scale is approximately 3000 to 6600 m²). Unlike the SJP, TPL is illegally cultivated private land. This originally refers to a small-scale farmland rather than linking the subject or illegality of cultivation. TPL is deemed an object as their own since households put considerable effort into cultivation. The authorities, however, investigate the TPL and impose land use fees to place it under the state control. In this process, land transaction has actually occurred and there are also certain cases where it is handed over to the neighboring landowner, or it is exchanged with other corresponding goods or cash. Although it is different from SK's land transaction that transfers ownership through such transaction processes, it can be assumed that land transaction of TPL would inevitably occur.



Figure 18 Spatial characteristics of the 'sotoji'. (a): between Onsong and Sambong, North Hamgyong; (b) the Sambong cooperative farm, Pheongwon; (c) Hyesan, Ryanggang (Image sources: Google Earth, date of access: 17 October 2019).

Figure 18 reveals that (a) describes the major feature of TPL located in the mountain slope with the evidence of forest farming. TPL may be located in a relatively lower elevation and land parcels where slopes have gentle or stable slopes. As the population grows in areas where arable land is scarce, people tend to take advantage of reclaiming land in fallow on the terraced hillsides that are easily accessible. Therefore, the proxies for TPL

include: lower elevation using a digital elevation model (DEM) and slopes have a gradient less than 15%. With HRSI, the small patches of vegetation cover between neighboring lands on the mountain can be considered as a proxy to detect and identify TPL. Meanwhile, (b) illustrates GP where individual households officially are allowed to cultivate and produce and SJP in their front yard or at the rear of a house. It also indicates SJP in the cooperative farmlands where group of farmers can cultivate the barren land. In this respect, the length or width of image features (small parcel size for GP and large parcel size for SJP), location-specific features (front/back yard or attached to each other), natural colors of features (GP and SJP are often depicted in green on the imagery). In addition, (c) is an exemplary attribute of TPL where individual households cultivate vacant lands along the streams, so adjacency to the streams or ditches and the small and regular/irregular patches of vegetation cover along the streams or ditches can be interpreted as transferrable and applicable proxies.

To sum, the authorities in NK drag ‘sotoji’ within the public land management sphere to restrict (illegal) land use. On the other hand, households generate more income out of the management area with the sense of land tenure of ‘mine’. Therefore, ‘sotoji’ can be important proxies that prove the existence of LTRs with some elements of image interpretation aforementioned.

4.4.5 Are There Land Access Rights (LARs) and Restrictions?

What is known about LARs is largely derived from a private land tenure system that give priority to the rights of individuals. The main segment of LARs frequently addressed are: an easement (servitude) and rights of way. A characteristic of LARs is that multiple objects are connected to single or multiple types of objects. An easement generally places an emphasis on allowing for separate usage of land which could refer to the right to use another household’s land for different purposes. There may be varying activities over the single parcel of land or an entire property over the land that represent LARs. For instance, one of the best known is installing public utilities into a certain land parcels (Stoter & van Oosterom, 2006, p. 24). Another major illustration is that reaching inaccessible properties or linking two separated objects through the road-related infrastructure.

Turning now to the LARs in a given context of this paper, it is important to bear in mind that we may accompany a possible bias in describing unknown land tenure relations since private land tenure is not recognized in NK and there is no land use regulation through the restriction of private rights. Although all land belongs to the State, we assume that both the State and collectives can restrict the use by restricting the access for

the public purpose. We, thus, for the purpose of analysis, assume that the State, collectives and the households in NK may acknowledge LARs.

If our assumptions are to be acceptable, then it enables us to provide a number of available proxies (see Figure 19). We also need to derive whether the object is under consideration is connected to any form of infrastructure or not as well as if other objects (such as silos) are connected to infrastructure. In this regard, identifying several utility networks offer an effective way of confirming the presence of LARs in NK. Moreover, when newly creating a parcel (called “division”) and two or more parcels of land from the existing one (called “subdivision”) for the commercial or residential purpose, these properties commonly generate different types of easements under certain physical characteristics of the objects. Therefore, the subdivision of land parcels or (in) consistent land use may implicate whether LARs are existed or not.

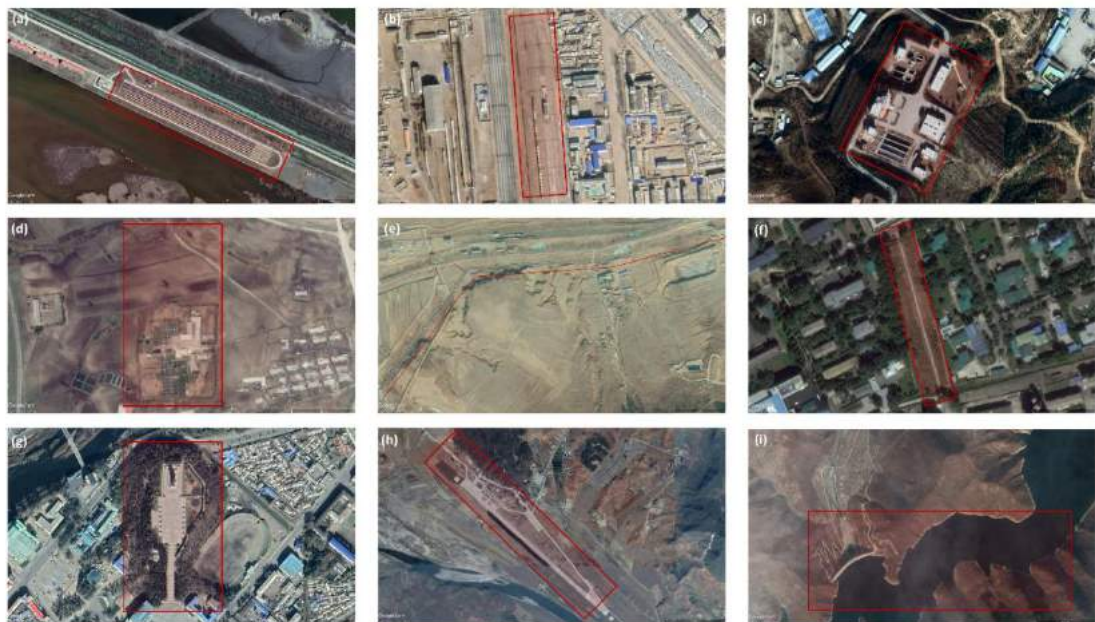


Figure 19 Multiple examples of urban structures on certain land parcels: (a) solar panels (in Kumsanpho solar power station), (b) railroads (in Rajin), (c) drinking water production facilities (in Kaesong), (d) a transmission tower (in Electric power transmission office in Sepho), (e) pipelines (in Seungri chemical complex refinery in Rason), (f) footpaths (in Pyeongyang), (g) public heritage (in Hyesan), (h) military site (in Pukchang), (i) reservoir (in Ryongrim) (Image sources: Google Earth, date of access: 17 October 2019).

As shown in Figure 19, we were able to detect and label what objects refer that especially linked to the public rights of way and servitude (focusing on restrictions on the use of land) rather than individual rights of way. These include: solar panels, railroads, drinking water production facilities, a transmission tower, pipelines, footpaths, military site, and reservoir. We noted that there are some site characteristics near public utility networks, nature reserves, and a public heritage site. However, defining which proxies are workable for LARs are highly context-dependent due to the lack of formalized and

proven rules as well as its application in different contexts. It also requires forming an ensemble with other types of proxies to describe socio-legal status of the objects. Among the elements of image interpretation, only site or situation elements are valid and reliable in detecting the public rights of way. We then came up with only few proxies by deriving similar site and situational features from nine images as follows: proximity to hazardous or isolated locations, poor accessibility (lack of access roads), elongated object shapes, and less green and open spaces.

4.5 Summary of Discussion

This section summarizes the findings to identify proxies to derive unknown land tenure relations over North Korea (see Table 8). The first set of questions aimed to address that whether the observed land is state or collective farmlands. There was no significant difference between two groups in both the general spatial arrangements in scope. However, we found that the location-specific features in line with physical and temporal characteristics helps to identify single objects on (dry) paddy fields. This is one of the most significant characteristics for detecting visually analogues arrangements of collective farmlands. On the other hand, what stands out in the state (farm) land is the combination of the geometric properties of objects characterizes a common feature of agriculture-based patches and infrastructures.

In order to assess the feasible proxies of LURs without having access to the ground, the different EO data sources have been utilized to not only detect LULC changes, but also ascertain a variety of dwellings and its morphological features. These EO data sets present a plausible interpretation with the association element that addresses the probable occurrence among different sets of entities as well as socio-legally documented local knowledge that leads to confirmation of LURs.

The cooperative farms under the collective ownership regime typically accompany a socialist morphology, with the unification of forms and construction. To distinguish whether individual or group-based LURs, proxies such as building geometry, arrangement pattern, and site characteristics could define multiple LURs of group over the same piece of land. The regular arrangement patterns of sites and building objects with other contextual knowledge is a common feature, thus representing group-based LURs that can be jointly used by the multiple groups of people.

Another question sought to determine whether there is LTRs or not. With respect to this subject, it was hypothesized that households reclaimed and cultivated vacant land as well as cleared the forests, and made transactions between households after illegal occupation. Based upon the normative concept of ‘small-land (Sotoji)’, the discernable

proxies that prove the existence of LTRs with following elements of image interpretation: the low elevation, slopes have gentle slopes less than 15%, small and regular/irregular patches of vegetation cover, the length or width, location, colors and adjacency to the specific objects.

The combination of multiple man-made structures over a single parcel of land or entire property over the land provides some support for the conceptual premise. Although all land belongs to the State, both the State and the collectives can restrict the use by restricting the access for the public purpose. Among the elements of image interpretation, only site or situation elements are valid and reliable in detecting the public rights of way. We then came up with only few proxies by deriving similar site and situational features from nine images as shown in Table 8.

While some progress has been made for cadastral mapping, very little was found on the question of how we bridge the semantic gap between land tenure and EO data. Thus, this account, in methodological terms, seeks to propose a new notion of remote-sensing based proxies for interpreting land tenure relations that could be transferable and applicable in land administration domain at a semantic level. With regard to research findings, some limitations need to be acknowledged. A first limitation is that since this study was only conducted from the step 1 to 3, validating was beyond the scope of this series of work (see figure 11). However, the preliminary investigations indicated that the subsequent steps for the validation (the step 4 to 6) will further move us closer to develop a full picture of identification of transferrable and applicable proxies for geospatially informed analysis. In other words, it is possible that these results are only valid when a holistic methodological approach takes place. This experiment also has not suggested any technological advancements yet and the proposed proxies require a rigorous AI-based (semi-)automated image interpretation of EO data with other complementary sets of proxies. One possible implication of this is that algorithmic approaches and methodologies concerning deep-learning networks will be able to mine land tenure relations from EO data and these are divided into: supervised learning approaches trained from scratch, pre-training and fine-tuning approaches, advanced learning techniques, and novel technologies developed by the remote-sensing community (Li, Huang, & Gong, 2019).

No.	Land tenure relations	Proposed proxies	Elements of EO data interpretation																			
		Harmonica houses (in rural areas): small roof with slate materials, chimneys on rooftops (small dot-shaped objects or a light shadow Silhouette) and fences (line-shaped objects)																				
		New construction or extension of residential building and expansion of construction activities																				
4.3	Group LURs	Amalgamation of diverse community amenities																				
		Conversion: presence of multiple building objects with similar patterns, high density of settlement, simple rectangular forms, and same roof colors																				
		Adjacent land uses: similarity or dissimilarity																				
		Construction/extension of community buildings or infrastructure by the existing building removal																				
		Accessibility: improved access to roads (paved road and wider widths)																				
		Greenhouses: new construction in a barren land and adjacency to dwellings (materials: plastic or glass, roof colors: white or grey, brightness: light, and texture: rough)																				
		Increase of the number of houses in a certain vicinity (high density)																				
		Existence of undivided shared areas of the common property or public infrastructure																				
4.4	LTRs	Presence of small land (sotoji): garden plot (GP), side-job plot (SJP), and Tiny patch of land (TPL)																				
		Garden plot (GP): small parcel size, in front/back yards or attached to each other, green color																				
		Side-job plot (SJP): large parcel size, in front/back yards or attached to each other, green color																				
		Tiny patch of land (TPL): lower elevation, gentle slope less than 15%, the small patches of vegetation cover between neighboring lands on the mountain (hillsides) or along the streams or ditches																				
4.5	LARs	Public utility networks, nature reserves, and heritage sites: in close proximity to hazardous or isolated locations, poor accessibility (lack of access roads; low to intermediate imperviousness), elongated object shapes, and less green and open spaces (less green colors and rough textures)																				
		Subdivision of land parcels																				

Table 8 Identifying proxies to derive unknown land tenure relations over North Korea in conjunction with EO data (devised by authors)

Note.	Color	Shape	Size	Texture	Pattern	Shadow	Height	Site	Association	Density
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4.6 Conclusion

Land tenure relations, which are relevant in the Korean (unification) context, include the difference between private, State and collective land, the type and location of land use rights, the spatial allocation of rights and restrictions, the ability and spatio-temporal changes of transferring land rights, and the spatial restrictions in access and use. So far, such land tenure relations could only be derived when combining topographic data with agricultural census data at the regional or national scale, and household surveys and a participatory mapping at the local scale. However, given documented insights into the nature of spatial arrangements and the similarities and patterns when observing in features of typical land use structures in North Korea, it was possible to derive proxies for particular types of land tenure from openly accessible EO data.

The proxies consist of specific combinations and patterns of shapes, colors, textures related to physical structures such as roofs, types of buildings, infrastructures, types of land use and vicinity of comparable features. The assumptions connected to these proxies relate to fundamental notions of tenure claims and interests such as collective ownership, land lease and use, occupation (reclamation), transaction (sell and convey) and land access (servitude and rights of way). Overall, this study strengthens the idea that data mining for North Korea related land (tenure) information in the context of Korean (re-)unification is possible and feasible.

The application of EO data involves image processing and data mining technologies which can help to generate a better insight in current land and property interests (such as land tenure, land rights, land responsibilities and duties related to land and properties), and to better prepare, execute, enforce, assess and monitor land interventions. In the context of (re-)unification, the sample tests are particularly relevant for re-uniting countries where different land tenure systems exist and where the data are not coherent. For example, prior to the (re-)unification in Germany, there were two different systems of land tenure, which co-existed next to each other. Unifying the system in Germany was difficult at first partly because each of the previous countries had recorded and administered in a significantly different manner. A similar situation exists in anticipation of a unified Korea, especially considering that little information is available about the varieties of land tenure and the missing links to individual people in North Korea.

One way to overcome this challenge is to detect land tenure with the use of remote sensing and open access aerial and satellite images. Normally, this technique is possible when having access to ground control points, civil registers and semantic interpretation of both the tenure and the people's components. When this information is however

missing or this data source is unreliable—as is the case in North Korea—one has to rely on a number of assumptions and a set of test trials, which if proven right, can be generalized with artificial intelligence connected to image processing. In other words, one has to understand the socio-legal relations to land with pixel. This socio-legalizing the pixel is still largely an idea rather than an available set of techniques. In order to develop such techniques, which will ultimately facilitate the land tenure unification process in Korea, and possibly also improve existing land tenure records (including both public/private land rights, restrictions and responsibilities), one needs a collaborative research development.

The next step is to enrich and test the information quality of the above assumptions and proxies with empirical data tests, inclusion and reflections of local knowledge on the ground (focusing on North Korean defectors' perspectives) and expert knowledge in EO and land administration sciences in North and South Korea. The findings in Section 4 could also help for creating more machine-learning and deep-learning algorithms that provide reference to other papers. The construction of these algorithms was, however, beyond the scope of this paper.

Chapter 5. Testing and validating the alignment of social and geospatial data on land tenure in North Korea for the Korean (re-)unification*

* This chapter is based on a submitted paper as follows: Lee, C., & de Vries, W. T. (2020). Testing and validating the alignment of social and geospatial data on land tenure in North Korea for the Korean (re-)unification. Target Journal: *Land Use Policy* (under review)

S U M M A R Y

There is a recognized need for reliable land tenure and geospatial information in North Korea for the Korean (re-)unification. However, the main challenge is the absence of completeness and inadequacy to clarify unknown land tenure relations and land governance arrangements. Deriving informative land tenure relations from geospatial data in line with socio-economic land attributes is most promising at this stage. With constructing geospatial data proxies, in-close and in-depth investigation on the validation of a set of proxies combining multiple values and the forms of knowledge co-production was considered. Thus, the primary aim is to provide empirical evidence whether proposed proxies are scientifically valid, policy-relevant and socially robust. We revealed that the distributions of the opinions for the land ownership and land transfer rights identification across scientific experts, bureaucrats and stakeholders were different. Moreover, it was enabled to measure intrinsic, contextual, representational and accessibility attributes of information quality regarding the associations between EO data and land tenure relations in North Korea from different viewpoints. This work offers valuable insights into new validation techniques for EO data in the land administration domain out of conventional practices which have already been formed and customized to the specific artefacts and validation objectives in the remote sensing community.

Keywords: land administration; land tenure; geospatial data; knowledge co-production; validation; information quality

Chapter 5. Testing and validating the alignment of social and geospatial data on land tenure in North Korea for the Korean (re-)unification

5.1 Introduction

Capturing the relation between land tenure and governance in a state (re-)unification process from different methodological accounts includes: (1) eliciting theoretical foundations regarding the role and the significance of land tenure using the Context-Intervention-Mechanisms-Outcomes-Constraints (CIMOC) framework (Lee and de Vries, 2018), (2) extracting evidence of how the government interacts in response to transforming land governance and which government tools were deployed within different institutional (re-)unification contexts (OCTS and OCTS model) using an embedded multiple case study (Lee et al., 2019), and (3) deriving informative land tenure relations from Earth Observation (EO) data supported by mix of methods and information fusion in the contexts of a difficult-to-access region (Lee and de Vries, 2020). Whereas previous approaches are based on documented spatial knowledge and reasoning on land tenure and land governance, this study intends to supplement and extend the insights by including and reflecting on local spatial knowledge and expertise of citizens.

Despite various studies about North Korea and their citizens, there are still insufficient insights in the fundamental differences between North Korean and South Korean perceptions, beliefs and experiences (Park and Do, 2019). Such an information gap may hamper a smooth transition towards unification. Therefore, it is fundamental that more insights are gained directly via North Korean citizens. Currently, the only possible way is to interview and engage with North Korean defectors. In fact, urban studies in North Korea tend to particularly necessitate on-site work, social contact and face-to-face interaction with population of interest rather than relying on existing literature and data available. However, most of the work carried out to date has not been able to provide robust evidence based on persistent observation and in-depth analysis (Hong, 2015). Therefore, Lee & de Vries (2020) suggest that multidisciplinary approaches, utilization of geospatial data and geospatial analysis techniques, combined with in-depth interviews with North Korean defectors should be considered in order to complement internally-produced literature in North Korea and extensive consultations with the outside experts (Hong, 2015; Park et al., 2016).

In general, gathering land-relevant information from multiple non-human resources such as legislation, policy documents and case studies is possible. However, the main challenge faced by many decision-makers is the incompleteness and inadequacy (inadequate proof of evidence) to clarify how land tenure relations and land governance arrangements are really constructed and maintained in North Korea. In light of these unknowns, additional data from multiple stakeholders is useful in order to obtain a more detailed insight in the spectrum of experiences, views and personal judgements (Mukherjee et al., 2018; Shadbolt et al., 2015). In this respect, North Korean defectors can act as human capital, not only to supplement publications on North Korea but also as a way to conduct empirical analysis with primary data on North Korea (Jeong, 2005). For land management, it is important to bear in mind that spatial decision-making is made on different spatial scales, from local to national scales and thus incorporate multiple spatial cognition and perspectives on both state and non-state agencies. A process of knowledge elicitation consists of a set of techniques and methods in decision-making such as: Interviews, Focus Group Discussion (FGD), Nominal Group Technique, Q methodology, Delphi technique, and Multi-criteria Decision Analysis (MCDA) (Mukherjee et al., 2018).

Results from an earlier study demonstrates how a process of socialization of pixels can take place via (re-)interpreted semantic land tenure relations (Lee and de Vries, 2020). This methodological paper proposes a mixed-methods design and information fusion approach, constructing a strong and consistent association between land tenure and EO data. However, a further investigation on validation of elaborated meaning or the interpreted information element needs to be undertaken before the association between land tenure and EO data in line with algorithmic approaches is more clearly understood. Thus, the primary aim of this paper is to provide empirical evidence for the claim that it is possible to standardize the identification and categorization of certain objects, environments, and semantics visible in EO data that can (re-)interpret land tenure relations. Given our awareness of critical consequences in misidentifying proxies from a lack of appropriate and rigorous validation methods, the approach to empirical knowledge elicitation is therefore threefold: (1) Extract scientific (or *priori*) knowledge with a high level of expertise based on topical (i.e. land tenure and land administration), methodological (i.e. remote sensing and earth observation) and contextual (i.e. Korean (re-)unification) interests, and (2) identify bureaucratic knowledge based on, and (3) Derive *ground-truthed* knowledge with locales in geographic areas of interest (i.e. North Korean defectors) those who have the most and accurate understanding (i.e. familiarity

or personal experience) of the land tenure relations, land governance and land use practices. This study sought to answer the following specific research questions:

- To what extent does scientific, bureaucratic and stakeholder knowledge about land tenure complement with a set of identified pixel-based proxies related to land tenure?
- How does (remotely sensed/earth observation) pixel-based land tenure information become legitimate land tenure knowledge?

This paper contains four parts. The first section deals with the conceptual and methodological accounts of the research and analyses. The subsequent part brings together the key findings of proxy identification and the measurement of information quality. The remaining part of the paper includes a discussion of the implications of the findings for future research.

5.2 Validation in Geospatially Informed Proxies

Validation of remote sensing data and products against the social context of the location is critical. Yet, despite the explosive growth of remote sensing usages in a wide range of applications in many different fields, there is still an increasing concern about a lack of rigorous social and contextual validation methods and techniques which in turn may cause misidentification or misinterpretation of proxies. Therefore, for a geospatially better-informed analysis, the procedure and legitimacy of validation with relevant proxies combining multiple values and the forms of knowledge co-production needs to be reflected upon.

5.2.1 Conventional Approaches to a Validation of EO Data

A validation and accuracy assessment are a fundamental requirement when employing EO data in any mapping projects. It provides a basis for identifying classification errors and with sample data one estimates the overall accuracy and uncertainty of the mapping outcomes (Olofsson et al., 2014). Congalton (2001) lists three reasons why validation has become so prominent. These are: (1) to identify usage errors in imagery and correct them; (2) to enable robust quantitative comparison of methods and; (3) to provide reliable information for better informed decision-making. Many of the available literature on remote sensing deals with the question of accuracy, however, Campbell and Wynne (2011) critically warn that accuracy assessment is a much more complex process as many consider and it has obvious difficulties in addressing whether the outcomes are correct in a convincing manner. The sampling design, response design and analysis are an important component in the accuracy assessment and plays a key role in yielding

rigorously defensible validation in the remote sensing science (Olofsson et al., 2014). As conventional methods, there are several possible validation techniques that examine the accuracy or error in EO data such as visual inspection, non-site specific analysis, difference image creation, error budgeting and quantitative accuracy assessment (Campbell and Wynne, 2011; Congalton, 2001). Indeed, a renewed interest on different image classification methods like Geographic Object-Based Image Analysis (GEOBIA) requires different validation efforts to meet own characteristics (Radoux and Bogaert, 2017).

Despite the cutting-edge advancements in validating EO data, it should be noted that remote sensors on satellites and aircraft cannot directly detect and record a certain social, political, economic and historical context of landscapes and its internal dynamics (Kelly and Kelly, 2014). In the same vein, using EO data to derive proxies for identifying and interpreting unknown land tenure relations requires a rigorous interpretation of various contextual information and a more nuanced insight of socio-legal-spatial properties. Therefore, there are limits to how far the conventional and solid validation procedures, which have already been formed and customized to the specific artefacts and validation objectives in the remote sensing community (Loew et al., 2017), can be taken in the land administration science. In other words, a tailored validation protocol would help to establish a greater degree of accuracy and feasibility on the results obtained from the EO data interpretation.

5.2.2 Knowledge Co-Production: Scientific, Bureaucratic and Stakeholder Knowledge

The term 'knowledge co-production' is commonly referred to the collaborative and interactive process of synthesizing different sources and types of knowledge (Armitage et al., 2011; Edelenbos et al., 2011; Pohl et al., 2010). Co-produced knowledge blurs the knowledge boundaries between science and practice (Lee and de Vries, 2019). Therefore, only experts, academics or professionals could no longer serve a pivotal role in the decision-making process, the engaged knowledge of the non-academic stakeholders should also be taken into account.

According to Freedman (1987), if scientifically valid trials involving a useful or interesting hypothesis are conducted or provide reliable information on the hypothesis being tested, this is recognized as scientific values and validity. To do so, scientific validation should consider the inclusion of expert knowledge with higher levels of education and professionalism in order to test for scientific acceptability such as transparency and replicability of results (SCHIE et al., 2011). Bureaucratic knowledge is now considered essential as bureaucrats or civil servants possess advanced knowledge through

governance processes that include top-down political representation, bottom-up citizen participation and informal knowledge sharing networks (Eckhard, 2020). Within administrative and governmental practices, ‘bureaucratic knowledge’ serves to navigate during complex decision-making. It associates political and strategic use of knowledge rather than the intrinsic (non-instrumental) value of knowledge such as the norms of ethos and ethics to bureaucratic works (Eckhard, 2020; Edelenbos et al., 2011; Kingdon, 1984; McClean and Shaw, 2005). Thus, a bureaucratic validation denotes that it synthesizes knowledge from both internal and external resources or create new forms of knowledge from perceptions of political feasibility and institutional arrangements (Hunt and Shackley, 1999). Unlike the scientific validation based on replication logic, bureaucratic knowledge relies on either pragmatic plausibility or feasibility logic, similar to political logic.

However, critical questions have been raised about the uncertainty of decision-making to resolve multifaceted local and societal problems, based solely on scientific and expert knowledge (Stilgoe, 2007). One of the most significant current discussion in this argument is incorporating varying stakeholder knowledge that reduces rigidity, represents multiple perspective, and promotes adaptability in decision-making (Gray et al., 2012). There is also a growing body of literature that recognizes the importance of stakeholder or lay knowledge as a key informants that emphasizes intense contextual and localized knowledge of people in their local environments (Petts and Brooks, 2006). Therefore, the potential advantage of using stakeholder’s validation is to be more precise with a contextualized and localized manner in validating proxies that cannot be verified through disciplinary expert assessment or administrative capacity. In view of all that has been mentioned so far, one may suppose as argued by Edelenbos et al. (2011) that only coproduced knowledge fully assesses the pre-identified proxies for geospatially informed analysis considering both scientific validity and policy relevance as well as social robustness.

5.2.3 Geospatially Informed Analysis

Geospatially informed analysis is the application of geospatial intelligence from remote sensing and earth observations to land management and land administration sciences. In the last few decades, describing, analyzing and understanding people-to-land relations with geospatial technology has derived effective legal, social, and spatial solutions to multifaceted problems of the land. Recently, more advanced geospatial intelligence not only offers administratively straightforward and technically feasible or financially affordable approaches (Lee and de Vries, 2020) but also provide rich data and

information that conventional analytical techniques have not been able to reach out or identify. We also view land management as a combination of interventions in governance and how and under which conditions such land interventions are responsible, and how such interventions can be supported by technologies (de Vries et al., 2020). It is possible, therefore, that geospatially informed analysis supports both smart and responsible land management, especially the difficult-to-access regions where unknown or unsupported land governance exists.

At one end, geospatial intelligence is currently not sufficiently embedded in decision-making processes; At the other, decision-makers do not sufficiently rely on geospatial intelligence even though it is available. Even geospatial intelligence is too much product-oriented and not process-oriented. Based on this line of argument, we note that, despite above claims of geospatially informed analysis, it still needs to be clarified how, where and when it can enrich both scientific and bureaucratic knowledge. Building on critical insights from the geospatially informed analysis, it enables us to address proxy development in a smart and responsible manner when significant uncertainty exists about data access, data integration and data reliability.

Geospatially informed analysis is fast becoming the ultimate driver of spatial decision-making in land management and shed new light on the new insights about societies, the environment, the earth, and sustainable development. However, scientifically framed knowledge and technical expertise in remote sensing and earth observation tends to exaggerate greatly the excellence of laboratory experiments under highly controlled conditions and technocratic approaches to dealing with land/spatial problems; while, at the same time, the dominance of bureaucratic knowledge in land policy-making devaluates other forms of knowledge and undermines the local context, political representation of citizens and social processes of land governance and land use practices. Using geospatial tools and instruments, citizen (stakeholder) is now able to not only consume and produce geospatial information but also engage grounded knowledge into spatial decision-making more effectively. The synchronization, complement or contradiction with views, judgements and experiences within the knowledge coproduction process affect the geospatially informed analysis utilized in spatial decision making and thus determine exactly how, where and when different forms of knowledge can legitimize scientific standards and conformity to bureaucracy and social norms.

5.3 Methods

The method was designed for an analysis in order to test which proxies academic, governmental professionals and stakeholders consider relevant and useful and how they

evaluate the information quality. This required a careful survey. A survey consisted of 77 sample respondents recruited from scientific, bureaucratic and stakeholder groups. Data for this study were collected using a web-based questionnaire and the both Chi-square test and one-way ANOVA test were chosen for the analysis. The upcoming subsections describe in greater detail what needs to be investigated, who are engaged and how to conduct a survey and analyse data.

5.3.1 Identification of Proxies and Quality of Information

Identifying proxies to derive unknown land tenure relations over North Korea in conjunction with EO data was the first important step of the analysis. A preliminary investigation proposed a set of candidate proxies regarding the key questions based on the elements of image interpretation of remote sensing fall into four categories: land ownership; land use; land transfer and; land access (Lee and de Vries, 2020). From this, a total of 66 proxies were taken from 32 groups of certain objects, environments, and semantics visible in EO data that can be (re-)interpreted to recognize unknown land tenure relations over North Korea (see Figure 20). These proxies generally consist of the following components, which are combination of: patterns of shapes, colors, textures related to physical structures, types of buildings, infrastructures, types of land use and vicinity of comparable features. This line of reasoning attached to the proxies significantly associated with central concepts of tenure claims and interests such as collective ownership, land lease and use, occupation, transaction and land access (Lee and de Vries, 2020). Hence, concerning our approach of validation in remotely sensed proxies, we set out the test the hypothesis that determines “whether proposed proxies are (1) scientifically valid, (2) administratively relevant or useful and (3) contextualized and localized.” Hence, the null hypothesis (H_0) is “no difference between scientific, bureaucratic and stakeholder distributions for identified proxies.”

Poor, incomplete, late or missing information is one of the most frequently stated problems with the quality of information. Lillrank’s comprehensive review on the quality of information concluded that the quality of information should consider both the technical quality as artefacts focusing on the relations between intention and outcome and the negotiated quality as deliverables between producer and receiver (Lillrank, 2003). One of the most influential accounts of a methodology for information quality assessment comes from (Lee et al., 2002) that has lay out the theoretical dimensions of information quality (IQ), and comprehensively looks at four key quality attributes from the both academics’ and practitioners’ perspectives: (1) intrinsic; (2) contextual; (3) representational; and (4) accessibility. Both intrinsic and contextual quality underlines the

informative factors, but intrinsic attributes are associated with accuracy, believability, reputation and objectivity whereas latter one considers tasks that require value-added, relevance, completeness, timeliness, appropriate amount. On the other hand, both representational and accessibility dimensions stress the technical accounts of the system that information must be interpretable, easy to understand and is represented clearly and consistently, as well as emphasizing accessibility and security (Lee et al., 2002). To test the hypothesis, two different approaches have attempted to account for: the identification of proxies (Part I in a questionnaire) and the measurement of information (proxy) quality (Part II in a questionnaire).

Geospatially Informed Analysis



Figure 20 The organization of proxies based on the identification of land ownership, land use, land transfer and land access (source: Authors, based on (Lee & de Vries, 2020))

5.3.2 Identification of Proxies and Measurement of Information Quality

5.3.2.1 Participants

The participants (see Table 9) were divided into three groups based on knowledge production methods: (1) scientific knowledge, especially focusing on topical, methodological and contextual interests; (2) bureaucratic knowledge existed within administrative and governmental practices; and (3) stakeholder knowledge as key informants that emphasize contextual and localized knowledge in North Korea. A random sample of the participants with a different set of knowledge was identified from personal and work engagement and inclusion with government agencies (from Korea Land and Geospatial Informatics Corporation (LX) and local authorities under the Ministry of Land, Infrastructure and Transport (MOLIT)), (non-)governmental organizations (from Korea Hana Foundation; Together Foundation; Saeil Academy), academic and research institutions (from Universities, Korea Research Institute for Human Settlements (KRIHS); Land & Housing Institute (LHI); Spatial Information Research Institute (SIRI)) in South Korea.

In total, 77 participants took part in the study. Of the total cohort of 77 participants, 29 belonged to scientific knowledge groups (38%) and 30 and 18 respondents were from bureaucratic (39%) and stakeholder knowledge groups (23%), respectively. (See Table 9). The participants I group (scientific knowledge) were academics and researchers representing a broad range of expertise and domains in land management, land administration, land governance, land tenure, and cadastre. Moreover, it included eligible specialists with substantial knowledge or ability who performs skillfully on remote sensing and earth observation technologies are included. Then, participants were also recruited from independent entities that bring and share their knowledge and deeper understanding of the Korean (re-)unification. Participants group II represented bureaucratic knowledge and policy usefulness, the following parameters were used: governmental professionals and officials those who are able to provide a professional set of skills and gained relevant work experiences in public sectors coping with land tenure/administration/management, land/cadastral surveying and geospatial information. To build our stakeholder samples, we considered people with a declared or conceivable interest or stake in the land tenure relations, land governance arrangements and land-use practices in North Korea. Thus, the Participants III group involves stakeholders' judgements those who have the most, direct and accurate understanding of the land systems in North Korea through their life experiences; therefore, it is North Korean defectors in this context.

To begin this process, each participant group was invited by e-mail to participate in this study and a link to the online questionnaire was included. The participants were

asked to complete two tasks: the identification of proxies and the measurement of information quality. When inviting participants, the purpose of the research was clearly explained with an introductory statement and instruction attached in the questionnaire. Originally, the design of the questionnaire was based on English. However, further works for translation into Korean were required to gain a better understanding of the possible identification of proxies and measurement of information quality. The participants were asked to complete two parts of the anonymized questionnaire were completed by two weeks (2020.6.29 – 7.15). After one-week, non-responders received a reminder via e-mail.

	Total	Knowledge groups		
		Scientific (A)	Bureaucratic (B)	Stakeholder (C)
<i>N</i>	77	29	30	18
<i>Gender (% female)</i>	32%	28%	27%	50%
<i>Age</i>				
30 years or younger	23%	17%	23%	33%
31-50 years	64%	69%	63%	56%
51 years or older	13%	14%	14%	11%
<i>Completed educational level</i>				
Middle-level applied: Middle & high school	8%	3%	3%	22%
Higher vocational: Bachelor's degree	35%	10%	40%	67%
Higher academic: Master's degree	29%	35%	34%	11%
Postgraduate academic: PhD	28%	52%	23%	0%
<i>Work experience</i>				
0-5 years	47%	48%	37%	61%
6-10 years	15%	14%	10%	28%
10 or more years	38%	38%	53%	11%

Table 9 Participant characteristics

5.3.2.2 Questionnaire

We have chosen to use a questionnaire approach in order to elicit scientific, bureaucratic and stakeholder opinions for proxy identification of land ownership and the rights of land use, land transfer and land access and its quality of information provided in the questionnaire. The questionnaire was developed under consultation and discussion with international and local academic communities in both languages, English and Korean: (1) by sharing cutting-edge scientific knowledge on smart and responsible land management; (2) by comparing how local contexts influences land tenure relations, especially in developing countries; (3) by underpinning a new conceptual and methodological account of a geospatially informed analysis in a remote sensing community.

On collecting data, a web-based questionnaire was carried out with the existing free Google Forms questionnaire due to budget constraints, time-limited and travel

restrictions (e.g., COVID-19). The questionnaire is divided into four main sections, each of which presents basic information of the respondents including categories of knowledge production, highest educational level completed, profession, number of years' experience in this profession, and the results relating to the identification of proxies and the measurement of information quality. In order to identify the most transferrable and applicable proxies, the participants were asked whether they agree or disagree using binary scales ('yes-no') that assume one of two possible values. One advantage of the binary scale is that it avoids the problem of nuanced and neutral answers from respondents. By forcing respondents' options, this approach gives us precise data in order to clarify and confirm the proxies we preliminary identified (See Figure 19). In addition, after every group category of proxies, we provide a supplementary space if participants want to add comments or suggestions for additional candidate proxies.

Unlike the binary scale format, Likert items offer more finely tuned response and it enables respondents easier to indicate their extent of agreement, including whether they are neutral to the questions. For the attitude questions in measuring information quality, a 5-point Likert scale was thus used whether respondents are "agree" or "disagree" as following variations: excellent, good, fair, poor, very poor. Question items for the measurement were partly adopted from the AIMQ methodology (Lee et al., 2002) and asked as to the believability, completeness, consistent representation, interpretability, objectivity, relevancy, timeliness and understandability among others. Finally, the participants were then told to leave an e-mail address if they wanted to know the results of the study.

5.3.2.3 Data Analysis

To formally compare the views and judgements of different group samples in identifying geospatially informed proxies, the Chi-square test were chosen to test whether the distributions across scientific experts, bureaucrats and stakeholders are (significantly) different. Although either the Chi-square test or Fisher's exact test can be utilized for the comparison between two categorical (binary) variables, we adopted the Chi-square test since this test is also possible for more than two nominal variables or arbitrary dimension (Rx C rather than 2x2). Moreover, it only needs to use Fisher's exact test, when more than 20% of cells have expected frequencies < 5 (McDonald, 2009; Warner, 2013). However, the experimental design of this study does not have 20% of expected frequencies lower than 5, we thus apply approximation methods with Chi-square test. The proxies representing only few statistical differences ($P < 0.05$) were considered to be in agreement. The experiment was conducted having two possible outcomes (yes or no) and

therefore the results on the proxy identification (validation) should be expressed as a proportion of the overall respondents from scientific, bureaucratic and stakeholder groups since our data are derived from random sampling.

For measuring information quality, a one-way ANOVA test was applied. The one-way ANOVA test is one of the most commonly-used techniques for determining whether statistically significant differences between the means of two or more independent variables are existed or not (e.g., between groups; within groups). In an experiment, the measurement variable is the independent variable; thus, it measured scientific, bureaucratic, and stakeholders' standpoints, respectively. The nominal variable is the dependent variable consisting of five values (very poor/poor/fair/goo/excellent) in terms of the information quality on the proxy identification based upon a 5-point Likert scale. It is equal to 1 if respondents answer with "very poor" as to the believability, completeness, consistent representation, interpretability, objectivity, relevancy, timeliness and understandability, on the other hand, it is equal to 5 when participants consider it is "excellent". Before taking the one-way ANOVA test, we also conducted the D'Agostino-Pearson normality and lognormality tests to determine if a data set is well-modelled. After one-way ANOVA test, we follow up with Tukey's multiple comparison test (Tukey-Kramer test) to compare every variable with every other variable.

5.4 Results

5.4.1 Identification of Proxies

5.4.1.1 Land Ownership

For the identification of land ownership, 15 proxies were included in the analysis (See Figure 19). Of the 15 proxies, first 8 proxies (No.1 – No.8) were related to collective (farm) land and the rest from No.9 to No.15 were associated with state (farm) land identification. We performed a Chi-square test of independence that whether there is a link between views and judgements of each knowledge group and the proposed proxies. From these, the null hypothesis (H_0) cannot be rejected that there is no difference between scientific, bureaucratic and stakeholder distributions for 9 proxies. For these 9 proxies, the judgements elicited from scientific knowledge are in agreement with those observed of bureaucratic opinions. On the other hand, we reject the null hypothesis that there is no difference between three different knowledge groups for 6 proxies including: rough/coarse image texture of (dry)paddy fields ($\chi^2 = 12.950, p = .001$); high density/compactness of settlements ($\chi^2 = 8.337, p = .015$); a signature line of the tilled roof of rural dwellings ($\chi^2 = 12.260, p = .002$); observation of seasonal changes of agricultural

activities ($\chi^2 = 16.140$, $p = .000$); small dot-shaped patch of orchards ($\chi^2 = 12.440$, $p = .002$); smooth texture of pastures ($\chi^2 = 7.631$, $p = .022$) and; low density of building (sites) ($\chi^2 = 6.407$, $p = .040$). Table 10 compares the results obtained from the Chi-square test of the validation of proxies for land ownership identification.

No	Proxies for Land Ownership Identification	Chi-square test χ^2 (p -value)	Knowledge groups (agreement, %)		
			Scientific (A)	Bureaucratic (B)	Stakeholder (C)
1	Presence of (dry)paddy fields	5.732 (.056)	31.0%	43.3%	66.7%
2	Rough/coarse image texture of (dry)paddy fields	12.950 (.001**)	20.7%	33.3%	72.2%
3	High density/compactness of settlements	8.337 (.015*)	34.5%	50.0%	77.8%
4	Object colors in grey scales of rural dwellings	5.873 (.053)	31.0%	50.0%	66.7%
5	A signature line of the tiled roof of rural dwellings	12.260 (.002**)	20.7%	40.0%	72.2%
6	Densely built-up structure with single-story detached houses	5.732 (.056)	31.0%	43.3%	66.7%
7	Presence of portable farming-related objects	5.366 (.068)	37.9%	46.7%	72.2%
8	Observation of seasonal changes of agricultural activities	16.140 (.000***)	24.1%	26.7%	77.8%
9	Small dot-shaped patch of orchards	12.440 (.002**)	17.2%	30.0%	66.7%
10	Smooth texture of pastures	7.631 (.022*)	17.2%	30.0%	55.6%
11	Out-buildings of warehouses	4.186 (.123)	31.0%	40.0%	61.1%
12	Low density of building (sites)	6.407 (.040*)	24.1%	40.0%	61.1%
13	Complex, elongated/irregular boundaries of buildings (sites)	5.155 (.076)	20.7%	43.3%	50.0%
14	Blue, green, yellow and red and light colors of roofs	2.465 (.291)	37.9%	50.0%	61.1%
15	Presence of agricultural, monumental and welfare infrastructure	0.462 (.462)	48.3%	53.3%	66.7%

Table 10 Validation of proxies for land ownership identification and differences between knowledge groups
Note.

* p value ≤ 0.05 ; statistically significant between knowledge groups

** p value ≤ 0.01 ; statistically very significant between knowledge groups

*** p value ≤ 0.001 ; statistically extremely significant between knowledge groups

In sum, when a p -value is reached less than 0.05 for each proxy (No 2, 3, 5, 8 – 10, and 12), it means that the opinions elicited from the scientific, bureaucratic and stakeholder groups are highly inconsistent and thus hindering the validation of a set of proxies. Although many disagreements from scientific groups (ranging from 17.2 % to 48.3%) arise as a result of interpretations of the identified proxies, the possible proxies for land ownership identification derived from EO data (No 1, 4, 6, 7, 11, and 13 - 15) have gained a better understanding from bureaucratic (the mean average: 46.2%) and stakeholder groups (the mean average: 63.9%). In Figure 21, it is more apparent that the difference

of agreement on the proxies among the scientific, bureaucratic and stakeholder knowledge groups is significantly highlighted.

5.4.1.2 Land Use Rights

There were 35 proxies included in identifying land use rights from EO data proxies. The indicated proxies from No.1-No.24 reflect on the aspects of individual land use rights and another explanation for group land use rights lies in the proxies of No.25 to No.35. Significant associations for the difference of assumptions between scientific, bureaucratic and stakeholder distributions were not found to be related throughout a Chi-square test for all the possible proxies of land use rights. In other words, the sample relationship was we retain the null hypothesis (p value ≤ 0.05) that there is no difference between the knowledge groups. All participant groups agreed that much uncertainty (from the answer ratio of $\leq 50\%$) still exists about the relationship between EO data and the identification of land use rights at some points. However, χ^2 and p value only demonstrates a statistically significant difference which is the results of a rational exercise with numbers but does not mean practical significance that there is no difference (see the difference of opinion in Figure 21). Table 11 shows the breakdown of χ^2 and p value as well as the fraction of total agreement according to Chi-square test for the validation of proxies for land use rights identification. A systematic understanding of how EO data contributes to land use rights identification is still lacking (No. 11 - 15, and 24) from scientific, bureaucratic and stakeholder knowledge groups (less than 30% in agreement); While strong evidence was found to support for validation of the six proxies in individual and seven proxies in group land use rights by agreeing to at least 40 percent in two separate groups (No 5, 6, 7, 16, 17, 22, 25 - 27, 29 - 31, and 34).

No	Proxies for Land Use Rights Identification	Chi-square test χ^2 (p -value)	Knowledge groups (agreement, %)		
			Scientific (A)	Bureaucratic (B)	Stakeholder (C)
1	LULC changes with intense land development	3.237 (.198)	31.0%	50.0%	27.8%
2	LULC changes with increase of agricultural land	1.149 (.563)	27.6%	40.0%	38.9%
3	LULC changes with urban areas with the development of water bodies	0.449 (.798)	31.0%	30.0%	38.9%
4	LULC changes in border regions than inland area	1.515 (.468)	31.0%	46.7%	38.9%
5	Presence of different types of houses/allotments	0.119 (.942)	55.2%	53.3%	50.0%
6	Low building density of (semi-)detached houses	0.026 (.986)	37.9%	40.0%	38.9%

No	Proxies for Land Use Rigts Identification	Chi-square test χ^2 (<i>p</i> -value)	Knowledge groups (agreement, %)		
			Scientific (A)	Bureaucratic (B)	Stakeholder (C)
7	1/2 stories of (semi-)detached houses	2.018 (.364)	27.6%	43.3%	44.4%
8	Uniformly shaped settlement of (semi-)detached houses	1.637 (.441)	27.6%	43.3%	33.3%
9	In close proximity to roads of (semi-)detached houses	1.637 (.441)	27.6%	43.3%	33.3%
10	Low to intermediate imperviousness of (semi-)detached houses	1.527 (.465)	31.0%	43.3%	27.8%
11	Large rectangular simple form of apartments	1.795 (.407)	17.2%	30.0%	16.7%
12	Regular alignment of apartments	0.761 (.683)	17.2%	26.7%	22.2%
13	More than 3 stories of apartments	1.157 (.560)	17.2%	23.3%	11.1%
14	Low to intermediate imperviousness of apartments	0.184 (.912)	17.2%	20.0%	22.2%
15	Shadow silhouettes of apartments	0.590 (.744)	10.3%	16.7%	16.7%
16	Detached small-sized buildings of allotments	2.128 (.345)	55.2%	46.7%	33.3%
17	Low built-up land of allotments	0.423 (.809)	48.3%	46.7%	38.9%
18	Low imperviousness of allotments	0.967 (.616)	41.4%	33.3%	27.8%
19	Buffer between houses of allotments	0.043 (.978)	31.0%	33.3%	33.3%
20	Small roofs with slate material of harmonica houses	0.281 (.868)	27.6%	33.3%	27.8%
21	Chimneys (small dot-shaped objects/light shadow silhouette) of harmonica houses	4.481 (.106)	10.3%	30.0%	33.3%
22	Fences (line-shaped objects) of harmonica houses	1.383 (.500)	34.5%	46.7%	50.0%
23	Observation of new construction or extension of residential buildings	0.663 (.717)	27.6%	33.3%	38.9%
24	Observation of expansion of construction activities	1.103 (.576)	27.6%	30.0%	16.7%
25	Presence of amalgamation of diverse community amenities	0.539 (.763)	41.4%	50.0%	50.0%
26	Multiple building objects with similar patterns for land conversion in collective use	0.835 (.658)	48.3%	36.7%	44.4%
27	High density of settlement for land conversion in collective use	0.483 (.785)	37.9%	46.7%	44.4%

No	Proxies for Land Use Rights Identification	Chi-square test χ^2 (<i>p</i> -value)	Knowledge groups (agreement, %)		
			Scientific (A)	Bureaucratic (B)	Stakeholder (C)
28	Simple rectangular forms for land conversion in collective use	2.537 (.281)	24.1%	43.3%	38.9%
29	Same roof colors for land conversion in collective use	0.715 (.699)	37.9%	40.0%	50.0%
30	Observation of construction/extension of community infrastructure	0.377 (.828)	48.3%	46.7%	55.6%
31	Improved accessibility with increase paved roads and wider widths	2.491 (.287)	27.6%	40.0%	50.0%
32	Newly built greenhouses in a barren land and adjacency to dwellings	0.490 (.782)	34.5%	36.7%	44.4%
33	Light object colors/white or grey colored roofs/rough texture of newly built greenhouses	3.524 (.171)	24.1%	30.0%	50.0%
34	Increase of the number of houses in a certain vicinity with presence in high density	2.264 (.322)	31.0%	50.0%	44.4%
35	Presence of undivided shared areas of the common property	2.413 (.299)	27.6%	36.7%	50.0%

Table 11 Validation of proxies for land use rights identification and differences between knowledge groups

5.4.1.3 Land Transfer Rights

The proxies for land transfer rights identification consisted of 11 responses to the questions of each knowledge group based on the following key components: the small land (sotoji) that divided into the garden plot (GP), the side-job plot (SJP) and the tiny patch of land (TPL) in North Korea. Consistent with data obtained from the previous section on land use rights identification, we also found that there is no statistical difference in a set of given observations (*p* value of all the proxies is higher than 0.05). Therefore, we fail to reject the null hypothesis for the difference of views, judgements and experiences between scientific, bureaucratic and stakeholder distributions on the proposed proxies for land transfer rights. There remain several aspects of the small land (sotoji) about which relatively little is known to scientific and bureaucratic knowledge groups in South Korea (only less than a third (30%) agreed in confirming land transfer rights). However, if we could turn for a moment to look at both Table 12 and Figure 21, we can see that the stakeholder group those who have the most and accurate understanding of the land tenure relations, land governance and land use practices had a higher mean estimated percentage (32%) of agreement among 11 proxies in validating proxies than the

average ratio of other groups, especially with No.2 (38.9%), 3 (44.4%), 4 (38.9%) and No.6 (44.4%).

No	Proxies for Land Transfer Rights Identification	Chi-square test χ^2 (<i>p</i> -value)	Knowledge groups (agreement, %)		
			Scientific (A)	Bureaucratic (B)	Stakeholder (C)
1	Presence of small land (sotoji)	2.167 (.338)	44.8%	26.7%	33.3%
2	Small parcel size of garden plot (GP)	0.783 (.675)	31.0%	26.7%	38.9%
3	GP in front/back yards or attached to each other	1.038 (.592)	34.5%	30.0%	44.4%
4	GP with green colors	0.918 (.631)	27.6%	26.7%	38.9%
5	Large parcel size of side-job plot (SJP)	1.034 (.596)	17.2%	16.7%	27.8%
6	SJP in front/back yards or attached to each other	1.415 (.492)	27.6%	33.3%	44.4%
7	SJP with green colors	0.258 (.878)	24.1%	30.0%	27.8%
8	Lower elevation of tiny patch of land (TPL)	1.413 (.493)	17.2%	30.0%	27.8%
9	Gentle slope less than 15% of TPL	1.413 (.493)	17.2%	30.0%	27.8%
10	TPL with small patches of vegetation cover between neighboring lands	0.761 (.683)	17.2%	26.7%	22.2%
11	Presence on the hillsides or along the streams or ditches of TPL	0.761 (.683)	17.2%	26.7%	22.2%

Table 12 Validation of proxies for land transfer rights identification and differences between knowledge groups

5.4.1.4 Land Access Rights

As was mentioned in the previous study, assuming and identifying EO data proxies for land access rights in North Korea is one of the most challenging problems as private land tenure is not recognized in North Korea and thus there is no land use regulations through the restriction of private rights (Lee and de Vries, 2020). Considering restrictions of land access rights only for public purpose, 5 proxies were included in the analysis. On average, these proxies received the highest agreement among identified land tenure claims ranging from 34.5% to 70%, together with scientific, bureaucratic and stakeholder knowledge groups. As Table 13 shows, there is a significant difference ($\chi^2 = 6.909$, $p = .031$) of the proxy on the fewer green colors and rough textures of public utility networks/nature reserves/heritage sites between the bureaucratic and scientific/stakeholder groups. Thus, the null hypothesis cannot be rejected that there is no difference between scientific, bureaucratic and stakeholder distributions for this proxy. What is interesting about the data here (see Figure 22) is that the bureaucratic knowledge group

resulted in the highest value of agreement on proxy identification (63.3%; 60.0%; 70.0%; 66.7% and; 50.0%, respectively in order).

No	Proxies for Land Transfer Rights Identification	Chi-square test χ^2 (<i>p</i> -value)	Knowledge groups (agreement, %)		
			Scientific (A)	Bureaucratic (B)	Stakeholder (C)
1	Public utility networks/nature reserves/heritage sites in colser proximity to hazardous or isolated location	1.768 (.413)	51.7%	63.3%	44.4%
2	Public utility networks/nature reserves/heritage sites with lack of access to roads; low to intermediate imperviouness	2.083 (.352)	55.1%	60.0%	38.9%
3	Elongated object shapes of public utility networks/nature reserves/heritage sites	4.115 (.127)	44.8%	70.0%	50.0%
4	Fewer green colors and rough textures of public utility networks/nature reserves/heritage sites	6.909 (.031*)	34.5%	66.7%	38.9%
5	Observation of subdivision of land parcels	1.474 (.478)	34.5%	50.0%	44.4%

Table 13 Validation of proxies for land access rights identification and differences between knowledge groups

Note. * *p* value ≤ 0.05 ; statistically significant between knowledge groups

5.4.2 Measurement of Information Quality

The participants were asked to pay attention to data, information or knowledge whether elaborated meaning or interpreted information element is valid or not and then to complete an 8-question survey about information quality. To determine statistically significant difference of information quality between knowledge groups, the one-way ANOVA test was used. Of the 8 aspects, there was no statistically significant differences between group means for believability ($F(2, 74) = 2.801, p = .067$), completeness ($F(2, 74) = 3.074, p = .052$), consistent representation ($F(2, 74) = 1.105, p = .336$), interpretability ($F(2, 74) = 1.633, p = .202$), objectivity ($F(2, 74) = 2.650, p = .077$) and timeliness ($F(2, 74) = 2.750, p = .070$) as determined by one-way ANOVA. In other words, this indicated that a high level of consensus on information quality among different knowledge groups was reached. On the other hand, there was a significant difference from those of variables between the means of three groups both on relevancy at the *p* value ≤ 0.05 level for the three conditions ($F(2, 74) = 7.526, p = .001$) and understandability ($F(2,74) = 3.895, p = .024$) of information (see Table 14). However, the one-way ANOVA test does not tell us where the difference exists, and which specific groups differed. Thus, we also follow up a post hoc test for relevancy and understandability variables with Tukey's

multiple comparison test. A post hoc Tukey indicated that the relevancy in scientific and bureaucratic (A-B) and bureaucratic and stakeholder (B-C) groups differed significantly at $p \leq .05$; for the understandability, there was statistically significant difference ($p = .018$) between scientific and bureaucratic (A-B) groups (see Table 15).

One-way ANOVA Test		Sum of Squares	df	Mean square	F	Sig.
Believability	Between groups	8.429	2	4.215	2.801	.067
	Within groups	111.400	74	1.505		
	Total	119.800	76			
Completeness	Between groups	9.419	2	4.710	3.074	.052
	Within groups	113.400	74	1.532		
	Total	122.800	76			
Consistent representation	Between groups	3.283	2	1.642	1.105	.336
	Within groups	109.900	74	1.486		
	Total	113.200	76			
Interpretability	Between groups	5.464	2	2.732	1.633	.202
	Within groups	123.800	74	1.673		
	Total	129.200	76			
Objectivity	Between groups	9.193	2	4.597	2.650	.077
	Within groups	128.300	74	1.734		
	Total	137.500	76			
Relevancy	Between groups	21.820	2	10.910	7.526	.001**
	Within groups	107.300	74	1.450		
	Total	129.100	76			
Timeliness	Between groups	8.902	2	4.451	2.750	.070
	Within groups	119.800	74	1.619		
	Total	128.700	76			
Understandability	Between groups	11.740	2	5.870	3.895	.024*
	Within groups	111.500	74	1.507		
	Total	123.200	76			

Table 14 differences of Information quality between knowledge groups
Note.

* p value ≤ 0.05 ; statistically significant between knowledge groups

** p value ≤ 0.01 ; statistically very significant between knowledge groups

Tukey's multiple comparisons test	Difference of levels	Mean Difference	Std. Error	95.00% CI of diff.		Sig.
				Lower Bound	Upper Bound	
Relevancy	A-B	-0.7908	0.3135	-1.541	-0.04089	.036*
	A-C	0.5536	0.3613	-0.3104	1.418	.281
	B-C	1.344	0.3590	0.4859	2.203	.001**
Understandability	A-B	-0.8897	0.3197	-1.654	-0.1251	.018*
	A-C	-0.5230	0.3683	-1.404	0.3580	.336
	B-C	0.3667	0.3660	-0.5087	1.242	.578

Table 15 A post-hoc test for the differences of relevancy and understandability between knowledge groups

Note.

* p value ≤ 0.05 ; statistically significant between knowledge groups

** p value ≤ 0.01 ; statistically very significant between knowledge groups

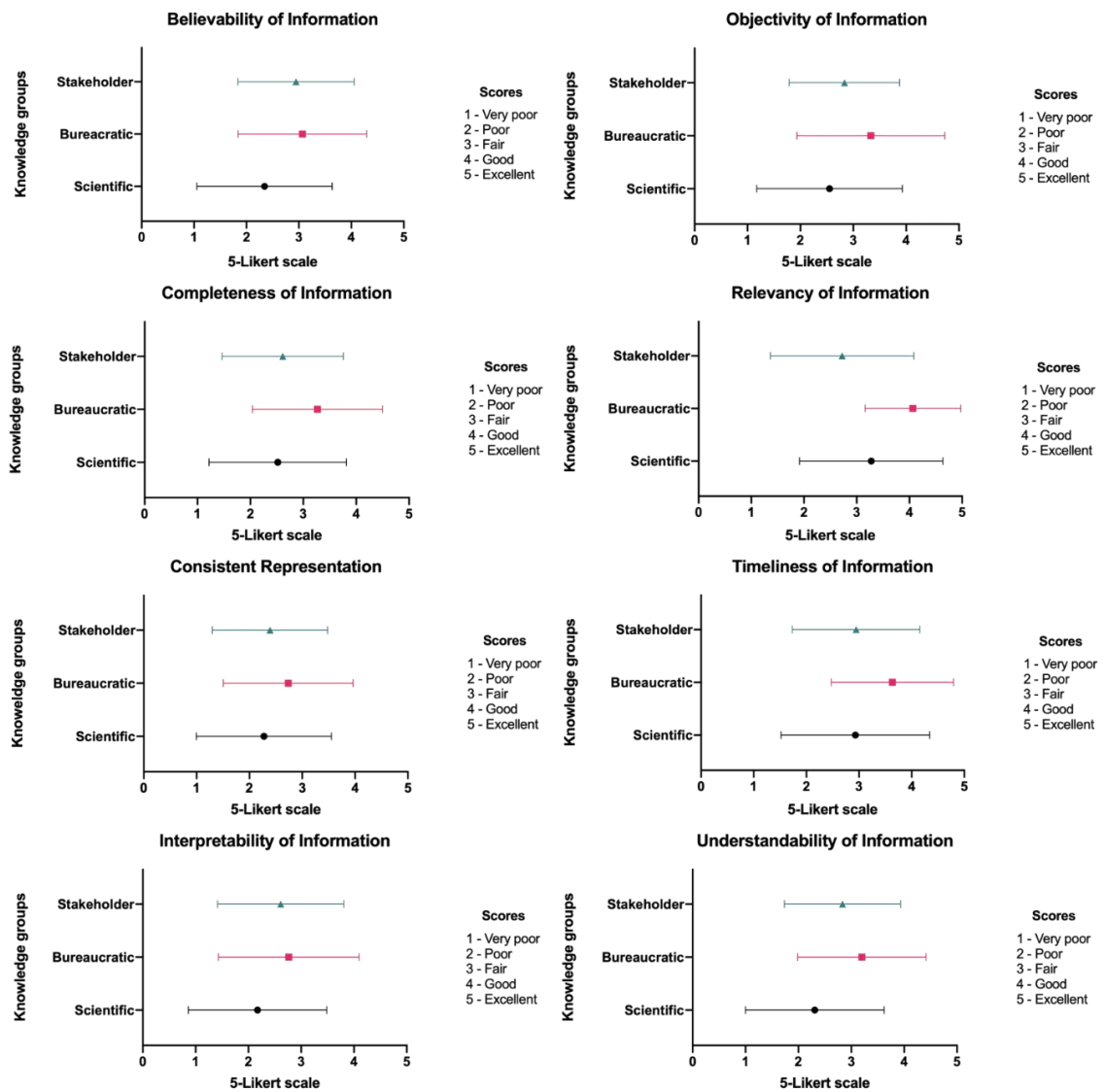


Figure 21 An arithmetic average of a range of values estimated using one-way ANOVA test. The quality of information (dependent variable) consists of five values (very poor/poor/fair/goo/excellent) based on a 5-point Likert scale. The independent variables are scientific, bureaucratic, and stakeholders' evaluation on information quality.

According to participants' responses, Figure 21 also shows a simple or arithmetic average of a range of values (1-5) for each information quality in different knowledge groups estimated using one-way ANOVA test. What stands out in this figure is bureaucratic group has the highest median ($M = 3.25833$) within the samples in all aspects of information quality; however, scientific ($M = 2.54741$) and stakeholder knowledge ($M = 2.73610$) groups had a lower average score compared to the bureaucratic groups, except for relevancy of information. In other words, the present results highlight the policy relevance of the first suggested methods and experiments for the public sector that geospatial intelligence from remote sensing and earth observation data would contribute to identifying unknown land tenure relations and land governance arrangements in North Korea. The results, as shown in Figure 21, indicated that relevancy of information had

relatively positive scores from bureaucratic ($M = 4.06667$) and scientific groups ($M = 3.27586$); on average, respondents from all groups reported lower levels of consistent representation ($M = 2.46602$) and interpretability ($M = 2.51673$).

5.5 Summary and Discussion

Figure 22 presents fraction of all three totals as a percentage showing the differences of views and judgements systematically between the scientific, bureaucratic and stakeholder knowledge groups. Due to the principal limitation with use of closed questions in a questionnaire, it restricted or imposed respondents' answers and expression in order to clarify and confirm the proxies we pre-identified. A small sample (77 random samples) was chosen because of the expected difficulty in obtaining high-level of expertise and most accurate understanding in a given context (North Korea) that significant uncertainty exists about geospatial and socio-economic data access, data integration and data reliability.

Although differences of opinions still exist, the most obvious finding to emerge from the analysis is that there appears to be some agreement in judgements of proxies among scientific, bureaucratic and stakeholder groups. On some proxies they agree, on others they do not. Signification associations of EO data and land ownership were identified for eight proxies, including No 1, 4, 6, 7, 11, and No. 13 – 15 out of 15 proxies. These proxies are related to both collective and state land ownership and strongly supported by bureaucratic and stakeholder groups that stress the political and strategic use of proxies as well as reflect most localized and contextualized knowledge. With regard to the proxies for land use rights identification, it is possible to confirm that six proxies in individual (No 5, 6, 7, 16, 17, and No. 22) and seven proxies in group land use rights (No. 25 - 27, 29 - 31, and No. 34) among 35 proxies are identified. These proxies have been found to be related to houses and allotments and land conversion and improvements of the location in particular. In addition, the findings indicate that No. 2, 3, 4, and No. 6 could be associated with applicable and transferrable proxies for land access rights. However, the knowledge gap here has also been represented by the lack of clear understanding of specific aspects and details of the small land (sotoji) in North Korea by South Korean researchers and governmental officers; while the stakeholder group (North Korean defectors) those who have the most and accurate understanding of the land tenure relations, land governance and land use practices have shown significantly higher ratio of agreement. For the identification of land access rights, whilst there has been strong agreement on the validation of proxies (No. 1 - 5) between all knowledge groups and considered to

be most negotiated knowledge that is scientifically most valid, policy-relevant and socially robust among others in this study.

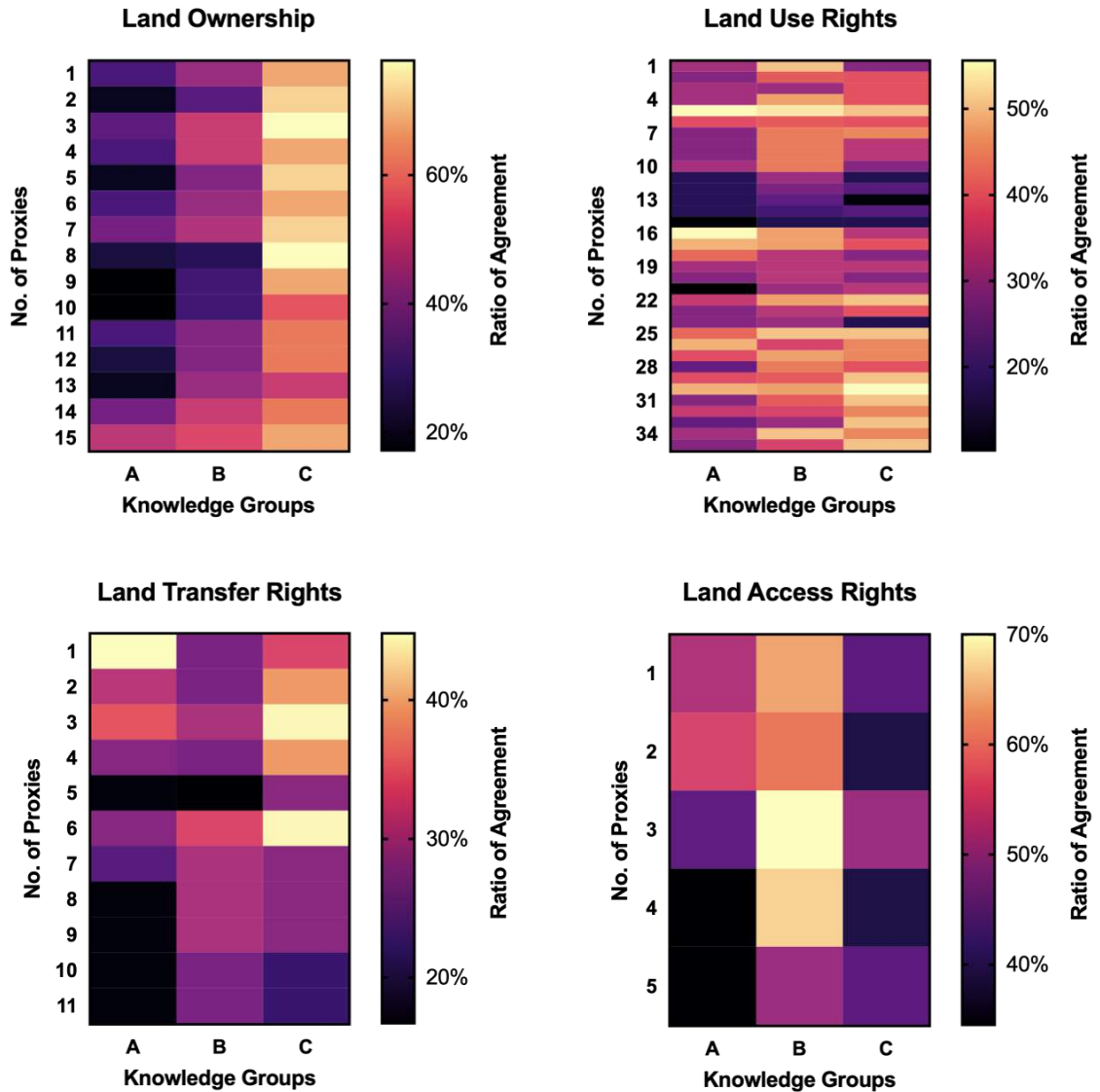


Figure 22 Validations of geospatially informed (EO data) proxies that re-interpret unknown land tenure relations in North Korea based on different land tenure claims and its differences of agreement between knowledge groups (source: devised by Authors) Note. A= scientific, B= bureaucratic, C= stakeholder

However, it is also possible that these results may not be generalizable to the detailed investigation into the study. Firstly, level of agreement of proxies for land ownership identification in the stakeholder group is much higher than other groups. This indicates a need to understand the different perceptions on land and land tenure that exist among North Korean defectors. Two discrete reasons emerged from this point. One reason for this difference there is a variety among North Korean defectors, based on different kinds of experiences. Another possible explanation for this result may be the lack of adequate

and empirical support as well as clarity in defining the term from different land management practices for South Korean researchers and governmental officials.

Secondly, although the findings should be interpreted with caution, it is likely that all knowledge groups have better sense and understanding of identifying land use rights from EO data proxies since the level of agreement observed in this investigation is little above than the average those observed of other claims. However, according to survey responses, some experts (No.55; 57 and; 64) claim that it is only possible to assume changes in land institutions (e.g., individual incentive systems for farming; promotion of individual land uses for ensuring food security; attribution of land revenues to individuals etc.) in North Korea that promote individual land uses rather than identifying land use rights with EO data. In addition, one of the respondents (No.62) from stakeholder groups critically argues that there is a conceptual weakness on “individual” and no individual land use right based on his/her work and educational experiences in North Korea until 2003.

The analysis of land tenure claims on land transfer rights suffers from a lower level of agreement in the knowledge groups that hinder ensuring its scientific validity, policy relevance and social robustness to the proxies for land transfer rights identification. However, we have questioned about the reliability of reported data that whether the participants are able to provide clear, detailed and reliable assessment for the proxy validation. For example, for those who do not have either high-level of expertise on both land tenure and remote sensing or contextualized knowledge on the small land (sotoji) in North Korea, it is rather difficult to make associations between EO data and land transfer rights in North Korea. To further identify the proxies, a set of techniques and methods should be carried out such as Interviews, Focus Group Discussion (FGD), Nominal Group Technique, Q methodology, Delphi technique, and Multi-criteria Decision Analysis (MCDA). However, qualitative research was beyond the scope of this work.

Next, participants in different groups were asked to confirm and validate the pre-identified proxies for land access rights. Of the 77 participants who completed the questionnaire, nearly half of those surveyed reported that land access rights can be identified in line with EO data. Although the observed difference between the knowledge groups was not significant, this is perhaps the most unexpected finding since we assume that the notion of land access rights is largely derived from a private land tenure system that gives priority to the rights of individuals. Thus, it is important to bear in mind the possible bias in these responses, especially from scientific and bureaucratic groups.

Regarding the measurement of information quality, although EO data proxy identification for land tenure relations in North Korea seems to be strongly relevant to

respondents' research, policies and social interests, one of the issues that emerged from these findings is that many participants were suffered from consistent representation and interpretability of information. In other words, a multi-disciplinary training, a translation of the scientific language into the communicative style and continuous support and guidance on the subject and methods during the test is required to further investigate and confirm this finding.

5.6 Conclusion

The research question in this study sought to determine what extent does scientific, bureaucratic and stakeholder knowledge coincide with a set of identified proxies that would enable to conclude whether proposed proxies are scientifically valid, administratively relevant and contextualized and localized. Then, the findings from this study could be used to standardize the identification and categorization of certain objects, environments, and semantics visible in EO data that can (re-)interpret land tenure relations in North Korea for the preparation of Korean (re-)unification.

Of four different land tenure claims, both Chi-square and one-way ANOVA analysis revealed that the distributions of the opinions for the land ownership and land transfer rights identification across scientific experts, bureaucrats and stakeholders were different. Moreover, it was enabled to measure intrinsic, contextual, representational and accessibility attributes of comprehensive information regarding the associations between EO data and land tenure relations in North Korea from different viewpoints. From these, the further step towards enhancing and developing the existing account is clearly supported by the current findings on information quality.

The findings of this investigation complement those of earlier study on the conceptual and methodological development for a geospatially informed analysis in the land administration domain (Lee and de Vries, 2020). And these findings contribute in several ways to our understanding of how the pixel can be converted to technologically and socially acceptable land tenure knowledge. First, this would help us to establish a tailored validation protocol with a greater degree of accuracy and feasibility on the identification and interpretation of unknown land tenure relations derived from the EO data and various contextual information and a more nuanced view of socio-legal-spatial properties. Second, these findings based on knowledge co-production are relevant to both researchers and policy-makers as well as practitioners in the decision-making process of land tenure re-formalization and land governance re-arrangements in line with emerging geospatial technologies and datasets in the context of Korean (re-)unification. Furthermore, the methods used for this study may be applied to other cases elsewhere in the world

such as difficult-to-access regions or fragile and conflict-affected areas. Lastly, the present study contributes additional evidence that suggests the geospatially informed analysis emphasizing scientific validity, policy-relevance and social robustness within a responsible and smart land management framework. The geospatially informed analysis is not about how geospatial intelligence can directly detect information, but it is about how technology can support to better inform scientists, policymakers and stakeholders, smartly and responsibly, about the land issues.

Although the current study is based on a small sample of participants using a focus group questionnaire, this work offers valuable insights into new validation techniques for EO data in the land administration domain out of conventional practices which have already been formed and customized to the specific artefacts and validation objectives in the remote sensing community. Some may argue that this is potentially biased. However, the scope of this study was limited in terms of knowledge that participants have such as high-level of expertise (scientific), administrative involvements (bureaucratic) and ground-truthed knowledge with locales in geographic areas of interest (stakeholder). The limited number of samples adds further caution regarding the generalizability of these findings. Thus, further investigation and experimentation with qualitative methods and techniques would be of great help in understanding associations between EO data and land tenure claims. Considerably more work will need to be done to identify intrinsic linkages between geospatial data and land tenure relations. Then, next should concentrated on the development of EO data interpretation in line with artificial intelligence (AI) that delves deeper into the future of land administration.

Chapter 6. Conclusion

6.1 Introduction

Although extensive research has been carried out on the importance of land tenure and comprehensive land governance frameworks in the context of Korean (re-)unification, the existing accounts rarely provide robust and convincing evidence for the claim that how, where, why and when land tenure and land governance contribute to the unification process is still lacking. Despite its considerable discussion on the issues undertaken for the past decades, discriminatory and biased attitudes and values that land tenure and land governance in North Korea should be transformed, modified and integrated based on the South's standards are remained to be answered. Owing to the highly complex and variable nature of social-political and economic conditions before and after Korean unification, many suffers from a paucity of standardized methods that seek to identify the contextual factors, relationship and priorities that have a positive or negative impact on land tenure and land governance. What is important for us to recognize in this study, although the source of geospatial information has become relatively abundant, researchers and policymakers still have not been able to treat the data in much detail due to the limited access of substantial parts and no detailed investigation how to synthesize the data in line with the existing spatial knowledge and reasoning.

Returning to the question posed at the beginning of this study, it is now possible to state that 'responsible' and 'smart' land management frameworks are central to provide some support for building the theoretical and methodological premise across technology and society that cover key thematic accounts of the thesis: land tenure; land governance; land administration and; urban remote sensing. Overall, this study is set out to investigate the emerging role and significance of land tenure and land governance in the context of Korean unification by both reviewing empirical evidence and identifying the contextualized factors, relationship and priorities through the development of various methods, tools and techniques. **Chapter 2** identify what (re-)unification is and describing how, where land tenure could be significant in a (re-)unification process using the Context-Intervention-Mechanisms-Outcomes-Constraints (CIMOC) framework. In **Chapter 3**, it views land governance and (re-)unification from structuration theory and the government tools-based approach. Then, by employing embedded multiple case study to compare OCTS and OCOS approaches, the chapter evaluates how land governance re-arranged in a state restructuring process, exploring land governance and (re-)unification. The following chapters seek to standardize the identification and categorization of

certain objects, environments and semantics visible in earth observation (EO) data that can (re-)interpret land tenure relations by providing both conceptual and methodological accounts of geospatially informed analysis (**Chapter 4**) and empirical evidence through the validation process based on knowledge co-production (**Chapter 5**).

Based on the research objectives formulated in the proposition, **Chapter 6** not only synthesises the results from Chapters Two to Five and but also aims to address the issue of land tenure and land governance within the responsible and smart land management framework in the context of Korean unification. It also outlines policy recommendations for land managers who intends to engage decision-making for the realization of land tenure re-formalization and land governance re-arrangements in the Korean unification process.

6.2 Main Findings

6.2.1 Theoretical Foundations for Ascertaining Linkages, between Land Tenure and (Re-)unification Processes, Their Inter-relationship and Significance

The first objective (**RO1**) and research questions (**RQ1 & 2**) requires systematic approach that takes both the time sequence and a number of aspects based on patterns found in literature into account in order to identify and define the following discourses: under what conditions (C) do land tenure (I) influence the unification process (O), and what mechanisms operating under the influence of land tenure (M) frame the reunification process (O) with what constraints (C)? **Chapter 2** seeks to explain these aspects systematically with the Context-Intervention-Mechanisms-Outcomes-Constraints (CI-MOC) framework.

(Re-)unification is labelled as a formation process by which homogenous political communities merge from a previously divided country to a unitary nation. This process is not immediate. (Re-)unification will only occur as part of a continuum of consisting of five stages from pre-division, initial division and medium-term division and rapprochement to unification (see Figure 3). Within this continuum, various interactions occur, ranging from conflict, independence, coordination and integration. Thus, it can be inferring that the transformation of North and South Korea requires a fundamental change in societal thinking. Moreover, the integration processes during the Korean (re-)unification require unifying political and economic systems and institutions and restoring national homogeneity. Lastly, (re-)unification denotes the territorial reconnection providing the country with a physical basis for infrastructural development in the reunified

nation. To sum this up, the condition of (re-)unification (see Table 1) ultimately means the transformation of North and South Korea; integration of politics, economy and national identity of a single Korea and territorial development.

In this transformation process, land tenure interventions are a reforming instrument and land tenure functions part of the peacebuilding and integration process. In addition, land tenure plays a critical role through territorial capital in the territorial development process. The key findings of the research synthesis (see Table 2) rationalize the significance of land tenure in the (re-)unification process, especially emphasizing security and transferability in transforming, legitimacy and identity in the integration process and creating a people-oriented process mechanism in with territorial development. Thus, the possible outcomes and consequences in the (re-)unification process can be identified. Firstly, land tenure in a transformation reflects the market economy paradigm including increasing food security, awareness of social justice, promoting political health and high productivity in agriculture as well as spatial reconstruction of the nation. Secondly, land tenure through integration requires the protection of human rights, institution building, creating of greater marketization, poverty alleviation, mitigation of social exclusion, easy access to urban services, reshaping administrative justice and the strengthening human and technical resources, institutional structures and social and technical processes. Lastly, land tenure in territorial development denotes an economic productivity gain, improving market functions, increasing responsiveness to local livelihoods, connecting with broader dynamic authority, dealing with social inequality and environmental repercussions.

6.2.2 Analytical Skeletons for a Systematic Classification of Institutions and its Tools of Land Governance

This study fills a gap in the research on the evaluation of land governance arrangements in cases of (re-)unification and is the first investigation that employs structuration theory aligned with tools of government approach (**RO2**). The finding confirms and substantiates how the government (agency) interacts in response to transforming people-to-land relationship (structures) and which governmental tools (resources) were deployed within different institutional (re-)unification contexts (OCOS and OCTS) by reflecting the institutional extractions from the theoretical and practical parameters of the analysis (see the analytical framework on structural dimensions and tools of land governance in Figure 4).

Returning to the research questions (**RQ3 & 4**) posed at the beginning of this thesis, it is now possible to state that land governance has a pivotal role in transforming

institutional forms and functions during and after (re-)unification processes. The investigation of land governance re-arrangements in the German case as OCOS has shown that nodality-based tools in signification structures and authority-based tools in legitimization structures are widely implemented that have shown necessary transformation respectively following particular demands during and after (re-)unification (see Figure 7). On the other hand, the most obvious finding to emerge from the China-Hong Kong case as OCTS is that authority-based tools in legitimization structures were more likely to be considered than other land governance tools (see Figure 10).

The reasons for difference between OCOS and OCTS are clearly supported by the findings. Germany utilized ‘adaptive land governance’, aiming for fast-track transformation during and after the state restructuring process, and using ad-hoc administration to tackle new land governance problems. In contrast, the China-Hong Kong (re-)unification used hierarchical enforcement in re-arranging land governance, whereby central and local governments (including HKSAR) has the right to establish public land ownership combined with a leasehold system. This leads to a more gradual transformation of land governance. Moreover, concerning domination structures, the federal government in Germany established ‘multi-level’ land governance systems, involving government from both federal and local level, independent state agencies, to community-based voluntary organizations and regional cooperatives of former landowners and existing tenants. This enhanced rural development and created transparent land markets in particular. Instead, the China-Hong Kong transformation emphasizes ‘land fiscalization’ more, given that land has gradually become recognized as a main source of revenue for local governments in both China and HKSAR. In addition, ‘issue-and-project-based land governance’, i.e., addressing cross-boundary territorial problems in GPRD for accelerating ‘integrative territorial development’, was promoted.

The evidence from this finding in **Chapter 3** suggests that:

- When adopting adaptive land governance, governments should monitor and identify formidable obstacles in (re-)unification processes and then proactively or reactively manage them using authority-based tools in legitimization structures.
- When relying on hierarchical enforcement, legitimization structures require strong political leadership at different administrative levels, which gradually transform land governance as a long-term project.
- When adopting multi-level land governance, the government should endeavour to establish transparent land markets and land tenure security at the domination structure phase, include rural development as a priority of land governance

transformation, and build multi-layer check-and-balance mechanisms through which various stakeholders can contribute.

- Adopting issue-and-project-based land governance only works when fundamentally different institutional contexts and frameworks exist prior to (re-)unification. It is important to cope with cross-boundary infrastructure and economic development before changing land governance.

6.2.3 Methodological Premise for a Geospatially Informed Analysis to Synthesize Land Tenure Relations with EO Data in Land Administration

The third objective of the thesis seeks to develop a geospatially informed analysis method using a mixed methods design and information fusion approach in order to investigate when land tenure and earth observation (EO) data integration occurs, what types of EO data are integrated and how to integrate them (**RO3**). When answering research questions (**RQ5 & 6**) or testing relationship between proposed proxies and ground-truth, it is important to quantify recurring spatial attributes and uniformity or distinctiveness in qualitative data allowing rigorous analysis and to determine rational and optimal proxies. It is therefore considered that triangulation logic and information fusion approach would supplement and extend the methodological and epistemological assumptions of semantic land tenure relations through EO data interpretation.

A strong relationship between land tenure and EO data has been reported in **Chapter 4** and was possible to propose a new notion of remote-sensing based proxies for interpreting land tenure relations that could be transferable and applicable in land administration domain at a semantic level. Given documented insights into the nature of spatial arrangements and the similarities and patterns when observing in features of typical land use structures in North Korea, it was possible to derive proxies for particular types of land tenure from openly accessible EO data (see Table 8). This study strengthens the idea that data mining for North Korea related land (tenure) information in the context of Korean (re-)unification is possible and feasible.

The first set of questions aimed to address that whether the observed land is state or collective farmlands. There was no significant difference between two groups in both the general spatial arrangements in scope. However, I found that the location-specific features in line with physical and temporal characteristics helps to identify single objects on (dry) paddy fields. This is one of the most significant characteristics for detecting visually analogues arrangements of collective farmlands. On the other hand, what stands out in the state (farm) land is the combination of the geometric properties of objects characterizes a common feature of agriculture-based patches and infrastructures.

In order to assess the feasible proxies of LURs without having access to the ground, the different EO data sources have been utilized to not only detect LULC changes, but also ascertain a variety of dwellings and its morphological features. These EO data sets present a plausible interpretation with the association element that addresses the probable occurrence among different sets of entities as well as socio-legally documented local knowledge that leads to confirmation of LURs.

The cooperative farms under the collective ownership regime typically accompany a socialist morphology, with the unification of forms and construction. To distinguish whether individual or group-based LURs, proxies such as building geometry, arrangement pattern, and site characteristics could define multiple LURs of group over the same piece of land. The regular arrangement patterns of sites and building objects with other contextual knowledge is a common feature, thus representing group-based LURs that can be jointly used by the multiple groups of people.

Another question sought to determine whether there is LTRs or not. With respect to this subject, it was hypothesized that households reclaimed and cultivated vacant land as well as cleared the forests, and made transactions between households after illegal occupation. Based upon the normative concept of 'small-land (Sotoji)', the discernable proxies that prove the existence of LTRs with following elements of image interpretation: the low elevation, slopes have gentle slopes less than 15%, small and regular/irregular patches of vegetation cover, the length or width, location, colors and adjacency to the specific objects.

The combination of multiple man-made structures over a single parcel of land or entire property over the land provides some support for the conceptual premise. Although all land belongs to the State, both the State and the collectives can restrict the use by restricting the access for the public purpose. Among the elements of image interpretation, only site or situation elements are valid and reliable in detecting the public rights of way. I then came up with only few proxies by deriving similar site and situational features from nine images.

6.2.4 Empirical Strands for a Geospatially Informed Decision-making in Land Management

The research questions (**RQ7 & 8**) in this study sought to determine what extent does scientific, bureaucratic and stakeholder knowledge coincide with a set of identified proxies that would enable to conclude whether proposed proxies are scientifically valid, administratively relevant and contextualized and localized. The findings of this investigation complement those of earlier study on the conceptual and methodological

development for a geospatially informed analysis in the land administration domain presented in **Chapter 4**. In other words, the findings from **Chapter 5** could be used to standardize the identification and categorization of certain objects, environments, and semantics visible in EO data that can (re-)interpret land tenure relations in North Korea for the preparation of Korean (re-)unification (**RO3**).

The fourth objective (**RO4**) of the thesis is fulfilled using knowledge co-production methods that emphasize the collaborative and interactive process of synthesizing different sources and types of knowledge. Of four different land tenure claims, both Chi-square and one-way ANOVA analysis revealed that the distributions of the opinions for the land ownership and land transfer rights identification across scientific experts, bureaucrats and stakeholders were different. Moreover, it was enabled to measure intrinsic, contextual, representational and accessibility attributes of comprehensive information regarding the associations between EO data and land tenure relations in North Korea from different viewpoints.

Although differences of opinions still exist, the most obvious finding to emerge from the analysis is that it appears to be some agreement on the views, judgements and knowledge for proxy identification and measurement of information quality elicited from scientific, bureaucratic and stakeholder groups (see Figure 22). However, it is also possible that these results may not be generalizable to the detailed investigation into the study. Firstly, level of agreement of proxies for land ownership identification in the stakeholder group is much higher than other groups (see Table 10). This indicates a need to understand the different perceptions on land and land tenure that exist among North Korean defectors. Two discrete reasons emerged from this point. One reason for this difference may be that North Korean defectors has been associated with different land tenure system under the socialism and they can easily define and distinguish what collective and state (farm) land. Another possible explanation for this result may be the lack of adequate and empirical support as well as clarity in defining the term from different land management practices for South Korean researchers and governmental officials.

Secondly, although the findings should be interpreted with caution, it is likely that all knowledge groups have better sense and understanding of identifying land use rights from EO data proxies since the level of agreement observed in this investigation is little above than the average those observed of other claims (see Table 11). However, according to survey responses, some experts claim that it is only possible to assume changes in land institutions in North Korea that promote individual land uses rather than identifying land use rights with EO data. In addition, one of the respondents from stakeholder groups critically argues that there is a conceptual weakness on “individual” and no

individual land use right based on his/her work and educational experiences in North Korea until 2003.

The analysis of third land tenure claim suffers from a lower level of agreement in the knowledge groups that hinder ensuring its scientific validity, policy relevance and social robustness to the proxies for land transfer rights identification (see Table 12). However, questions have been raised about the reliability of reported data that whether the participants are able to provide clear, detailed and reliable assessment for the proxy validation. For example, for those who do not have either high-level of expertise on both land tenure and remote sensing or contextualized knowledge on the small land (sotoji) in North Korea, it is rather difficult to make associations between EO data and land transfer rights in North Korea. To further identify the proxies, a set of techniques and methods should be carried out such as Interviews, Focus Group Discussion (FGD), Nominal Group Technique, Q methodology, Delphi technique, and Multi-criteria Decision Analysis (MCDA).

Next, participants in different groups were asked to confirm and validate the pre-identified proxies for land access rights (see Table 13). Of the 77 participants who completed the questionnaire, nearly half of those surveyed reported that land access rights can be identified in line with EO data. Although the observed difference between the knowledge groups was not significant, this is perhaps the most unexpected finding since I assume that the notion of land access rights is largely derived from a private land tenure system that gives priority to the rights of individuals. Thus, it is important to bear in mind the possible bias in these responses, especially from scientific and bureaucratic groups.

Regarding the measurement of information quality, it seems possible that these results were likely to be expected (see Table 14, 15 & Figure 22). Although EO data proxy identification for land tenure relations in North Korea seems to be strongly relevant to respondents' research, policies and social interests, one of the issues that emerged from these finding is that many participants were suffered from consistent representation and interpretability of information. In other words, a multi-disciplinary training, a translation of the scientific language into the communicative style and continuous support and guidance on the subject and methods during the test is required to further investigate and confirm this finding.

6.3 Implications and Recommendations for Practice and Policy in the Responsible and Smart Land Management Framework

Previous chapters of the thesis have referred to insights on the emerging role and significance of land tenure and land governance in the context of Korean unification by

both investigating empirical evidence and identifying the contextualized factors, relationship and priorities through the development of various theoretical linkages, analytical tools and techniques and methodological premises. With all this knowledge now presented, it is now able to suggest several courses of actions for both policy and practice in the responsible and smart land management framework, but also as a starting point for the development of future research exploring the role of land tenure and land governance in contributing to Korean (re-)unification and further both difficult-to-access regions and fragile and conflict-affected areas.

6.3.1 Synthesis of Existing and Grounded Knowledge

The work presented here provides one of the first investigation into how to accumulate, synthesize, and disseminate existing knowledge on land tenure and land governance in the Korean (re-)unification context. With respect to this, accumulated knowledge and insights on land tenure, land governance, land administration and land management from the merger of a broad array of scholarly disciplines should be synthesized in both research and policy-making where there may be a high degree of uncertainty, over-generalizations, multifaceted stakeholder engagement, and the limited access to reliable data in the context of Korean (re-)unification. As discussed throughout the chapters, land tenure, land governance and a variety of land interventions are associated with peace-building processes and state transformation is strong and conclusive; however, in the Korean context, a systematic understanding of how land tenure and land governance contribute to the (re-)unification is still lacking. Although a great deal of theoretical, analytical, methodological and empirical accounts in this thesis has been discussed and suggested, other studies still tend to use these subjects separately from one another. This study should, therefore, be of value to researchers, policymakers and stakeholders wishing to develop a standardized model for synthesizing existing knowledge on land tenure and land governance in Korean (re-)unification and for further both difficult-to-access regions and fragile and conflict-affected areas. This will help engaged knowledge to deepen their understanding of inconsistencies in scattered evidence and can identify gaps in scientific and empirical evidence to define future land policy formulation and implementation and stakeholder interests.

One of the strengths of the synthesizing existing knowledge is that it represents a comprehensive examination of the whole concepts and discourses in terms of Korean unification, land tenure and land governance. For instance, North Korea and unification have been treated as subjective, fragmentary, and temporal objects rather than investigated and presented in an objective, empirical, systematic, and constant manner. In the

same vein, the subject on land tenure and land governance are linked to socio-technical, economic, institutional, legal and political aspects. Consequently, a variety of perspectives were expressed in this thesis from environmental sciences, geospatial sciences, international development, land administration and management, public administration and spatial planning and regional studies to economics, and peace and conflict research. In other words, a holistic approach has been taken place, integrating disparate viewpoints, materials and knowledge to consolidate and expand a knowledge base on this topic. In this regard, the methods used for this study may be applied to other researches, especially where the countries tend towards fragmentation and separation or integration and (re-)unification in the world or some countries where economies do not consistently render an account of internal data owing to conflict, lack of data capacity, or other reasons including quality of sources. Therefore, it is hoped that the synthesis of existing knowledge will also contribute to the knowledge translation process (e.g., voluntary guidelines; policy briefs; fact-finding projects etc.) for policymakers and practitioners by demonstrating and providing converging and consistent evidence for where unknown or unsupported land tenure and land governance exists.

6.3.2 Realization of Policy Implementation

Traditionally, policy implementation comprises of affirmative actions by engaged stakeholders toward achieving the goals laid out in prior policy decision-making and this incorporates not only one-off efforts to convert decision-making into operational terms but also continuing efforts to accompany the significant and subtle changes required by policy decisions (Van Meter & Van Horn, 1975). It has also been argued that policy implementation can be seen as a driving force behind social tensions generated between and within four components of implementing processes that embrace: idealized policy, implementing organization, target group, and environmental factors (Smith, 1973). Adopting a similar position, the combination of these components provides some support for the realization of policy implementation that encompass the outcomes of land interventions and policies, as well as more comprehensive social innovation approaches.

When it comes to the ‘unexpected’ or ‘intended’ occurrence of state transformation, socio-economic integration, and opportunities of spatial development in (re-)unification processes (tensions), the existing accounts are limited by weak policy design and a failure to address the question of: what are the idealized patterns of interaction that the policymakers attempt to induce in response to transforming people-to-land relationship (e.g., the idealized policy: land tenure re-formalization and land governance re-arrangements?); which and how policymakers are required to adapt the new pattern of

interaction (e.g., target group: resources of land governance such as nodality, authority, treasure, and organization) by the policy?; which organizations (e.g., implementing organizations: MoU; MOLIT; MOEF etc.) are responsible for the implementation of the policy among the various units of governmental bureaucracy? and; what factors (e.g., environmental factors: cultural, social, political, and economic conditions) can influence or be influenced by the policy implementation?.

In particular, this study sought to answer the questions aforementioned and makes a valuable contribution to the realization of policy implementation, especially focusing on land tenure re-formalization and land governance re-arrangements by providing the theoretical-analytical-methodological-empirical nexus for a better understanding of the institutional effectiveness of public actions and new modes of governance. In addition, it provides the most practical lenses to not only reveal similarities, differences, strengths and weaknesses of selected land interventions and policies, but also distinguish the environmental nature of instrumental choices with social innovation approaches. Thus, the finding makes an original contribution to the normative responsible and smart land management framework and provides the first comprehensive toolkit to assess, monitor and foster an responsible and smart decision-making for sustainable land management prior, during and after the reunification process.

6.3.3 Geospatial Technology to Meet the Societal Demands

The notion of responsible and smart land management has been a matter of ongoing discussion among smart use of information and communication technology (ICT) and informed and responsible decision-making concerning the impacts of land management interventions in both land management sciences and practices. Based on this line of argument, this present study has shed a contemporary light on the contentious issues of how the pixel (EO data) can be converted to technologically and socially acceptable land tenure knowledge and land governance practices. For the purpose of analysis, the notion of geospatially informed analysis has been developed that supports the smart and responsible land management framework.

The application of EO data involves image processing and data mining technologies which can help to generate a better insight in current land and property interests (such as land tenure, land rights, land responsibilities and duties related to land and properties), and to better prepare, execute, enforce, assess and monitor land interventions. In the context of (re-)unification, the sample tests are particularly relevant for re-uniting countries where different land tenure systems exist and where the data are not coherent. One way to overcome this challenge is to identify land tenure with the use of remote

sensing and open access aerial and satellite images. Normally, this technique is possible when having access to ground control points, civil registers and semantic interpretation of both the tenure and the people's components. When this information is however missing or this data source is unreliable—as is the case in North Korea—one has to rely on a number of assumptions and a set of test trials, which if proven right, can be generalized with artificial intelligence connected to image processing. In other words, one has to understand the socio-legal relations to land with pixel.

Despite of the claims of geospatially informed analysis, it still needs to be considered to clarify exactly what is important for us to meet the societal demand for the contention of 'better' approach. If the previously devised notion tends to focus on enriching administrative capacity, technical feasibility and financial affordability supported by smartness of geospatial technologies, the geospatially better-informed analysis further places an emphasis on three key kinds of validity for the responsible knowledge production taken from experts-driven, bureaucracy-centered and stakeholder-oriented decision-making process: scientific validity, policy relevance and social robustness. Building on critical insights from the geospatially informed analysis and its 'better' concerns, it enables us to address a gap between land tenure/land governance and EO data in a smart and responsible manner when significant uncertainty exists about data access, data integration and data reliability. So, to conclude, the geospatially better-informed analysis is not about how geospatial intelligence can directly detect information, but it is about how technology can support to better inform scientists, policymakers and stakeholders, smartly and responsibly, about the land issues.

6.4 Limitations of the Study

Several limitations to this study need to be acknowledged. First, such an investigation does not include various scenarios relating to transformation of land tenure and land governance in the unified Korea. However, previous research to date has tended to focus on a scenario planning approach; in particular, of all the options for both land tenure re-formalization and governance re-arrangement, most have only been carried out using discriminatory and biased attitudes and values rather than a balanced standpoint. To avoid such contention that reflects wishful thinking and illusions on North Korea's collapse and the Korean unification scenarios defining research scope and the content of the existing accounts, this work instead generates fresh insight into the current topics. This account does not consider more direct examples of (re-)unification except for Germany and China-Hong-Kong cases due to the time, budget and resource constraints. Moreover, I do not conclude which approaches for (re-)unification are appropriate for

land tenure re-formalization and land governance re-arrangements, since all countries have different historical contexts and institutional arrangements.

Although this study has recognized associations between EO data and land tenure/land governance, research has yet to fully investigate and develop most applicable and transferable proxies in land administration domain as well as a set of image interpretation techniques and AI-based algorithms. To validate identified proxies throughout the geospatially informed analysis, a small sample size was chosen because of the expected difficulty in obtaining high-level of expertise and most accurate understanding in a given context that significant uncertainty exists about geospatial and socio-economic data access, data integration and data reliability. It is still important to bear in mind the possible technological bias, methodological rationale and a lack of social sensing in the finding and implications. While evidence reviewed here seems to suggest qualitative methods that can be more useful for identifying and characterising the intrinsic value of stakeholder's knowledge, this still not yet been extensively applied.

6.5 Suggestions for Future Work

More research on this topic needs to be undertaken before the association between land tenure/land governance and unification is more clearly understood. There is a need for in-depth analysis of post-conflicts and (re-)unification case studies that how they have resolved or struggled land tenure and its governance issues. Moreover, a further research may suggest the concrete implementation measures of land tenure re-formalization and land governance re-arrangement according to possible (re-)unification formulas beyond the policy scenario mapping. In future investigations, it might be possible to use a more empirical qualitative analysis using such as interviews, focus group discussion, nominal group technique, Q methodology, Delphi technique, and multi-criteria decision analysis. Therefore, further empirical analysis is recommended to verify how and where the transformation processes are initiated and structured.

This socio-legalizing the pixel using the geospatially informed analysis is still largely an idea rather than an available set of techniques. In order to develop such techniques, which will ultimately facilitate the land tenure unification process in Korea, and possibly also improve existing land tenure records (including both public/private land rights, restrictions and responsibilities), one needs a collaborative research development. The limited number of samples adds further caution regarding the generalizability of these findings. Thus, further investigation and experimentation with qualitative methods and techniques would be of great help in understanding associations between EO data and land tenure claims. Considerably more work will need to be done to identify intrinsic linkages

between geospatial data and land tenure relations. Then, next should concentrated on the development of EO data interpretation in line with artificial intelligence (AI) that delves deeper into the future of land administration. Due to multi- and trans-disciplinary characteristics of the research, many stakeholders were suffered from consistent representation and interpretability of information. Therefore, a multi-disciplinary training, a translation of the scientific language into the communicative style and continuous support and guidance on the subject and methods during the test is required to further investigate and confirm this finding.

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Appendices

A. Questionnaire (English and Korean)

Section 1 (Selection of Proxy)

1.1 Land Ownership (LO)

1.1.1 Does the presence of (dry)paddy fields help to derive collective (farm) land ownership?

Yes (1) (2) *No*

1.1.2 Does the rough (or coarse) image texture that identifies (dry) paddy fields help to derive collective (farm) land ownership?

Yes (1) (2) *No*

1.1.3 Does the high density (or compactness) that identifies settlements help to derive collective (farm) land ownership?

Yes (1) (2) *No*

1.1.4 Does the object colours in grey scales that identify rural dwellings help to derive collective (farm) land ownership?

Yes (1) (2) *No*

1.1.5 Does a signature line of the tiled roof that identifies rural dwellings help to derive collective (farm) land ownership?

Yes (1) (2) *No*

1.1.6 Does a densely built-up structure with single-story detached houses that identify rural dwellings help to derive collective (farm) land ownership?

Yes (1) (2) *No*

1.1.7 Does the presence of portable farming-related objects help to derive collective (farm) land ownership?

Yes (1) (2) *No*

1.1.8 Does the observation of seasonal changes of agricultural activities help to derive collective (farm) land ownership?

Yes (1) (2) *No*

1.1.9 Does the small dot-shaped patch that identifies orchards help to derive state (farm) land ownership?

Yes (1) (2) *No*

1.1.10 Does the smooth texture that identifies pastures help to derive state (farm) land ownership?

Yes (1) (2) *No*

1.1.11 Does the out-buildings that identify warehouses (or sheds) help to derive state (farm) land ownership?

Yes (1) (2) *No*

1.1.12 Does the low density (or compactness) that identifies buildings (sites) help to derive state (farm) land ownership?

Yes (1) (2) *No*

1.1.13 Does the complex, elongate, or irregular boundaries that identify buildings (sites) help to derive state (farm) land ownership?

Yes (1) (2) *No*

1.1.14 Does the blue, green, yellow, and red and light (brightness) colours that identify roofs help to derive state (farm) land ownership?

Yes (1) (2) *No*

1.1.15 Does the presence of agricultural/monumental/welfare infrastructures help to derive state (farm) land ownership?

Yes (1) (2) *No*

1.2 Land Use Rights (LURs)

1.2.1 Do land use and land cover changes by intense land development help to derive individual land use rights?

Yes (1) (2) *No*

1.2.2 Do land use and land cover changes by the increase of agricultural land help to derive individual land use rights?

Yes (1) (2) *No*

1.2.3 Do land use and land cover changes of urban areas with the development of water bodies help to derive individual land use rights?

Yes (1) (2) *No*

1.2.4 Do land use and land cover changes in border regions than inland areas help to derive individual land use rights?

Yes (1) (2) *No*

1.2.5 Does the presence of diverse types of houses/allotments help to derive individual land use rights?

Yes (1) (2) *No*

1.2.6 Does the low building density that identifies (semi-)detached houses help to derive individual land use rights?

Yes (1) (2) *No*

1.2.7 Does the 1 or 2 story houses that identify (semi-)detached houses help to derive individual land use rights?

Yes (1) (2) *No*

1.2.8 Does the uniformly shaped settlement that identifies (semi-)detached houses help to derive individual land use rights?

Yes (1) (2) *No*

1.2.9 Do the (semi-)detached houses in close proximity to roads help to derive individual land use rights?

Yes (1) (2) *No*

1.2.10 Does the (semi-)detached houses with low to intermediate imperviousness help to derive individual land use rights?

Yes (1) (2) *No*

1.2.11 Does the large rectangular simple form of apartments help to derive individual land use rights?

Yes (1) (2) *No*

1.2.12 Does the regular alignment that identifies apartments help to derive individual land use rights?

Yes (1) (2) *No*

1.2.13 Does more than three stories that identify apartments help to derive individual land use rights?

Yes (1) (2) *No*

1.2.14 Does the low to intermediate imperviousness that identifies apartments help to derive individual land use rights?

Yes (1) (2) *No*

1.2.15 Does the shadow silhouettes that identify apartments help to derive individual land use rights?

Yes (1) (2) *No*

1.2.16 Do the allotments detached small-sized buildings help to derive individual land use rights?

Yes (1) (2) *No*

1.2.17 Do the allotments on low built-up land help to derive individual land use rights?

Yes (1) (2) *No*

1.2.18 Do the allotments with low imperviousness help to derive individual land use rights?

Yes (1) (2) *No*

1.2.19 Do the allotments that have a buffer between houses help to derive individual land use rights?

Yes (1) (2) *No*

1.2.20 Do the harmonica houses (in rural regions) with small roof with slate materials help to derive individual land use rights?

Yes (1) (2) *No*

1.2.21 Do the harmonica houses (in rural regions) with chimneys (small dot-shaped objects/light shadow silhouette) help to derive individual land use rights?

Yes (1) (2) *No*

1.2.22 Do the harmonica houses (in rural regions) with fences (line-shaped objects) help to derive individual land use rights?

Yes (1) (2) *No*

1.2.23 Does the observation of new construction or extension of residential buildings help to derive individual land use rights?

Yes (1) (2) *No*

1.2.24 Does the observation of expansion of construction activities help to derive individual land use rights?

Yes (1) (2) *No*

1.2.25 Does the presence of amalgamation of diverse community amenities help to derive group land use rights?

Yes (1) (2) *No*

1.2.26 Does the multiple building objects with similar patterns that identify land conversion in collective use help to derive group land use rights?

Yes (1) (2) *No*

1.2.27 Does the high density of settlement that identifies land conversion in collective use help to derive group land use rights?

Yes (1) (2) *No*

1.2.28 Does the simple rectangular forms of buildings that identifies land conversion in collective use help to derive group land use rights?

Yes (1) (2) *No*

1.2.29 Does the same roof colours of buildings that identifies land conversion in collective use help to derive group land use rights?

Yes (1) (2) *No*

1.2.30 Does the observation of construction/extension of community infrastructure help to derive group land use rights?

Yes (1) (2) *No*

1.2.31 Does the accessibility with the increase of paved roads and wider widths help to derive group land use rights?

Yes (1) (2) *No*

1.2.32 Does the newly built greenhouses in a barren land and adjacent to dwellings help to derive group land use rights?

Yes (1) (2) *No*

1.2.33 Do the newly built greenhouses with light object colours/white or grey coloured roofs/rough texture help to derive group land use rights?

Yes (1) (2) *No*

1.2.34 Does the presence of the increased number of houses in a certain vicinity with high- density help to derive group land use rights?

Yes (1) (2) *No*

1.2.35 Does the presence of undivided shared areas of the common property help to derive group land use rights?

Yes (1) (2) *No*

1.3 Land Transfer Rights (LTRs)

1.3.1 Does the presence of small land (sotoji) help to derive land transfer rights?

Yes (1) (2) *No*

1.3.2 Does the garden plot (GP) with a small parcel size help to derive land transfer rights?

Yes (1) (2) *No*

1.3.3 Does the garden plot (GP) in front/back yards or attached to each other help to derive land transfer rights?

Yes (1) (2) *No*

1.3.4 Does the garden plot (GP) with green colours help to derive land transfer rights?

Yes (1) (2) *No*

1.3.5 Does the side-job plot (SJP) with large parcel sizes help to derive land transfer rights?

Yes (1) (2) *No*

1.3.6 Does the side-job plot (SJP) in front/back yards or attached to each other help to derive land transfer rights?

Yes (1) (2) *No*

1.3.7 Does the side-job plot (SJP) with green colours help to derive land transfer rights?

Yes (1) (2) *No*

1.3.8 Does the tiny patch of land (TPL) with lower elevation help to derive land transfer rights?

Yes (1) (2) *No*

1.3.9 Does the tiny patch of land (TPL) with gentle slope less than 15% help to derive land transfer rights?

Yes (1) (2) *No*

1.3.10 Does the tiny patch of land (TPL) with small patches of vegetation cover between neighbouring lands help to derive land transfer rights?

Yes (1) (2) *No*

1.3.11 Does the tiny patch of land (TPL) on the hillsides or along the streams or ditches help to derive land transfer rights?

Yes (1) (2) *No*

1.4 Land Access Rights (LARs)

1.4.1 Does the public utility networks/nature reserves/heritage sites in closer proximity to hazardous or isolated location help to derive land access rights?

Yes (1) (2) *No*

1.4.2 Does the public utility networks/nature reserves/heritage sites with limited access to roads and low to intermediate imperviousness help to derive land access rights?

Yes (1) (2) *No*

1.4.3 Does the public utility networks/nature reserves/heritage sites with elongated object shapes help to derive land access rights?

Yes (1) (2) *No*

1.4.4 Does the public utility networks/nature reserves/heritage sites with fewer green colours and rough textures help to derive land access rights?

Yes (1) (2) *No*

1.4.5 Does the observation of subdivision of land parcels help to derive land access rights?

Yes (1) (2) *No*

Section 2 (Measurement of Information Quality)

2.1 Is this information believable?

Strongly agree (1) (2) (3) (4) (5) *Strongly disagree*

2.2 Is this information sufficiently complete for the needs?

Strongly agree (1) (2) (3) (4) (5) *Strongly disagree*

2.3 Is this information correct?

Strongly agree (1) (2) (3) (4) (5) *Strongly disagree*

2.4 Is it easy to interpret what this information means?

Strongly agree (1) (2) (3) (4) (5) *Strongly disagree*

2.5 Is this information objectively collected?

Strongly agree (1) (2) (3) (4) (5) *Strongly disagree*

2.6 Is this information relevant to the subject?

Strongly agree (1) (2) (3) (4) (5) *Strongly disagree*

2.7 Is this information sufficiently timely?

Strongly agree (1) (2) (3) (4) (5) *Strongly disagree*

2.8 Is this information easy to understand?

Strongly agree (1) (2) (3) (4) (5) *Strongly disagree*

Section 3 (participants characteristics)

3.1 What is your sex/gender?

- (1) Male
- (2) Female

3.2 Into which age category do you fit?

- (1) 30 years or younger
- (2) 31 ~ 50 years
- (3) 51 years or older

3.3 What is your completed educational level?

- (1) Middle-level applied – apprenticeship or certificate
- (2) Higher vocational – Bachelor's degree
- (3) Higher academic – Master's degree
- (4) Postgraduate academic - PhD

3.4 How long have you worked professionally?

- (1) 0 ~ 5 years
- (2) 6 ~ 10 years
- (3) 10 or more years

3.5 What sectors do you work in?

- (1) Scientific – academic/research institutions or independent researchers
- (2) Bureaucratic – (state/local) government professionals and officials
- (3) Stakeholder – North Korean defectors

Thank You for your cooperation!

위성 영상을 통한 북한 토지 권리 관계 입증에 관한 연구

안녕하십니까?

먼저, 본 연구를 위하여 귀하의 소중한 시간을 내주셔서 감사합니다. 응답해 주신 내용은 연구의 귀중한 자료가 되오니 바쁘시더라도 한 문항도 빠짐없이 성실하게 답변해주시기를 부탁드립니다.

본 연구의 목적은 최근 미국 (NASA)과 유럽 (ESA)의 항공우주국 등에서 제공하는 고해상도의 인공위성 영상 및 구글과 네이버 지도와 같이 무료로 이용할 수 있는 인공위성 영상 등을 활용하여 우리가 잘 알지 못하는 북한의 토지 권리 관계를 예측하고 확인하려는 것입니다.

*토지 권리 관계: 북한에서 개인 또는 국가가 토지를 소유할 수 있는 권리, 토지를 이용할 수 있는 권리, 토지를 거래할 수 있는 권리, 그리고 토지에 접근할 수 있는 권리로 구분하여 연구를 진행하고 있습니다.

한편, 북한의 토지 권리 관계를 실제로 확인할 수 있는 북한의 토지대장 및 지적도와 같은 자료가 존재하지 않는 것을 전제로 본 연구의 유효성을 검증하고자 다음의 설문을 진행하고자 합니다.

본 연구는 토지, 원격탐사 그리고 통일분야의 전문 지식을 가지고 있는 교수/연구원, 공사/공무원, 그리고 북한의 토지 제도 및 관습을 직접적으로 경험해 본 북한이탈주민을 대상으로 진행합니다.

귀하께서 본 연구의 참여에 동의하시는 경우, 설문조사가 진행됩니다.

(섹션 2-5) 먼저, 본 연구는 이미 인공위성 영상 해석 기준을 통해서 북한의 토지 권리 관계를 알아내는데 도움이 되는 66가지의 지표를 마련하였습니다. 따라서 참여자분께서는 자신의 경험 및 지식을 토대로 각 설문에서 제시된 지표에 동의를 하신다면 "예" 그리고 동의하지 않는다면 "아니오"를 선택해 주시면 됩니다.

(섹션 6) 그리고 본 설문에서 제시된 인공위성 영상을 통해 북한의 토지 권리 관계를 확인하는 연구 방법 및 정보에 대한 점수를 "1점 (전혀 그렇지 않다)"에서 5점(매우 그렇다)" 사이에서 응답 해주시면 됩니다.

(섹션 7) 마지막으로, 응답자의 인적 사항 (성별, 연령, 학력, 업무)에 대해 응답해주시면 설문이 마무리가 됩니다.

설문은 약 10~15분 정도 소요됩니다. 본 설문조사는 비밀보장을 위해 무기명으로 진행되며, 조사된 내용은 본 연구 목적 외에는 사용하지 않음을 약속드립니다.

귀하께서는 설문을 제출했다라도 특별한 사유와 설명 없이도 연구 참여를 철회하실 수 있습니다. 철회를 원하시는 경우에는 설문조사를 진행한 날로부터 1주일 이내로 아래 기재된 연락처를 통해 연락주시기 바랍니다. 이 경우 해당 데이터는 본 연구에 포함되지 않음을 약속드립니다.

귀하의 설문조사를 통하여 확보된 데이터는 연구가 마무리 된 이후에도 본 연구자에 의하여 유지·보관됨을 알려드립니다. 연구가 마무리 된 이후, 귀하의 요청에 따라서 연구결과의 요약

본을 이용하실 수 있습니다.

문의 사항이 있는 경우, 아래의 연락처로 연락 부탁드립니다.

2020년 6월

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* Required

설문 응답 요령

- 서로 유사하거나 비슷하다고 생각되는 질문이라도 한 문항도 빠짐없이 응답해 주십시오.
- 귀하의 귀중한 시간과 노력이 헛되지 않도록 훌륭한 연구로 보답하고자 하오니 마지막 페이지까지 응답을 부탁드립니다.
- 대단히 감사드립니다.

1. 토지 소유 권 (Land Ownership)

본 섹션은 북한의 토지 소유에 대한 권리 여부를 예측하기 위해 도움이 될 것으로 판단한 지표의 동의 여부에 따라 '네' 혹은 '아니오' 로 응답해 주시기 바랍니다. 한편, 북한의 토지 권리 관계를 실제로 확인할 수 있는 북한의 토지대장 및 지적도와 같은 자료가 존재하지 않는 것을 전제로 설문에 응답해 주시면 됩니다. 단, 추가적인 설명이나 언급되지 않은 새로운 데이터 혹은 아이디어의 제안을 원할 경우, 각 문항의 기타(other)란에 작성해 주시기 바랍니다.

주요 용어 설명

- 협동농장: 토지 및 생산수단의 협동적 소유에 바탕을 둔 농장으로서 주로 쌀, 옥수수, 콩, 감자 등과 같은 주요 식량 및 농산물을 생산
- 국영농장: 북한의 토지개혁 및 농업협동화 과정에서 농장, 목장, 과수원 등을 국가 소유화한 농장으로서 주로 종자, 종축, 축산물, 특수작물 등을 생산
- 문화주택: 주로 농촌에 건설된 개량주택으로서 주로 방 2개에 부엌과 창고가 딸려 있음

샘플 이미지 1 ((a) 북한의 평안남도 온천군에 위치한 은하 협동농장; (b) 협동 농장 내 계획된 공간 배열과 건물과 주거지의 중앙집중화; (c) 협동 농장 내 유사한 자재를 사용한 건물과 주거지 그리고 유사한 건물의 형태 및 단순한 지붕 구조; (d) 협동 농장 내 관개 수로와 논, 밭의 표면



샘플 이미지 2 ((a) 북한 양강도의 대흥단군에 위치한 제5호 국영농장; (b) 화학비료 생산 공장, 농업관련 대학 및 연구 기반시설, 혁명박물관과 같은 역사 기념 건물 그리고 문화, 시장, 상점 및 유치원과 같은 복지 시설 등이 위치해 있음; (c) 복합비료공장 (위쪽)과 농사시험장 및 비닐하우스 (중간); (d) 감자생산공장



1. 1.1 위성 영상에서 협동 농장 내의 논과 밭을 통해 (농장)토지의 공동 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니요
- Other: _____

2. 1.2 위성 영상에서 협동 농장 내에 "이미지 상의 거친 재질의 표면"으로 나타나는 논밭을 통해 (농장)토지의 공동 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니요
- Other: _____

3. 1.3 위성 영상에서 협동 농장 내에 건물의 밀도가 높은 지역을 통해 (농장)토지의 공동 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니요
- Other: _____

4. 1.4 위성 영상에서 협동 농장 지역 내에 회색으로 보이는 건물로 나타나는 농촌 주거지 (예: 문화 주택) 를 통해 (농장)토지의 공동 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니요
- Other: _____

5. 1.5 위성 영상에서 협동 농장 지역 내에 기와 지붕 선형으로 나타나는 농촌 주거지 (예: 문화 주택)를 통해 (농장)토지의 공동 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니요
- Other: _____

6. 1.6 위성 영상에서 협동 농장 내의 촘촘한 구조의 1층 단독 주택으로 나타나는 농촌 주거지 (예: 문화 주택)를 통해 (농장)토지의 공동 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니요
- Other: _____

7. 1.7 위성 영상에서 협동 농장 지역 내에 있는 농업 생산활동과 관련된 장비 및 물품을 통해 (농장)토지의 공동 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니요
- Other: _____

8. 1.8 위성 영상에서 협동 농장 지역 내에서 파악할 수 있는 계절별 농업 생산 활동의 변화를 통해 (농장)토지의 공동 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니요
- Other: _____

9. 1.9 위성 영상에서 국영 농장 지역 내에 작은 점 모양으로 나타나는 과수원을 통해 (농장)토지의 국가 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

10. 1.10 위성 영상에서 국영 농장 지역 내에 매끄러운 질감을 통해 식별되는 목장을 통해 (농장)토지의 국가 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

11. 1.11 위성 영상에서 국영 농장 내에 집이나 농장 등에 속하는 작은 별채의 건물을 통해 식별되는 창고는 (농장)토지의 국가 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

12. 1.12 위성 영상에서 국영 농장 내에 밀도가 낮은 건물 및 그 부지를 통해 (농장)토지의 국가 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

13. 1.13 위성 영상에서 국영 농장 내에 복잡하거나, 길고 불규칙한 경계를 통해 식별된 건물 및 그 부지를 통해 (농장)토지의 국가 소유 여부를 알 수 있다고 생각하십니까? *

*

Mark only one oval.

- 네
- 아니오
- Other: _____

14. 1.14 위성 영상에서 국영 농장 내에 파란색, 녹색, 노란색, 빨간색 및 밝은 색상을 보이는 건물 (e.g. 공업용/상업용/주거용)의 지붕을 통해 (농장)토지의 국가 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

15. 1.15 위성 영상에서 국영 농장 내에 농업, 기념 및 역사, 복지 관련 기반시설을 통해 (농장)토지의 국가 소유 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

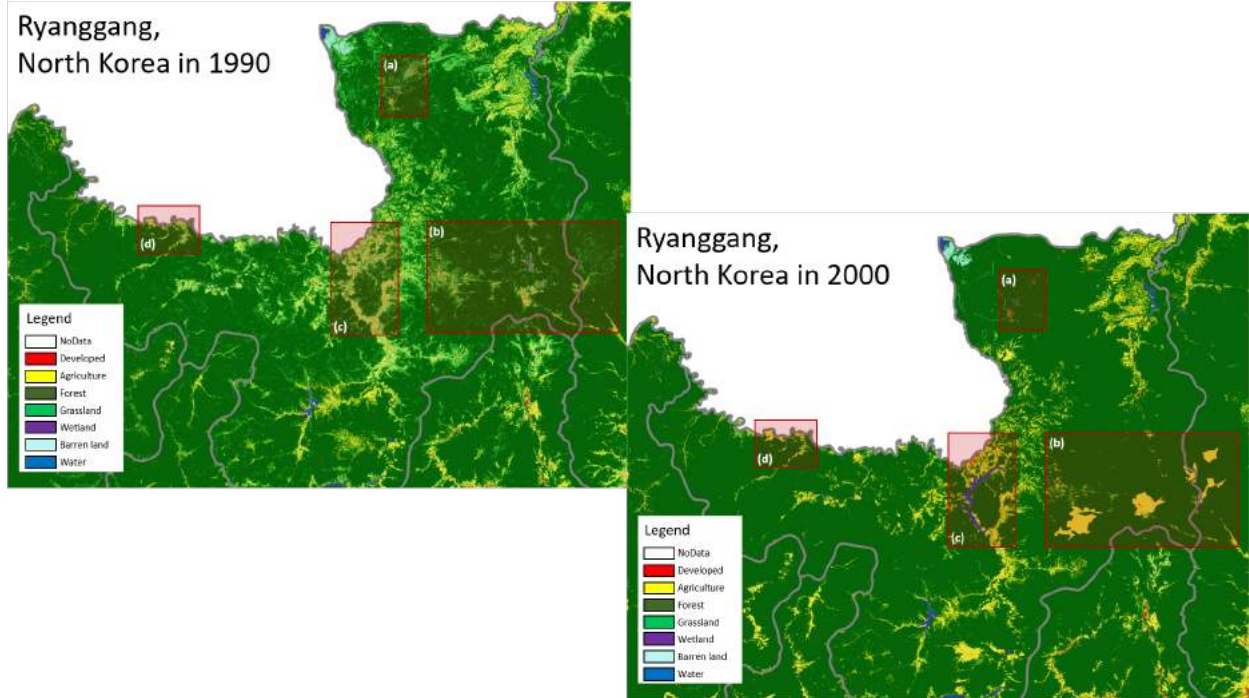
2. 토지 이용권 (Land Use Rights)

본 섹션은 북한의 토지 이용에 대한 권리 여부를 예측하기 위해 도움이 될 것으로 판단한 원격 탐사 데이터의 유효성 등의 여부에 따라 '네' 혹은 '아니오' 로 응답해 주시기 바랍니다. 한편, 북한의 토지 권리 관계를 실제로 확인할 수 있는 북한의 토지대장 및 지적도와 같은 자료가 존재하지 않는 것을 전제로 질문에 응답해 주시면 됩니다. 단, 추가적인 설명이나 언급되지 않은 새로운 데이터 혹은 아이디어의 제안을 원할 경우, 각 문항의 기타(other)란에 작성해 주시기 바랍니다.

주요 용어 설명

- 하모니카 주택: 북한의 일반 주민들이 가장 많이 살고 있는 방하나 부엌하나가 딸린 집. 옆으로 긴 다세대 주택의 모양이 하모니카처럼 생겨 하모니카주택으로 불림

샘플 이미지 1 (양강도 토지 이용 변화 1990-2000)



샘플 이미지 2 (위성영상을 통해 볼 수 있는 북한의 다양한 종류의 주택 및 그 형태; (a) 아파트와 주거용 공동주택단지; (b) 단독 주택; (c) 연립 주택; (d) 선형, 곡선형, 사각형의 주택 형태 및 다양한 지붕 색상 등의 주택의 다양한 형태 표현)



샘플 이미지 3 (a) 와 (b) 북한 함경북도의 경원군의 새별 협동농장에서 나타나는 사회주의 생활방식의 도시 형태 및 구조 변화, 2002-2018; (c) 농경지에서 주거지로의 토지 이용 변화 관찰; (d) 공동기반시설을 위한 토지 이용 변화 관찰; (e) 새롭게 건설된 농업 시설 관찰; (f) 밀도가 높은 주거용지로의 변화 관찰)



16. 2.1 위성 영상에서 집중적인 개발을 통해 나타나는 토지의 이용 변화를 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

17. 2.2 위성 영상에서 농경지의 증가에 따른 토지 이용의 변화를 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

18. 2.3 위성 영상에서 관개시설(호수,저수지,댐 등)이 발달된 도시지역의 토지 이용의 변화를 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

19. 2.4 북한의 내륙지역보다는 접경지역의 토지 이용의 변화가 개인의 토지 이용권 여부를 알 수 있는데 용이하다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

20. 2.5 위성 영상에서 다양한 유형의 주택 및 정원과 마당의 존재를 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

21. 2.6 위성 영상에서 주로 밀도가 낮은 단독 및 연립 주택을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

22. 2.7 위성 영상에서 주로 1~2층으로 나타나는 단독 및 연립 주택을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

23. 2.8 위성 영상에서 주로 균일한 형태의 주택 단지로 나타나는 단독 및 연립 주택을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

24. 2.9 위성 영상에서 주로 도로와 가까운 곳에 위치한 것으로 나타나는 단독 및 연립 주택을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

25. 2.10 위성 영상에서 주로 도로 포장율이 중간 이하인 단독 및 연립 주택을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

26. 2.11 위성 영상에서 주로 직사각형의 단순한 형태로 나타나는 아파트를 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

27. 2.12 위성 영상에서 주로 균일하게 배열된 형태로 나타나는 아파트는 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

28. 2.13 위성 영상에서 3층 이상의 건물로 나타나는 아파트는 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

29. 2.14 위성 영상에서 주로 도로 포장율이 중간 이하인 아파트를 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

30. 2.15 위성 영상에서 그림자 실루엣으로 식별되는 아파트를 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

31. 2.16 위성 영상에서 소규모 건물에 딸려 있는 마당 혹은 정원 등을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

32. 2.17 위성 영상에서 건물이 들어선 토지에 있는 마당 혹은 정원 등을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

33. 2.18 위성 영상에서 도로 포장율이 적은 마당 혹은 정원 등을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

34. 2.19 위성 영상에서 주택 사이의 공터에 있는 마당 혹은 정원 등을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

35. 2.20 위성 영상에서 석면 슬레이트 자재로 된 작은 지붕으로 식별되는 하모니카 주택 (농촌 지역)을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

36. 2.21 위성 영상에서 작은 점 모양의 물체 및 그림자 실루엣을 통해 굴뚝으로 식별되는 하모니카 주택 (농촌 지역)을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

37. 2.22 위성 영상에서 선형으로 나타나는 울타리 (담장)로 식별되는 하모니카 주택 (농촌 지역)을 통해 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

38. 2.23 위성 영상에서 주거용 건물의 신축 및 증축의 관찰을 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

39. 2.24 위성 영상에서 주택 및 시설물 건설의 증가를 통해 개인의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

40. 2.25 위성 영상에서 다양한 공동 편의 시설에 결합된 토지를 통해 공동 (혹은 집단)의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

41. 2.26 위성 영상에서 유사한 패턴을 가진 복수의 신규 건축물의 출현은 토지의 용도 전환을 의미하고, 이는 공동 (혹은 집단)의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

42. 2.27 위성 영상에서 높은 밀도의 신규 거주지의 출현은 토지의 용도 전환을 의미하고, 이는 공동 (혹은 집단)의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

43. 2.28 위성 영상에서 단순한 직사각형 형태의 신규 건축물은 토지의 용도 전환을 의미하고, 이는 공동 (혹은 집단)의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

44. 2.29 위성 영상에서 지붕의 동일한 색상 변화는 토지의 용도 전환을 의미하고, 이는 공동 (혹은 집단)의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

45. 2.30 위성 영상에서 공동기반시설의 건설 및 확장을 통해 공동 (혹은 집단)의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

46. 2.31 위성 영상에서 포장도로의 증가와 넓어진 도로 폭으로 나타나는 향상된 교통의 접근성을 통해 공동 (혹은 집단)의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

47. 2.32 위성 영상에서 버려진 토지 및 주거지와 인접해 있는 곳에 새로 지어진 비닐하우스를 통해 공동 (혹은 집단)의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

48. 2.33 위성 영상에서 가벼운 색상 혹은 흰색과 회색의 지붕 그리고 거친 질감으로 나타나는 비닐하우스를 통해 공동 (혹은 집단)의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

49. 2.34 위성 영상에서 고밀도 주택이 특정 지역에 증가하는 현상을 통해 공동 (혹은 집단)의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

50. 2.35 위성 영상에서 분할되지 않은 공유 지역의 존재를 통해 공동 (혹은 집단)의 토지 이용권 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

3. 토지 거래권 (Land Transfer Rights)

본 섹션은 북한의 토지 거래에 대한 권리 여부를 예측하기 위해 도움이 될 것으로 판단한 원격 탐사 데이터의 유효성 등의 여부에 따라 '네' 혹은 '아니오' 로 응답해 주시기 바랍니다. 한편, 북한의 토지 권리 관계를 실제로 확인할 수 있는 북한의 토지대장 및 지적도와 같은 자료가 존재하지 않는 것을 전제로 질문에 응답해 주시면 됩니다. 단, 추가적인 설명이나 언급되지 않은 새로운 데이터 혹은 아이디어의 제안을 원할 경우, 각 문항의 기타(other)란에 작성해 주시기 바랍니다.

주요 용어 설명

- 소토지: 개인이 경작 가능한 토지를 의미하며, 텃밭, 부업밭, 돼기밭을 포함한다. 이를 통해 수확한 생산물은 개인 소유임
- 텃밭: 농가의 앞마당이나 농가와 농가 사이의 빈터에 만들어진 개별 농가 단위의 경작지를 의미
- 부업밭: 개간되지 않은 척박한 땅을 개간하여 경작하는 집단 단위의 경작지를 의미
- 돼기밭: 불법적 사적 경작지로서 매우 작은 규모의 개인 단위의 농지를 의미

샘플 이미지 (소토지의 특징; (a) 북한의 온송과 삼봉 사이에서 개간되지 않은 땅을 개간한 소토지로서 주로 산비탈 지역에 위치; (b) 북한 평원군의 삼봉협동농장에 위치한 소토지로서 주택의 앞마당과 뒷마당에 주로 위치; (c) 북한의 양강도 해산에 위치한 소토지로서 개울과 도랑 주변에 위치)



51. 3.1 위성 영상에서 소토지의 존재를 통해 토지 거래권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

52. 3.2 위성 영상에서 필지의 규모가 작은 것으로 보이는 텃밭을 통해 토지 거래권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

53. 3.3 위성 영상에서 주택의 앞/뒷 마당에 있거나 서로 붙어 있는 것으로 보이는 텃밭을 통해 토지 거래권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

54. 3.4 위성 영상에서 주로 녹색으로 보이는 텃밭을 통해 토지 거래권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

55. 3.5 위성 영상에서 필지의 규모가 큰 것으로 보이는 부업밭을 통해 토지 거래권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

56. 3.6 위성 영상에서 주택의 앞/뒷 마당에 있거나 서로 붙어 있는 것으로 보이는 부업밭을 통해 토지 거래권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

57. 3.7 위성 영상에서 주로 녹색으로 보이는 부엽밭을 통해 토지 거래권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

58. 3.8 위성 영상에서 해발이 높지 않은 곳에 위치하는 뚝기밭을 통해 토지 거래권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

59. 3.9 위성 영상에서 경사가 약 15% 안팎의 완만한 곳에 위치하는 뚝기밭을 통해 토지 거래권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

60. 3.10 위성 영상에서 인접 토지 사이에서 녹지로 덮인 작은 표면으로 보이는 뚝기밭을 통해 토지 거래권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

61. 3.11 위성 영상에서 산비탈 및 개울 혹은 도랑을 따라 위치하는 돼기밭을 통해 토지 거래권의 여부를 알 수 있다고 생각하십니까? *

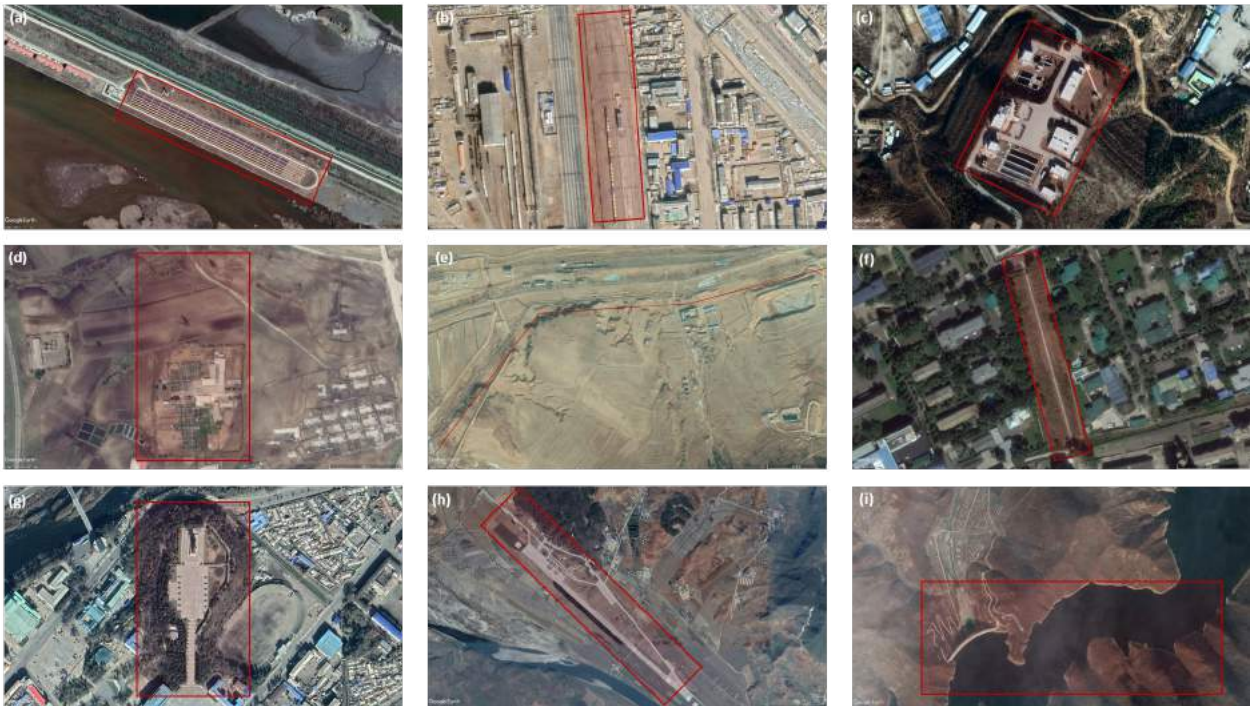
Mark only one oval.

- 네
- 아니오
- Other: _____

4. 토지 접근권 (Land Access Rights)

본 섹션은 북한의 토지 접근에 대한 권리 여부를 위해 도움이 될 것으로 판단한 원격 탐사 데이터의 유효성 동의 여부에 따라 '네' 혹은 '아니오' 로 응답해 주시기 바랍니다. 한편, 북한의 토지 권리 관계를 실제로 확인할 수 있는 북한의 토지대장 및 지적도와 같은 자료가 존재하지 않는 것을 전제로 설문에 응답해 주시면 됩니다. 단, 추가적인 설명이나 언급되지 않은 새로운 데이터 혹은 아이디어의 제안을 원할 경우, 각 문항의 기타(other)란에 작성해 주시기 바랍니다.

샘플 이미지 ((a) 북한 금산포 태양발전소에 있는 태양광 패널; (b) 북한 라진에 있는 기차역 및 철로; (c) 북한의 개성에 있는 식수생산시설; (d) 북한 세포에 위치한 전력발전소 내의 송전탑; (e) 북한 라선의 승리 석유화학단지에서 위치한 송유관; (f) 북한 평양의 외교관 주거단지에 위치한 오솔길; (g) 북한의 해산에 있는 기념탑; (h): 북한 북창의 군용 공항; (i) 북한의 용림에 있는 저수지)



62. 4.1 위성 영상에서 위험하거나 다소 격리된 지역에 위치하는 수도/전기/가스 시설물, 자연보호구역, 문화유산보호지역 등을 통해 토지 접근권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

63. 4.2 위성 영상에서 도로 접근성이 제한되고, 도로 포장율이 중간 이하인 수도/전기/가스 시설물, 자연보호구역, 문화유산보호 지역 등을 통해 토지 접근권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

64. 4.3 위성 영상에서 주로 객체의 모양이 길게 보이는 수도/전기/가스 시설물, 자연보호구역, 문화유산보호 지역 등을 통해 토지 접근권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

65. 4.4 위성 영상에서 주로 적은 녹지 지역 (녹색)과 표면이 거친 재질로 보이는 수도/전기/가스 시설물, 자연보호구역, 문화유산보호 지역 등을 통해 토지 접근권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

66. 4.5 위성 영상에서 필지 분할의 관찰을 통해 토지 접근권의 여부를 알 수 있다고 생각하십니까? *

Mark only one oval.

- 네
- 아니오
- Other: _____

5. 설문 정보의 질 측정 (Measurement of Information Quality)

본 섹션은 본 설문에서 제시된 인공위성 영상을 통해 북한의 토지 권리 관계를 확인하는 연구 방법 및 정보와 관련된 항목으로 구성되어 있습니다. 질문을 읽은 후, 질문 내용의 동의 여부에 따라 '1점 (전혀 그렇지 않다)' 부터 '5점 (매우 그렇다)'까지의 점수로 응답해 주시기 바랍니다.

67. 5.1 위성영상을 통해 북한의 토지 권리 관계에 대한 정보를 알아낼 수 있다는 점에 대해 얼마나 신뢰하십니까? *

Mark only one oval.

- | | | | | | | |
|------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------|
| | 1 | 2 | 3 | 4 | 5 | |
| 전혀 그렇지 않다. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | 매우 그렇다. |

68. 5.2 위성영상을 통해 알아낸 북한의 토지 권리 관계 입증에 대한 본 연구가 충분한 완성도를 가지고 있다고 생각하십니까? *

Mark only one oval.

1	2	3	4	5	
전혀 그렇지 않다.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> 매우 그렇다.

69. 5.3 위성영상을 통해 북한의 토지 권리 관계에 대한 정보를 알아내는 것이 정확하다고 생각하십니까? *

Mark only one oval.

1	2	3	4	5	
전혀 그렇지 않다.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> 매우 그렇다.

70. 5.4 위성영상을 통해 알아낸 북한의 토지 권리 관계에 대한 정보를 쉽게 해석할 수 있습니까? *

Mark only one oval.

1	2	3	4	5	
전혀 그렇지 않다.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> 매우 그렇다.

71. 5.5 위성영상을 통해 알아낸 북한의 토지 권리 관계에 대한 정보가 객관적으로 수집되었다고 생각하십니까? *

Mark only one oval.

1	2	3	4	5	
전혀 그렇지 않다.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> 매우 그렇다.

72. 5.6 본 설문 내용은 귀하의 업무 및 관심사와 관련이 있습니까? *

Mark only one oval.

1 2 3 4 5

전혀 그렇지 않다. 매우 그렇다.

73. 5.7 위성영상을 통해 북한의 토지 권리 관계를 알아내기 위한 이 방법론이 현지점에서 충분히 시의적절하다고 생각하십니까? *

Mark only one oval.

1 2 3 4 5

전혀 그렇지 않다. 매우 그렇다.

74. 5.8 위성영상을 통해 알아낸 북한의 토지 권리 관계에 대한 정보를 쉽게 이해할 수 있습니까? *

Mark only one oval.

1 2 3 4 5

전혀 그렇지 않다. 매우 그렇다.

6. 응답자 인적 사항
(Participants'
Characteristics)

본 섹션은 귀하의 기본 인적 사항 (participants' characteristics)과 관련된 항목으로 구성되어 있습니다. 질문을 읽고 난 후, 해당 사항에 표시해 주시기 바랍니다.

75. 6.1 귀하의 성별에 표시해 주세요. *

Mark only one oval.

여자

남자

76. 6.2 귀하의 연령대에 표시해 주세요. *

Mark only one oval.

- 30세 미만
 31 ~ 50세
 51세 이상

77. 6.3 귀하의 최종학력에 표시해 주세요. *

Mark only one oval.

- 중·고등학교 졸업
 (전문) 학사 학위
 석사 학위
 박사 학위

78. 6.4 귀하의 업무 재직 기간에 표시해 주세요. *

Mark only one oval.

- 0 ~ 5년
 6 ~ 10년
 10년 이상

79. 6.5 귀하의 해당 항목에 표시해 주세요. *

Mark only one oval.

- 교수/연구원/독립연구자
 공사/공무원
 북한이탈주민

Google Forms

B. List of Publications

List of Publication

Paper 1: Lee, C., & de Vries, W. T. (2018). A divided nation: Rethinking and rescaling land tenure in the Korean (re-) unification. *Land Use Policy*, 75, 127-136. DOI: <https://doi.org/10.1016/j.landusepol.2018.02.046>

Authors' contribution: Lee, C (70%); de Vries, W. T. (30%)

Paper 2: Lee, C., de Vries, W. T., & Chigbu, U. E. (2019). Land Governance Re-Arrangements: The One-Country One-System (OCOS) versus One-Country Two-System (OCTS) Approach. *Administrative Sciences*, 9(1), 21. DOI: <https://doi.org/10.3390/admsci9010021>

Authors' contribution: Lee, C (55%); de Vries, W. T. (25%); Chigbu, U. E. (20%)

Paper 3: Lee, C., & de Vries, W. T. (2020). Bridging the Semantic Gap between Land Tenure and EO Data: Conceptual and Methodological Underpinnings for a Geospatially Informed Analysis. *Remote Sensing*, 12(2), 255. DOI: <https://doi.org/10.3390/rs12020255>

Authors' contribution: Lee, C (70%); de Vries, W. T. (30%)

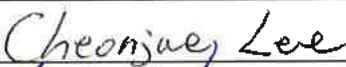

Paper 4: Lee, C., & de Vries, W. T. (2020). Testing and validating the alignment of social and geospatial data on land tenure in North Korea for the Korean (re-)unification. *Land Use Policy*. (a manuscript submitted)

Authors' contribution: Lee, C (70%); de Vries, W. T. (30%)

Paper 5: Lee, C., & de Vries, W. T. A Divided Nation: Land Tenure, Governance and the Korean (Re-)unification: A Research Synthesis. (In Preparation)

Authors' contribution: Lee, C (80%); de Vries, W. T. (20%)

The authors confirm that the above information with his/her own contribution is true and correct.

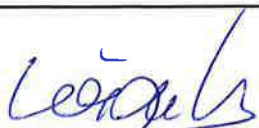
Author	Signature	Date
Lee, C.		23/09/2020
de Vries, W. T.		23.09.2020
Chigbu, U. E.		23/09/2020

Cheonjae Lee
 Signature

Munich / 23/09/2020
 Place/Date

Lee Cheonjae
 Doctoral Candidate

Signature



Walter Timo de Vries
 Name of Supervisor

Munich, 22.9.2020
 Place/Date