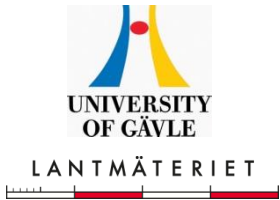




Dimitrios KITSAKIS
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6th International FIG Workshop on 3D Cadastres
2-4 October 2018, Delft, The Netherlands



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Layer approach to ownership in 3D cadastre – a subway case

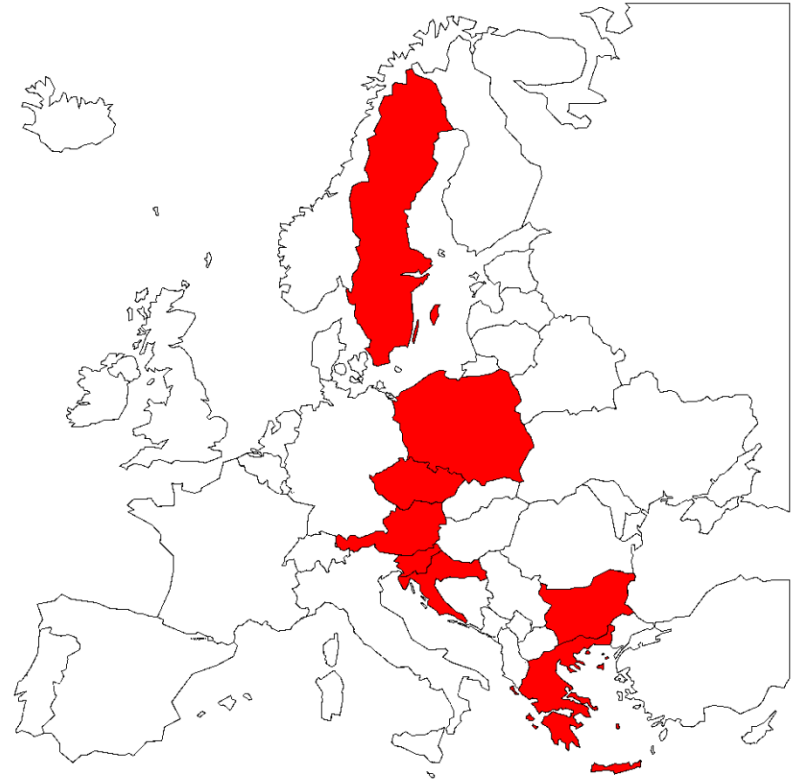
AIMS OF AN ARTICLE

- *Analysis of the current way of registration of rights to subway tunnels in the chosen countries.*
- *Analysis of its effectiveness in ensuring appropriate property rights to construct and exploit tunnels.*
- *Identification of the benefits which might be achieved by the introduction of a 3D real property cadastre for subway tunnels.*
- *Analysis of the available data concerning the geometry of subway tunnels in particular countries.*

Case studies - countries

Selected countries

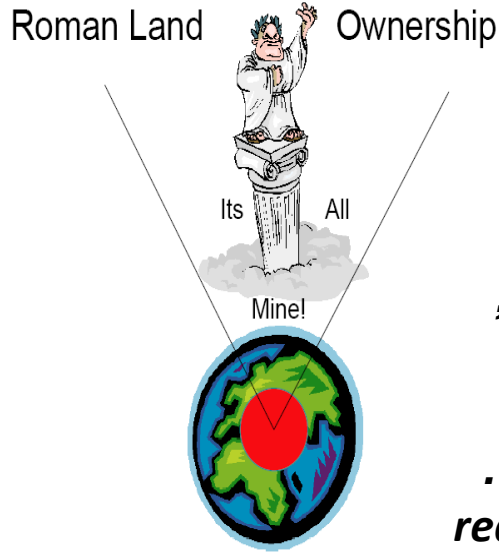
- ✓ Austria
- ✓ Bulgaria
- ✓ Czech Republic
- ✓ Croatia
- ✓ Greece
- ✓ Poland
- ✓ Sweden
- ✓ Slovenia



Each co-author was asked to provide:

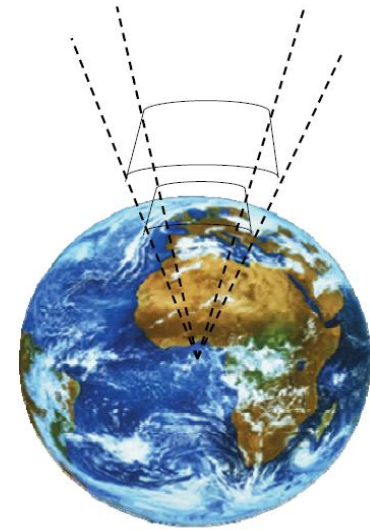
- General data
- Current status of 'subway tunnels' recordings in Cadastre and LR.
- Answer the question: What kind of right is established in a case of interaction of tunnel with private property?

“ROMAN PRINCIPLES” AND “LAYER APPROACH” TO OWNERSHIP IN 3D CADASTRE



Roman principles:
„superficies solo cedit”
„dominus soli est dominus
coeli et inferorum”
„usque ad sidera, usque ad
inferos”

***...describes the vertical extent of
real property from the centre of the
Earth to infinity...***



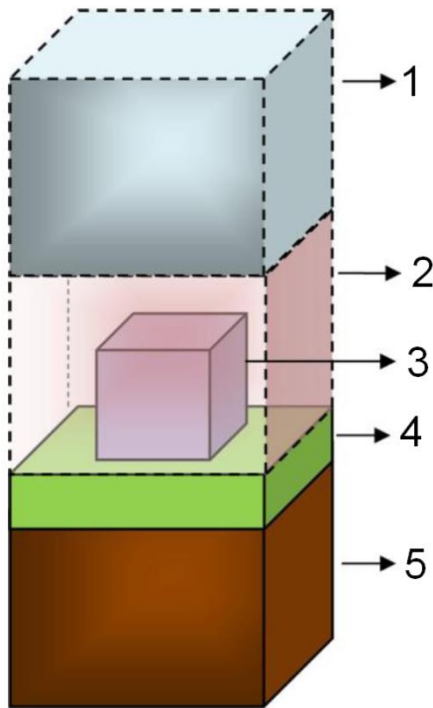
Victor Khoo „3D Cadastre in Singapore”
2nd International Workshop on 3D
Cadastrals 16-18 November 2011, Delft,
The Netherlands

*Civil Code describes restrictions of the vertical extent of real property ownership
“to the height and depth that the owner has no interest in opposing against it”
(e.g. German Civil Code, Art. 903; Greek Civil Code, art. 1001)*

Additionally: Aviation Law, The Water Law, The Geological and Mining law, ...

Specific minimum depth of disposal of underground land are not very common in national legislation (in metric units). For example, in Malaysia, minimum depth of underground space disposal ranges from 6 to 15 metres, depending on surface parcel land use (Zaini et al., 2013)

“LAYER APPROACH” TO OWNERSHIP IN 3D CADASTRE



Source: Dimopoulou E, Elia E. (2012): „Legal Aspects of 3D Property Rights, Restrictions and Responsibilities in Greece and Cyprus” 3rd International Workshop on 3D Cadastres: Developments and Practices, 25-26 October 2012, Shenzhen, China,

- 1- Potential building/constructing space right owned by the State or the Local Authority.**
- 2- Potential building/constructing space right owned by the parcel owner/s.**
- 3- Existing building owned by the parcel owner/s.**
- 4- Parcel owned by one or more private parties.**
- 5- Land space under the parcel owned by the State or the Local Authority.**

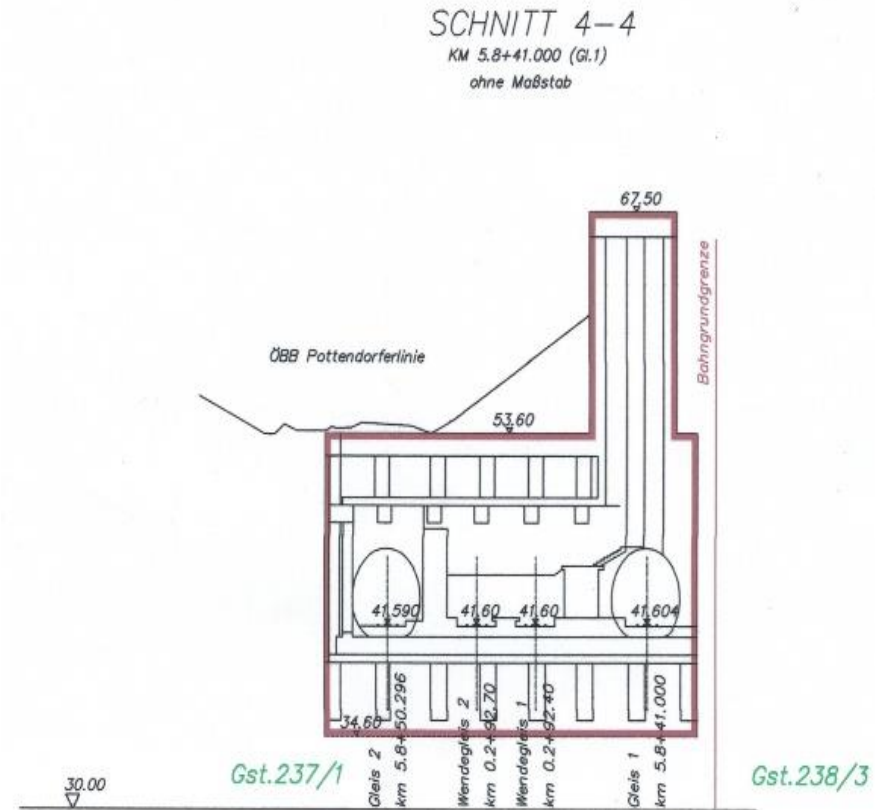
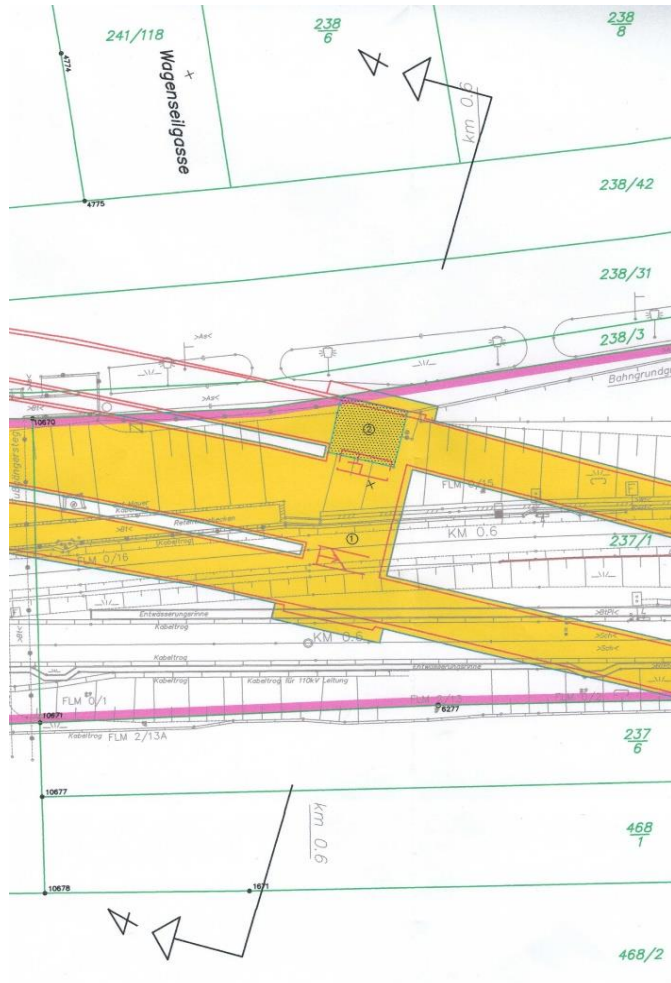


<http://boobsimge.com/2012/03/06/highway+running+through+building/13>



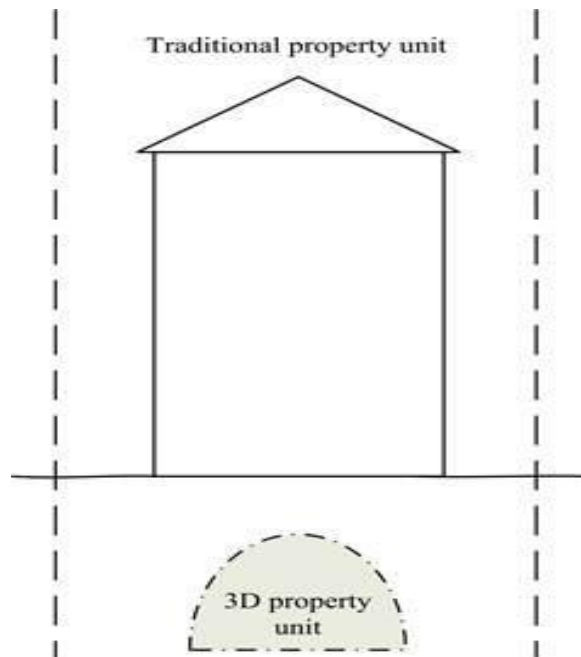
<http://boobsimge.com/2012/03/06/highway+running+through+building/24>

Case studies - Austria

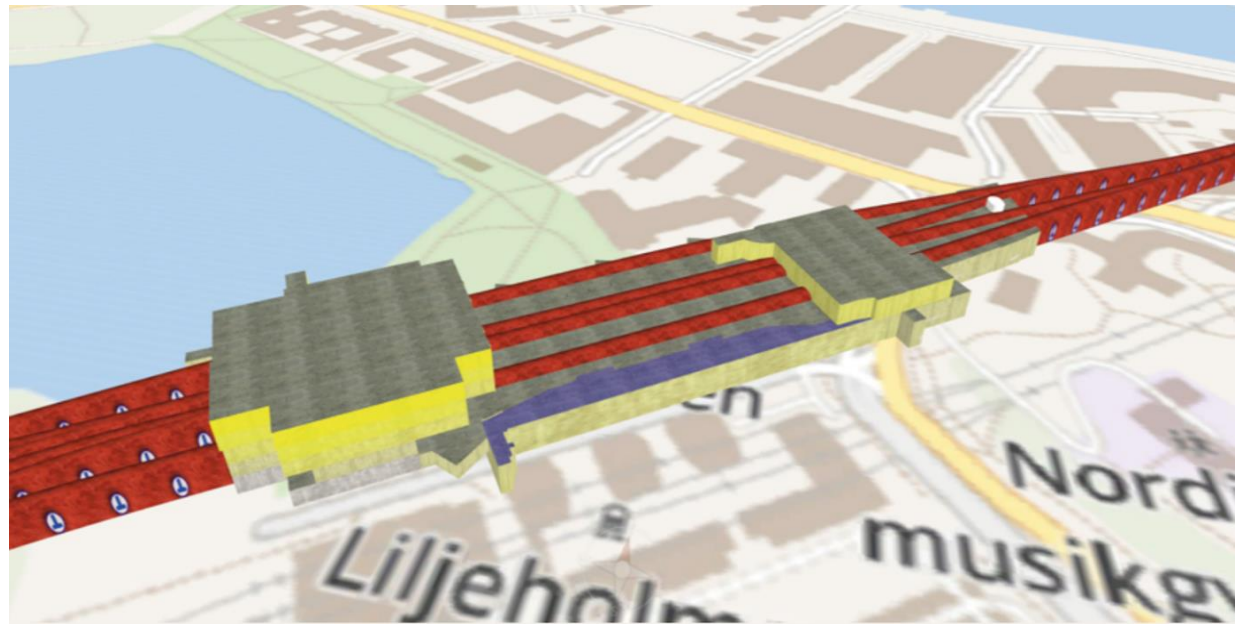


**Details from easement plan for the subway line U6
(data: Korschineck & Partner Vermessung ZT-GmbH, 2013)**

Case studies – Sweden



Example of 3D property formation for underground tunnels in Sweden (Paulsson, 2013, p. 201).



3D property formation of subway station in Stockholm (Source: <http://www.sl4d.se/pilotprojekt-3.html>)

Purposes of 3D property registered in the Swedish national real property register (Lantmäteriet, 2016, part of table 09D)

6.	UTRYMMESTYP	2	N	UTRYMMESÄNDAMÅL 1 = Bergrum 2 = Bro 3 = Byggnad 4 = Tunnel 5 = Övrig Anläggning REDOVISNING AV ÄGARLÄGENHETFASTIGHET 6= Ägarlägenhetfastighet	J
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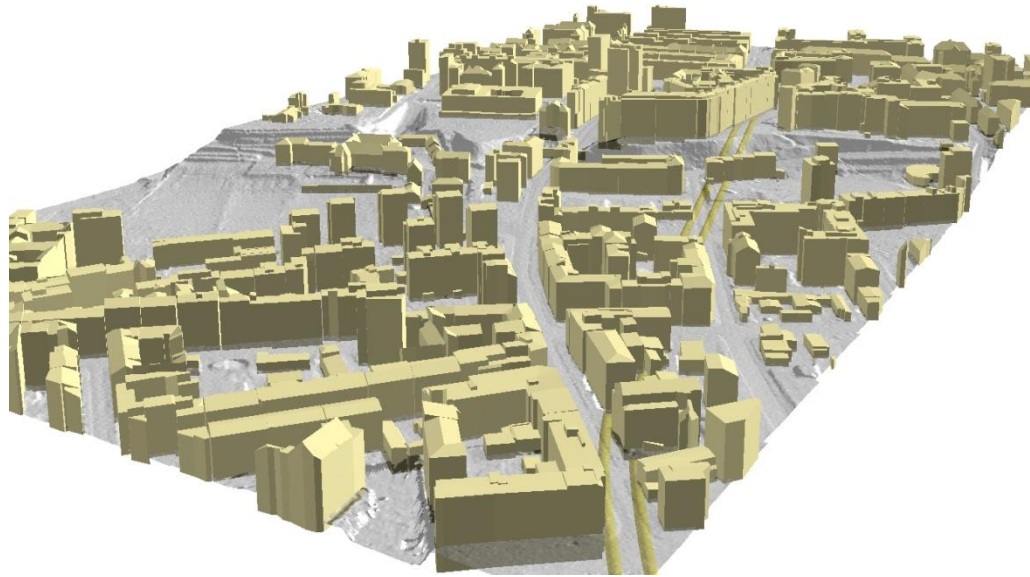
Case studies – Poland



Subway data on a cadastral and base map

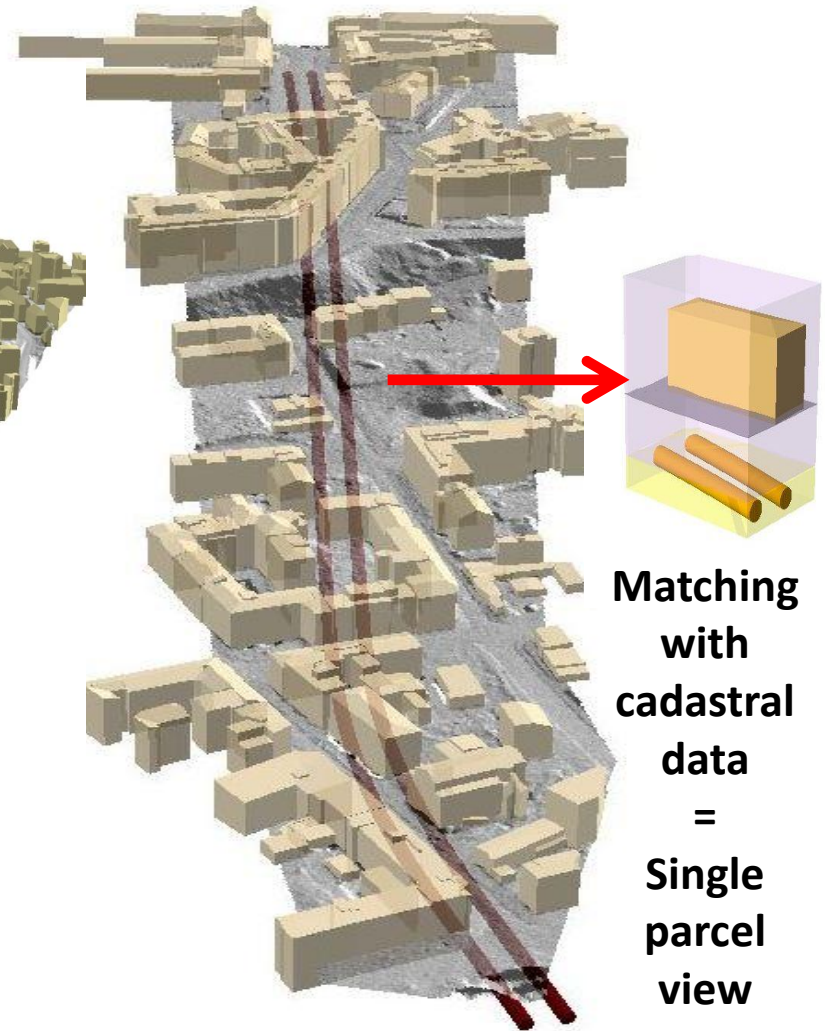
Karabin M. (2011). Rules concerned registration of the spatial objects in Poland in the context of 3D cadaster's requirements. In Proceedings 2nd International Workshop on 3D Cadastres – Delft Netherlands, 16-18 November 2011, pp. 433-452

Case studies – Poland



The perspective view of the 3D city model of Warsaw at the LoD2 level of details, with the visible subway tunnel under the terrain surface.

Left Picture published in Karabin M., Olszewski R., Gotlib D., Bakula K., Fijałkowska A., (2017). The new methods of visualisation of the cadastral data in Poland. In FIG Working Week 2017, Surveying the world of tomorrow – From digitalisation to augmented reality, Helsinki, Finland 29 May–2 June 2017.



Right picture (not published) by Karabin M., Bakula K., Fijałkowska A - Warsaw University of Technology

	<i>Subways</i>	<i>If tunnels intersect s Private properties</i>	<i>Geometry of subway tunnels in cadastre</i>	<i>Rights established for subway in a case of different owners of surface parcel and tunnel</i>
<i>Austria</i>	<i>Vienna</i>	<i>Yes</i>	<i>No</i>	<i>Serviude/Easment registered in Land Register 2D documents</i>
<i>Bulgaria</i>	<i>Sofia</i>	<i>Yes</i>	<i>Yes still in 2D sometimes 3D plans and visualisations attached</i>	<i>Serviude/Easment registered in Land Register</i>
<i>Czech Republic</i>	<i>Prague</i>	<i>Yes</i>	<i>Yes in 2D only parts located above the ground</i>	<i>Serviude/Easment or so called temporary land take (a kind of lease contract)</i>
<i>Croatia</i>	<i>No subway</i>	<i>Yes</i>	<i>On topographic maps</i>	<i>None</i>
<i>Greece</i>	<i>Athens Thessaloniki</i>	<i>Yes</i>	<i>No</i>	<i>Surface parcel owners are obliged to tolerate the construction of tunnels and all other works related to the development of the subway network without any compensation, as long as current use of the land surface parcel is not affected.</i>
<i>Poland</i>	<i>Warsaw</i>	<i>Yes/Not</i>	<i>No only on base maps (outlines)</i>	<i>None</i>
<i>Sweden</i>	<i>Stokholm</i>	<i>Yes</i>	<i>Yes</i>	<i>Independent 3D Property – ownership right</i>
<i>Slovenia</i>	<i>No subway</i>	<i>Yes</i>	<i>No</i>	<i>Serviude/Easment registered in Land Register for underground tunnels</i>

SUBWAY'S REGISTRATION IN 3D CADASTRE – THE BENEFITS

- *division into 3D property units with independent ownership - each part of space can be mortgaged and used as collateral*
- *the three-dimensionally delimited parts of the property are securing the value of real property for the users of it by removing obstacles such as the limitation of rights that can lapse and increasing the possibilities for the right holder to make changes to the property according to needs*
- *the improved documentation of rights*
- *opens the path for 3D spatial planning*

CONCLUSIONS

- *Registration of underground infrastructures - a challenge for national land administrations systems*
- *limited number of underground subway projects in all the examined countries*
- *In the majority of the examined countries subway network was developed, partially or entirely, below municipal or state owned land*
- *In case of land parcels owned by private individuals, 3 options are identified:*
 - 1. the whole land parcel is expropriated for public purposes, e.g. Greece*
 - 2. Servitudes are established, e.g. Austria and Czech Republic (cross-section diagrams, 2D documents)*
 - 3. The modern – third option: 3D real property units established for the vertical partition of the 3D space required for the development of subway tunnels (registered on Swedish cadastral index map).*

FURTHER RESEARCH

- *Extend research to other countries*
- *Interdisciplinary work in cooperation with other professionals, especially: lawyers, spatial planners*
- ...



**Thank You
for attention.**



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of Technology**