LAND ADMINISTRATION OR LAND ADMINISTRAITION?

Land Administration as a social responsible and sustainable institution, using Artificial Intelligence in times of Climate Change

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Paper, prepared for the

"XXIII IPRA-CINDER International Congress of Registration Law"

San José, Costa Rica, December 4-6, 2024

Introduction

This paper argues that land administration should be seen as a socially responsible and sustainable institution. Land registration is a fundamental component of land administration systems, providing a legal framework for recording and managing property rights. As registrars, we are guardians of legal certainty and provide trust and clarity regarding the question 'Who owns what?'. But land administration is not limited to giving the answer to that question.

In light of land registries being socially responsible and sustainable institutions, various questions with regard to (the use of) emerging technologies have to be asked and answers to these questions are given, where and when possible. This paper tries to find an answer with regard to the question what the added value can be of using emerging technologies and how these technologies should or should not be implemented. This paper does not discuss the use of blockchain or distributed ledger technology, as this has been extensively described in previous papers. VOS, J.(2022) & VOS,J. (2017-I). Instead, the focus will be on Artificial Intelligence (AI). Both the advantages and disadvantages of AI are outlined.

One of the major disadvantages for a (general) implementation of these modern technologies, besides a possible lack of Trust and Legal Certainty, is the carbon footprint. As Land Administration organisations are to be seen as sustainable and operate as circular as possible, the use of AI should be questioned. It is well known that Artificial Intelligence is an energy guzzler. And while we must limit our climate impact and the effects of our human actions on nature and protect nature as much as possible, this raises the question whether nature should have its own voice. This voice is increasingly being characterized by recognizing the Rights of Nature. It is not about *granting* rights *to* nature (rights *for* nature), but *recognizing* these rights (rights *of* nature).

If Rights of Nature are recognized, what do these rights imply? And what effect can or will these rights have when maintaining a land registry (system)? What if rights are recognized and the object not only remains an object (nature) but also becomes a subject (Nature) by itself?

In various countries, this relatively new concept has been implemented in different ways. In this paper, I outline the most common ways in which the rights of nature are respected and constructed in society and legislation. This paper also questions whether Rights of Nature (RoN) is the ultimate solution to safeguarding nature. With RoN certain desires and considered long-held wishes of specific groups of people, aligning with long-developed thoughts and lifestyles of these mostly indigenous people are met. But are there other options as well? Or there alternative methods or ways to guard and respect nature and its natural resources? What if citizens, in general, had obligations regarding energy-saving measures? Can governments impose this on their citizens? Or should this be seen as a form of expropriation? And is that form permissible or not? From that perspective, if we consider the concept of ownership, might this be a small step towards a renewal of the concept of ownership? And how should such a new interpretation of the concept of ownership affect land administration and its processes?

CHAPTER ONE

Land Administration, a socially responsible & sustainable institution

Land administration is in the middle of society and one of the corner stones of building economic growth. DE SOTO (2000) argues that secure property rights, established through formal land registration, are crucial for economic development. He emphasizes that without formal property rights, assets cannot be easily traded, used as collateral for loans, or protected by law, which limits economic growth and development. It not only creates legal certainty, but according to World Bank (2003), DEININGER, et al (2009) and BESLEY (2010) land administration also gives acces to credit, makes it easier for governments to levy property taxes, allows governments to plan and develop more effectively and can help protect the rights of vulnerable groups (e.g. indigenous people, the elderly or women).

Societal developments

To maintain this important position and serve society as effectively as possible, land administrations must recognize and adapt to societal developments. Some of the most important and current problems in society are climate change, migration (due to human interactions (e.g. threaths or war) or as an effect of climate change, than called managed retreat, as a last resort measure to combat climate change and its consequences) and the impact of digitalisation.

1. **Climate change**

With regard to climate change, the Intergovernmental Panel of Climate Change (IPCC)[1] released its latest synthesis report, the (sixth) Assessment Report[2], on 20 March 2023. This report summarises the state of knowledge of climate change, its widespread impact and risks, and climate change mitigation and adaptation. The report concludes inter alia that widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred and human-caused climate change is already affecting many weather and climate extremes in every region across the globe. There have already been adverse impacts from human-caused climate change and it has been concluded that this will continue to intensify. Despite progress of adaptation planning and implementation across all sectors and regions, gaps exist and will continue to grow at current rates of implementation in some ecosystems and regions.[3]

2. **Migration**

Global migration is a repeating phenomenon. Historically, there are numerous examples of major migration movements, such as the Great Migration Period (between the 4th and 6th centuries AD, HEATHER, P. (2005)), where various Germanic tribes (e.g. the Visigoths, Vandals, and Franks (KLEIN, H.S. (2010)) migrated across Europe, leading to significant changes in the continent's population and political structures and the disturbing Atlantic Slave Trade (16th to the 19th century) where millions of people were forcibly transported to the Americas as slaves and, amongst other major migration movements was also the Irish Potato Famine in the 1840's as described by Ó GRÁDA, C. (1999), leading to mass famine and therefore migration from Ireland to the United States and Canada and the modern migration in the 20th and 21st centuries, mostly

[1] https://www.ipcc.ch/
[2] https://www.ipcc.ch/assessment-report/ar6/
[3] https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf

due to war or post-war circumstances (CASTLES, Et Al (2014). Therefore, migration has to be seen as a fundamental part of human history and remains a significant topic in today's world.

The current state of global migration may be caused by ongoing conflicts and wars in inter alia Middle Eastern countries and Ukraine. Next to wars there are economical and political reasons for migration and nowadays climate change is increasingly influencing migration patterns. Extreme weather events such as droughts, floods, and rising sea levels are pushing people to move to safer areas. On the positive side, advances in technology and better communication tools make it easier for people to obtain information about migration opportunities and stay connected with their home countries, which makes them also migrate to places they prefer to live. But the impact of climate change on migration is a significant and growing concern.

The number of migrants

On average, one person is displaced each second by a disaster-related hazard (MC ADAM, J. (2017). Most people move within their own countries (internal displacement), but some are forced across international borders. According to the Internal Displacement Monitoring Centre (IDMC)[4] at the end of 2023, 7.7 million people were living in internal displacement due to disaster.[5] Not all disaster displacements are climate-related. But as climate change increases, ever more people are at risk of being forced to flee their homes. Internal displacement can happen everywhere, as the global report of IDMC displays very well. The 148 countries and territories reporting disaster displacement to IDMC include high-income countries such as Canada and New Zealand which reported their highest figures ever.

During the year 2023 there have been recorded 26.4 million internal displacements by disaster recorded and 20.5 million internal displacements by conflict or violence. An internal displacement is a forced movement recorded during the year. This figure helps capture repeated and multiple movements as the same person can be forced to move multiple times, where each movement counts as one.

These (in total) 46.9 million internal displacements, or movements, recorded during 2023, took place across 151 countries and territories. A total of 42 countries and territories reported both conflict displacement and disaster replacement and only three countries or territories did 'only' experience conflict displacement.

The IDMC reported 75.9 million Internally Displaced People (IDP) at the end of the year 2023. That is an increase by 51% over the past 5 years. This figure continues to rise as more people flee each year, adding to the numbers of those who have been living in displacement for years or even decades and have not yet achieved a durable solution. Of those 75.9 million IDP's, 7.7 million people have been displaced due to reasons of disaster (and 68.3 million by conflict or violence).

3. Impact of digitalisation / transformation

The third and final societal development is digitalisation. Digitalisation has had a profound impact on society, influencing various aspects of our daily lives, economy, and culture. This does concern the full spectrum of our society, from (e.g.) communication, economy and healthcare to social impact, innovation and technology. One might say that given the impact of digitalisation nowadays, we have to speak about transformation.

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[4] https://www.internal-displacement.org/about-us/

[5] https://www.internal-displacement.org/focus-areas/Displacement-disasters-and-climate-change/.

Communication

The internet has democratized access to information, allowing people to share and receive knowledge quickly. Digital tools like social media, messaging apps, and video conferencing have made it easier to stay connected with people worldwide. But this instant connectivity also has a downside: real social interaction is under pressure and using social media sometimes seems to create a 'filter bubble', also called an 'ideological frame'. PARISER (2011) predicted that individualized personalization by algorithmic filtering would lead to intellectual isolation and social fragmentation, by defining the concept 'filter bubble' (PARAMORE, L. (2010)) as "that personal ecosystem of information that's been catered by these algorithms." The search results can be based on information about the user (e.g. the location or past click-behavior of the user or the users search history. The result of this ideological frame is that the user gets separated from information that disagrees with their viewpoints. The user therefore effectively gets isolated in his own cultural or ideological bubble. The choices made by these algorithms are only sometimes transparent.

There are however conflicting reports about the extent to which personalized filtering happens and whether such activity is beneficial or harmful, with various studies producing inconclusive results. The state of intellectual isolation that can result from algorithmic curation and recommendation systems, but it can also be caused by personalized searches.

A study by CHITRA, et al (2020) aimed to study the impact of filter bubble and algorithmic filtering on social media polarization. The researchers used a mathematical framework to assess the Eli Pariser's "filter bubble" hypothesis and used this framework on the environments of Reddit and Twitter. They found that polarization increased significantly at 400% in non-regularized networks, while polarization increased by 4% in regularized networks and disagreement by 5%.

Economy

By making use of modern technology, online shopping has revolutionized retail, providing convenience and a wider range of products. But it has also caused a decline in many shopping streets. Nowadays, people buy many of their (daily) needs on-line instead of from local retailers. Digital tools have enabled remote work, offering flexibility and changing traditional office dynamics. On a daily basis this prevents a lot of commuting and traffic jams, but on the other hand, on some of the working days it results in almost empty office buildings and little direct collegial interaction.

Healthcare

Digitalisation has improved healthcare access through telemedicine, allowing remote consultations and monitoring. On the other hand, many people still prefer a physical visit to the doctor. They have trust in a face-to-face conversation; the visit of the medical specialist in a private examination room is still highly valued. Moreover, certain visits and examinations cannot be conducted online. The use of AI improves diagnostic accuracy through image analysis and predictive analytics. Electronic health records and health apps have streamlined patient care and personal health management. AI helps tailor treatments to individual patients based on their genetic information and health data. On the other hand, these medical records and apps, containing all the patient's medical data, are transmitted or accessed online. This naturally brings privacy risks due to the potential for data breaches.

Social impact

Efforts to bridge the digital divide aim to ensure everyone has access to digital tools and the internet. With this access for everyone digital inclusion should be a fact. But not everyone is equally digitally skilled, for several reasons, e.g. due to a certain age or level of education. This means that rapidly successive innovations are difficult for vulnerable groups to follow. Moreover, not everyone has (reliable) access to the internet, which puts also this group at a disadvantage. All of these vulnerable parties may then be left behind, which is why the digital divide is actually widening. It is an important task for society and more particular the government to provide these weaker parties with access to digital tools and the internet and for software developers to make the systems simple enough so that these vulnerable groups can continue to participate and make use of digital tools and the internet. And the increase in digitalisation has raised concerns about data privacy and security, perhaps even more with regard to the vulnerable people.

Innovation and technology

Digitalisation (or transformation) continues to evolve, bringing both opportunities and challenges. Digital technologies are being used to create digital twins and smart cities with improved infrastructure and services. By making use of digital twins decisionmakers can have a visual overview and assess the feasibility or impact of a partical scenario or decision.

Due to automation and swift advances in artifical intelligence, industries and job markets are reshaping. The downside of these developments is of course the bespoke digital divide in society. It is mainly the jobs filled by low-skilled workers that are disappearing due to automation. This means that this group of workers need to retrain or, in the worst case scenario: may not be able to find any job at all, due to the tight labor market (job displacement).

While some jobs are automated, AI also creates new roles in tech development, data analysis, and AI maintenance. The downside to this advantage is the level of education or knowledge needed.

The sheer volume of research papers, articles, and updates in AI is absolutely overwhelming. It therefore has no use to try to give an overview of these developments, updates and the research that has been done in the past period of time. Amidst the flood of information, identifying which advancements are most relevant and impactful is very challenging, especially since AI intersects with various fields of research, inter alia computer science, neuroscience, ethics, and law. It therefore requires a broad understanding of multiple disciplines, which is challenging by itself.

With the rapid advancements in the AI landscape, some of the jobs typically performed by highly educated people are also at risk or are subject of change, at least. More and more tasks carried out by highly educated individuals are being taken over by AI. This includes not only the creative sector (creating an image or artwork, writing a story or book, and making a film) but also the work of doctors (such as interpreting X-rays) and lawyers (such as searching through case law and writing legal advice). Artificial Intelligence automates repetitive tasks, increasing efficiency but also raising concerns about job displacement. The use of AI by - or instead of - lawyers will be dexcribed in more detail in the next chapter. Before discussing the use of AI by lawyers, the concept of AI and its developments will be described.

CHAPTER TWO

The use of Artificial Intelligence

The developments in the field of AI are progressing so rapidly that it is impossible to provide an up-to-date overview. What is new today is outdated tomorrow. It is now possible to write a script and create an entire feature film based on a topic of your interest and yourself being the main character by uploading a single photo of yourself. You can also easily upload a book and request a summary of it. But if you don't like reading, you can have this summary read aloud or listen to it in the form of a podcast. Hence, this paper is also available as a podcast.[6]

Even outside the creative sector, the use of AI can sometimes be extremely useful and time-saving. For example, AI chatbots can provide 24/7 customer support. The technology can also handle routine inquiries and improve customer satisfaction. It can rather easily analyze customer data to offer personalized recommendations and services.

The possibilities seem endless and therefore many questions arise: how do you keep up with rapid technological advancements? To what extend does AI, and more specifically generative AI, take into account copyrights, trademarks, and above all, accurate output? Should we use AI in Land Administration processes? And if so, how should we make use of these new technologies?

AI can be of help in very positive situations. Just to mention three examples: AI can help to predict Bordeaux red wine geographical origins (100% accuracy) and vintages (50% accuracy) from raw gas chromatograms, which will help preserving the identity and expression of a terrior and to enhance combat counterfeiting (SCHARTNER, Et Al. (2023). But it can also help predicting for prostate concer diagnosis (collaborating decision-making), although CAI, C.J. et al (2018) come to the conclusion that delivery of accurate algorithmic predictions alone is insufficient for effective human-AI collaboration whereas PRIMAKOV, S.P., Et Al. (2022) presented a fully automated pipeline for the detection and volumetric segmentation of non-small lung cancer, performing better than radiologists and radiation oncologists.

The use of AI does come with several drawbacks, and one of them is somehow ironic: its high energy consumption. While AI can help us understand and mitigate the effects of climate change, the process of training and running AI models itself requires a significant amount of energy, which can contribute to the very problem it aims to solve.

The downside of AI

One of the negative impacts of AI on humans concerns the possible reduced cognitive efforts, as mentioned by CARR (2010). If AI takes over many tasks, there is a risk that people might think less for themselves and get more dependent of it (PERRET, 2024). This could lead to a decrease in problem-solving abilities and creativity, as we are less challenged to come up with solutions on our own. It may even lead to the decline in intelligence (GREENFIELD, 2014). While AI can help us find information quickly, it might also lead to a superficial knowledge base. If we rely too much on AI without understanding the underlying concepts, it could diminish our deep knowledge and

[6] By using Google's NotebookLM (https://notebooklm.google.com) or any other relevant AI tool. After logging on to the tool, you upload this paper and push 'generate', wait and starts listening. The author of this paper is not responsible for any of these AI-tools and/or their output. Listening to the output of this tool is entirely at the listener's own risk. Any form of liability resulting from possible inaccuracies in the use of the tool, the content of the generated podcast(s), or any omissions or discrepancies between the paper and the podcast is expressly excluded by the author.

critical thinking skills. As PERRET, A. (2024) states: 'understanding how to communicate is different from understanding information', as AI - Perret only relates to ChatGPT - 'is not an information system' and 'the risk of error is present due to the very nature of the tool'. Now that computers can produce content that is completely similar to that which a human being can produce, the only thing remaining for us is to interpret this content which according to VITALI-ROSATI, M. (2023) is nothing new.

Next to these risks, there is the risk of mental dullness (TURKLE, 2011). With the constant availability of AI assistants, people might be less inclined to learn and discover things on their own. Especially since the new versions use human-sounding voiceassistents and new series of AI models designed to spend more time thinking before they respond[7], using the two concepts of thinking introduced by KAHNEMAN, D.(2011), these models start looking like a (virtual) omniscient friend (oracle), emulating the judgment and reasoning of humans. This could result in a certain degree of mental laziness and a decrease in curiosity and eagerness to learn, not only with regard to the cognitive senses, but also in a societal and social context. Perhaps it would lead to resignation or fear, when thinking about the goal of emulating reasoning of humans. With respect to the registrar, building on and trusting Artificial General Intelligence (AGI) – or are they stochastic parrots that still hallucinate and contain errors?[8] – this would perhaps lead to no longer being the creative solution-thinking lawyer as mentioned (VOS, J. (2022)).

Although not claiming to be exhaustive, the final possible risk distinguished in this paper is the dependence on technology (POSTMAN, 1993). Over-reliance on AI can be problematic if the technology fails or is unavailable. People might struggle to function without these tools.

To mitigate these negative effects, it's important to find a balance between using AI and continuing to develop our own skills and knowledge by keep thinking critically, keep learning and use AI as a supplement (BRYNJOLFSSON & McAFEE (2014), not as a replacement of human intelligence, knowledge and creativity. This is also of importance when using AI in Land Administration processes, as is described in this chapter.

This chapter concludes with a sustainability aspect of Generative AI. As Land Administration is a socially responsible and sustainable institution, the carbon footprint of Generative AI is not only of interest but should also be taken into account when using AI for land administration pruposes.

What is Artificial Intelligence

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think and learn like humans. These intelligent systems can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. It can be categorized in several ways. I choose to categorize the concept of AI into two main types: narrow AI (weak AI) and general AI (strong AI), where narrow AI is designed to perform a specific task (e.g. autonomous vehicles and voice assistens) and general AI is a still largely theoretical concept of a system with generalized human cognitive abilities as it should be able to learn, understand, and apply knowledge across a wide range of tasks.

[7] https://openai.com/index/introducing-openai-o1-preview/

[8] https://www.businessinsider.nl/openais-o1-model-is-a-new-paradigm-but-lets-not-get-carried-away-about-agi-just-yet/

The origins and development of AI

The history of artificial intelligence (AI) is fascinating and full of significant milestones. In the early years of AI (1950-1970's) TURING (1950) posed the question of whether machines can think. Turing introduced the Turing Test as a way to determine if a machine can exhibit intelligent behavior indistinguishable from that of a human. In order to prove theorems in symbolic logic, NEWELL & SIMON (1956) described the Logic Theorist Machine, a program, created along with J.C. Shaw at the RAND Corporation, often considered the first artificial intelligence (AI) and used a technique known as "heuristic search methods", to generate and evaluate possible proofs. The program tried different paths and selected the most promising ones based on certain rules and strategies to prove mathematical theorems. WEIZENBAUM (1966) developed an early natural language processing program called ELIZA, that was able to communicate with people by following simple conversational rules. It was one of the first chatbots.

During the first AI Winter and Revival (1970-1990) various expert systems were created, such as MYCIN. This system was developed for medical diagnosis and could make complex decisions based on a set of rules and knowledge. Another cornerstone of AI in this period of time was the rediscovering of the Backpropagation Algorithm by RUMELHART et al (1986). This algorithm has been crucial for the development of neural networks and machine learning.

After the revival of AI came the rise of Machine Learning (1990-2000), when Support Vector Machines CORTES & VAPNIK (1995): algorithms for classification and regression tasks playing a significant role in the early days of machine learning, became popular. Another big achievement was the well known introduction in 1997 of IBM's chess computer, called Deep Blue, marking a milestone in AI's ability to play complex games (CAMPBELL, Et Al (2002), highlighted by defeating world champion Garry Kasparov.

In the early beginning of the new millenium Google's search algorithms used AI techniques to improve the relevance of search results, significantly impacting how people find information (BRIN & PAGE, 1998).

The so-called modern AI Revolution (2010 – present) is marked by breakthroughs in deep learning, particularly through the use of large neural networks. This led to significant improvements in image and speech recognition. In 2016, as described by (SILVER, Et. Al. 2016) DeepMind's AlphaGo defeated the world champion in Go, a game much more complex than chess, marking a significant achievement for AI.

On June 11, 2018, RADFORD et al (2018) published a paper introducing the first generative pre-trained transformer (GPT). This is a type of generative large language model that is pre-trained with an enormous and diverse tekst corpus in datasets, followed by discriminative fine-tuning to focus on a specific task.

Ever since, new and alternative versions of GPT and deep neural network, superseding recurrence and convolution-based architectures with an attention mechanism that allows the model to focus selectively on segments of input text it predicts to be most relevant, have been released. These language models are nowadays capable of understanding and generating human language.

New versions and applications are emerging hand in hand and succeeding each other at such a rapid pace that it is illusory to - even attempt to - provide an up-to-date description of the current state of technology.

The difference between AI and Generative AI

Artificial Intelligence (AI) is a broad field within computer science that focuses on creating systems capable of performing tasks that typically require human intelligence. This includes a wide range of applications, such as: Machine Learning (ML), Natural Language Processing (NLP), Computer Vision ans Robotics. Machine Learning does consist of systems learning from data to make predictions or decisions without being explicitly programmed. Natural Language Processing is the ability of a computational system to understand and generate human language, where Computer Vision can be described as the ability of a computational system to interpret and understand visual information. Robotics is the design and construction of robots that can perform tasks in the physical world. In general, AI can be used for specific tasks, such as speech recognition, playing chess, diagnosing diseases, and recommending products.

Generative AI is a specific subcategory of AI that focuses on the creation of new, original content. This can include text, images, music or other forms of media. Unlike traditional AI systems, which are often designed for specific tasks, generative AI can be used for a wide variety of purposes. This technology uses advanced models, such as large language models (LLMs), to generate new and original content based on patterns it has learned from existing data. LLM's are trained on vast amounts of data and can generate coherent and contextually relevant texts.

To illustrate the difference between AI and GenAI, an example. Imagine an AI system that diagnoses medical conditions based on patient data. This system uses machine learning to recognize patterns in the data and make a diagnosis. This is an example of AI.

A true example of Generative AI is an AI system that can write new medical articles based on existing medical literature. This system makes use of a crucial component for this type of AI: a large language model, in order to generate new, original texts that are coherent and informative.

Large Language Models

A Large Language Model (LLM) is a type of computational model designed for natural language processing tasks, such as language generation. It stands out because it can generate text for general purposes, such as generative artificial intelligence. This generative character distinguishes LLM from ordinary language models that are only usable for a specific purpose.

As language models, LLMs acquire these abilities by learning statistical relationships from vast amounts of text (training sets) during a self-supervised and semi-supervised traning process. These large training sets can only be created through web scraping.

The workings are somewhat kept secret by the developers, but it is assumed that they have knowledge of the syntax and semantics of human language. Usually, two components are used: one component with knowledge of the language and one component with information. This capability is achieved by using deep learning to establish statistical relationships between words through extensive training on training sets, (e.g.) text documents. As a result, a user can have a chat conversation with a large language model in a way that almost feels like talking to a real person. Such a language model can also generate texts, for example for a book, letters, official documents, computer translations, summaries, and even programming code.

Let's explain the functioning of LLM's with an example. Suppose we want to generate a sentence that begins with "The lawyer argued that…".

First, the model is trained on millions of sentences and documents, learning patterns and relationships between words. It knows, for example, that after “The lawyer argued that” often follows an argument or statement. The model uses the context of the preceding words to predict what the next word should be. In this case, after “The lawyer argued that”, the model might predict that words like “the”, “a”, “an” are likely. And the model than selects the most likely next word and then begins the calculation for the following word. This process repeats until the sentence is complete.

Deep Learning

Deep learning is a type of Machine Learning that uses neural networks with many layers (hence “deep”) to analyze various types of data. These neural networks are designed to mimic the way the human brain processes information, allowing the model to learn and make decisions on its own. The structure of a Neural Network consists of layers of nodes, called neurons. Each node is connected to nodes in the previous and next layers. There are typically three types of layers: th input layer (that receives the initial data), the hidden layers, performing computations and extract features from the data and the output layer, producing the final result or prediction.

The model is trained on large datasets that need preprocessing. For example, a deep learning model for image recognition might be trained on millions of labeled images or texts. Because machine learning algorithms process numbers rather than text, the text must be converted to numbers. In the first step, a vocabulary is decided upon, then integer indices are arbitrarily but uniquely assigned to each vocabulary entry, and finally, an embedding is associated to the integer index. An additional benefit of tokenization is the compression of the datasets.

Large training sets can only be created through web scraping. The workings are somewhat kept secret by the developers, but it is assumed that they have knowledge of the syntax and semantics of human language. Usually, two components are used: one with knowledge of the language and one with information. The information stored is very large and therefore contains a lot of versatile information. It is also possible to choose to use only a dataset with information on a specific subject or with the knowledge within a particular company. Such a choice requires less heavy hardware, less computing power, and consumes less energy.

During training, the model adjusts the weights of the connections between nodes to minimize the difference between its predictions and the actual outcomes. This process is called backpropagation. Algorithms like gradient descent are used to optimize the weights and improve the model’s accuracy. Once trained, the model can make predictions or decisions based on new data. For example, a trained image recognition model can identify objects in new images it has never seen before.

Deep learning has a wide range of applications, including Speech recognition, autonomous vehicles and Natural Language Processing. The biggest challenges of Deep Learning are related to its data. Deep learning models can bes een as so-called ‘black boxes’, as it is often difficult to understand the functioning of the technology and the way decisions are made. It is therefore not very interoperable, let alone understandable. For that reason, there may be a lack of trust. Next to that, the training of deep learning model scan be computationally intensive. They can require powerful hardware, as a lot of data has to processed. And this is the third challenge: deep learning models require an enormous amount of data. In order to perform consistent and correct, these data should be of the highest quality and need to be correct (or corrected if not correct).

The Ground Truth

Ground truth refers to the accurate and reliable data that serves as a standard or reference. It is the "truth" against which the predictions or results of a model are compared. Its purpose is to evaluate the accuracy and performance of a machine learning model. By comparing the model's predictions to the ground truth, you can determine how well the model is performing.

Creating ground truth involves collecting and labeling data that will serve as the reference. At first a representative dataset has to be gathered. This dataset should be relevant to the task you want the artificial intelligence tool to perform. This data than has to be labelled very accurately by assigning the correct classification or value to (each element of) the data. This labelling can be done manually by humans (e.g., annotators) or automatically, using other reliable methods.

These labels than have to be validated. This means that they have to be consistent and correct. Again, this has to be done by having multiple annotators label the same data and comparing the results and/or by using validation techniques (e.g. by verifying a subset of the data).

The final step is to evaluate your model's performance by making use of these labeled data. The model's predictions can be compared to the ground truth in order to calculate metrics, such as the accuracy, precision, recall, and as a result the F1-score of the model.

The process of creating ground truth involves carefully collecting, labelling, and validating data.

The F1-score

One of the key elements of a well-functioning AI-model is a metric used to evaluate the performance of a classification model. This is especially important in case of the use of imbalanced datasets. It is the harmonic mean of two important metrics (precision and recall) used to evaluate the performace of a classification model. They provide a single score that balances both the false positives and false negatives.

Precision is the ratio of correctly predicted positive observations to the total predicted positives. It answers the question: of all the instances that were predicted as positive, how many were actually positive?

Recall (or sensitivity) is the ratio of correctly predicted positive observations to all observations in actual class. Recall provides an answer to the question: of all the instances that were actually positive, how many were correctly predicted as positive?

Precision	=	True Positives (TP)	/	True Positives (TP) + False Positives (FP)
Recall	=	True Positives (TP)	/	True Positives (TP) + False Negatives (FN)
F1-score	=	2 x Precision x Recall	/	Precision + Recall

To give an example:

If the number of true positives (TP), the number of correctly predicted positive cases, is 70, the number of False Positives (FP) is 9 and the number of False Negatives (FN) is 10, the calculation is as follows:

Precision:	70 / 70 + 9 = 70/79 = ~0,886
Recall:	70 / 70 +10 = 70/80 = ~ 0,875
F1-score:	2 x (0,886 x 0,875/ 0,886 + 0,875) = 2 x 0,775 / 1,761 = ~0,880

With both precision and recall being high, a high F1-score is the result. This indicated the accuracy of the classification model.

Wrongful use in Daily Practices

In many AI systems perpetuate biases are be presented in their training data, leading to unfair outcomes. AI bias occurs when an AI system produces results that are systematically prejudiced due to erroneous assumptions in the machine learning process. This happens in many occassions and working fields. In facial recognition there have been racial bias, where higher error rates occured for people with darker skin tones, causing misidentification and serious implications for law enforcement and surveillance. But also in the hiring algorithms biases have causes gender and racial bias. Some AI systems used for screening job applicants have been shown to favor certain demographics over others. And in the field of predictive policing geographic bias resulted in disproportionately targetting neighborhoods with higher populations of minority groups, leading to over-policing in those areas. This often stems from biased historical crime data. Biases also accured related to healthcare (wrongful treatment recommendations or diagnoses), Loan approvement, credit scoring, content moderation and **(**biased against certain languages or cultural expressions, resulting in unfair censorship or the overlooking of harmful content in less represented languages) and – but not limited to - voice recognition (understanding non-standard accents or dialects).

(Wrongful) Use in Law Practices

From a questionnaire, distributed in August 2023 among 7500 lawyers, students, and citizens, it has been found that nearly half of all lawyers believe generative AI tools will significantly transform the practice of law (92 percent). Lawyers see the highest potential for generative AI tools to assist them in researching matters, in drafting documents and in document analysis.[9] Since this

There are a few notable examples where judges have used or ruled on the use of AI or a lawyer did (not) successfully or wrongfully make use of AI. The number of these cases is growing. There are various cases in several courts in the United States that have reviewed the use of predictive policing tools, which use AI to forecast where crimes are likely to occur. These cases often focus on the potential for bias and the need for transparency in how these tools are used. Various courts have ruled on cases involving algorithmic bias, particularly in employment and housing. These rulings often focus on ensuring that AI systems do not perpetuate discrimination and that there is accountability for biased outcomes.

Judges increasingly rely on AI-powered (legal) research tools to assist in case law analysis and decision-making. While specific cases may not always be documented, the trend shows a growing acceptance of AI in the judiciary. These cases and developments illustrate the judiciary's cautious but growing engagement with AI technologies. Nevertheles, the proper use of AI is not without risk and is subject to conditions. As AI triest o distill a rule by linking combinations of facts from judicial rulings to their outcomes, there is a possible flaw or bias to the distilled rule, as this rule does not necessarily have to be the same as the legal norm, for example, because combinations of facts often occur together by chance and are therefore considered valuable by the system. As explained, AI needs a lot of training-data for every case. Hence, to make a

[9] https://www.lexisnexis.com/community/pressroom/b/news/posts/lexisnexis-international-legal-generative-ai-survey-shows-nearly-half-of-the-legal-profession-believe-generative-ai-will-transform-the-practice-of-law

prediction in a legal court case, AI needs a lot of court rulings, certainly around tens of thousands. Such judicial decisions are often not available. Even if they were and could all be entered into an AI system, it is not immediately clear how the system found these rules. Due to the large amount of data and the lack of systems to explain why it draws certain conclusions, a *black box* is created; there is a lack of insight into how the prediction was made and what the basis for the formed rules is (PRINS & ROEST, 2018). Additionally: the system can be compared to the human brain, which is why it is also called a neural network. It is also not possible to determine why a particular decision is made.

In most cases, the application of AI might not be more problematic than the performance of a human. A judge who enters search terms into a legal search engine is not better able, nore might he be more objective, to select case law than AI potentially could be. Where AI supports judges, for example, the right to a fair trial will often not directly limit the use of AI (THEMELI & PHILIPSEN, 2019).

Closely related to this case may be the case of Loomis v. Wisconsin,[10] where the State of Wisconsin's use of closed-source risk assessment software in the sentencing of Eric Loomis was challenged. The case alleged that using such software in sentencing violates the defendant's constitutional right to due process because it prevents the defendant from challenging the scientific validity and accuracy of such test and it also alleged that the system in question (Correctional Offender Management Profiling for Alternative Sanctions: COMPAS), developed by a private company, violates due process rights by taking gender and race into account in formulating the risk assessment. Hearing this case would have given the court the opportunity to rule on whether it violates due process to sentence someone based on a risk-assessment instrument whose workings are protected as a trade secret, yet, the Supreme Court denied the *writ of certiorari*, thus declining to hear the case.

As concluded by VERHULP & RIETVELD (2019), technological developments bring both opportunities and significant risks, also for the judiciary. In their opinion, it would be wise to first focus on more human applications, such as expert systems, supplemented by AI systems that play a supportive role and contribute to searching and analyzing previous case law. Judicial freedom, decision-making space, and a good procedural order must remain paramount, regardless of the application used.

In the Netherlands, a Subdistrict Court Justice (in Dutch: Kantonrechter) recently gave a ruling[11] where ChatGPT was used for estimating the amount of the damage occured and for substantiating the reasoning of the judgment. This caused a lot of controversy in the media, and there were doubts about whether the use of ChatGPT in the courtroom is permissible and responsible. CUSTERS (2024) published his opinion on this judicial ruling by stating that ChatGPT can be a tool, yet the judge must ultimately decide and provide reasoning. He concludes that this also happened in the case of the solar panels, despite the fact that the judge used ChatGPT wrongfully. As chatbot is a LLM, generating texts as an expected answer to the question raised and the outcome (or underpinning data) can be unreliable, causing the judge to draw an incorrect conclusion. However, in this particular court case it was of minor importance, as the results did not deviate much from reality (damage calculation) and the claim was ultimately rejected.

[10] Loomis v. Wisconsin, 881 N.W.2d 749 (Wis. 2016), cert. denied, 137 S. Ct. 2290 (2017), retrieved by using https://www.scotusblog.com/case-files/cases/loomis-v-wisconsin/.
[11] https://uitspraken.rechtspraak.nl/details?id=ECLI:NL:RBGEL:2024:3636

Although the impact of the incorrect use was very minimal in this case, this does not negate the possibility that a judge may rely on potentially incorrect information. For this reason, the judge must handle the use of AI in parts of the process carefully and verify the source.

This Dutch case is certainly not an isolated case. For example, take a case that took place more than a year earlier In Cartagena, Colombia where a judge has caused a stir by the inclusion of his conversations with Chat GPT in his ruling to support his decision whether an autistic child 's insurance should cover all of the costs of his medical treatement. Next to using ChatGPT the judge used precedent from previous rulings to support his decision and judge defended his use of Chat GPT, suggesting it could make Colombia's bloated legal system more efficient. According to CARRASQUILLA-DIÁZ, Et. Al. (2024) Colombia is working on AI adoption in Colombian legal practice. Colombia's response to Covid-19 was the acceleration of the use of new technologies within legal proceedings (RIVERA, 2020). In a reaction at the judge's admission, professor Gutierrez called for urgent "digital literacy" training for judges.[12] It is suggested that public lawyers should use technologies where possible to make their work more efficient. In my personal opinion it is evident that lawyers must use AI, especially when it comes to saving costs for clients. There are several technological solutions in the market[13] and the number of those solutions is growing at a rapid pace. However, it is crucial that AI must be used correctly. This was not the case in the USA District Court case of *Mata v Avianca Inc*[14]., the first case that drew worldwide attention to the risk of relying on generative AI for research purposes in litigation without independent verification. In this case, attorneys of a firm relied on generative AI in order to prepare legal submissions which were filed. They referred to non-existent cases, and initially stood by the submissions. When called into question by the court, they were found to have abandoned their professional responsibilities and sanctioned by directing each of them to pay a $5,000 fine to the court and obliging them to send letters to their client and the judges who were falsely identified as the authors of several fake opinions.[15] Judge Castel stated that "technological advances are commonplace and there is nothing inherently improper about using a reliable artificial intelligence tool for assistance. But existing rules impose a gatekeeping role on attorneys to ensure the accuracy of their filings." In this case, also cited in a court case of the Federal Circuit and Family Court of Australia[16], the lawyers abandoned their responsibilities when submitting non-existent judicial opinions with fake quotes and citations created by artificial intelligence. Especially continuing to stand by these fake opinions after judicial orders called their existence into question gave reason to the judge to sanction the lawyers firmly. These cases show that not only can the lawyer make a mistake by, for instance, not asking the right question to AI (such as creating an incorrect prompt) or using output out of context, but AI itself can also hallucinate.

The risk of Hallucination

Content verification is required specifically for Generative AI. Since generative AI can create content, it's important to verify the accuracy and authenticity of the generated content. In the previous subsection on Large Language Models, I described the functioning of LLM's, as the next

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[12] https://www.theguardian.com/technology/2023/feb/03/colombia-judge-chatgpt-ruling.

[13] Just some examples of domain specific AI for lawyers, (or) enabling autonomous or manual actions with recommendations to augment existing workflows are https://www.harvey.ai/, https://claude.ai/ and https://kelvin.ai

[14] *Mata v. Avianca, Inc,* 678 F.Supp.3d 443 (S.D.N.Y. 2023) ("*Mata v Avianca, Inc*").

[15] *Mata v Avanica, Inc,* 448. See:
https://storage.courtlistener.com/recap/gov.uscourts.nysd.575368/gov.uscourts.nysd.575368.54.0_3.pdf

[16] Dayal [2024] FedCFamC2F 1166 - BarNet Jade - BarNet Jade https://jade.io/article/1092470

word in a sentence is predicted by the Artificial Intelligence, using calculations, based on and taking into account the context of the preceding words, when generating an answer, response, or text.

The model works with *context* but does not understand the *meaning* itself. This means that the model can sometimes generate sentences that are grammatically correct but contain nonsense. For example, the model might generate: “The lawyer argued that the new law was a blue apple.” While grammatically correct, the sentence is nonsensical. It is also possible that the sentence is grammatically correct and does not contain nonsense, but is a repetition to the previous sentence or text. As long as it does not materially deviates from the repeated sentence, there does not seem to be a serious problem. Yet, it may be a serious problem and lead to legal uncertainty if the sentence is contradictory to the rest of the text, or to one of the (previous) sentences. This phenomenon is called “hallucination”. The degree of hallucination can be set, but when hallucination is less or not allowed, the model will more often get stuck, break off the answer, or even give no answer at all. So, one may conclude that, to prevent hallucinations, verifying the outcome is of the utmost importance. This can be done by using cross-verification: comparing the AI-generated output with multiple sources to ensure consistency and accuracy or to consulting the (legal) expert or AI specialists to validate the AI’s findings. Next to that, it is important for judges to understand the reasoning behind the outputs, hence they should only use AI systems that provide explanations for their decisions (transparency and explainability). And, although very plausible, and possibly stating the obvious, judges should only implement AI tools in a controlled environment, by at first observing the performance of the tools and making adjustments if necessary before full-scale deployment.

Using AI in Land Administration processes

As is mentioned, AI is increasingly being integrated into the legal profession, transforming various aspects of legal work. These technologies are mostly used in the key areas of legal research (document analysis and predictive analytics), legal analytics (case outcome predictions and benchmarking) and compliancy and risk management (regulatory monitoring and risk assessment). Next to that, it is often used in the field of contract generation and automated contract review.

For recording documents and updating a register, this automated contract review can be of importance. AI can review contracts for specific clauses, significantly speeding up the process. As it can review contracts, it can also be of help for recognizing specific elements in contracts that should be taken into account when recording documents and adjusting land egistries accordingly are in place.

Artificial Intelligence is also used for e-discovery purposed, e.g. data sorting, shifting through vast amounts of electronic data to identify relevant information and pattern recognition, detecting patterns and anomalies in data that might be missed by human reviewers.

These are exactly the cases where Dutch Kadaster implemented the use of AI in the updating of its key register (basisregistratie kadaster). Many other countries, also some of the perhaps somehow less digital frontrunning countries, are working on implementing AI tools in order to fulfil the task of maintaining and updating their land registries or foresee the potential use of AI in near future to enable more efficient and transparant management of land rights, ownership and transactions (OKEMBO, Et Al., 2023).

In many cases, 80 percent accuracy or the knowledge that the information provided is not entirely correct may be good enough. But in the case of health issues, court rulings or when legal questions arise and answers have to be correct, such as is the case in land registration and issuing land titles, it is not desirable to provide (partially) incorrect information. This is where all land registries find their common ground.

Especialy when scrutinizing a deed or document that is subject to registration, flaws, break offs or defects are not allowed. As legal texts deviate from the average of language in daily life, a specific legal Large Language Model is needed. This model needs to be trained on a large dataset with a predicted outcome (training set) and needs to be validated on the basis of a validation set. Probably the most important element of the validation is the scrutiny on the dataset of the registrar and his staff.

For the correct functioning of AI keeping the Human in the Loop is not the only precondition. There is also the need for continuous improvement, as we have seen AI models sometimes start to hallucinate. To prevent hallucination, feedback loops should be in place, just as continuous research and development in order to help address existing limitations. Incorporating user feedback helps improve AI systems over time. This ensures that the AI evolves to meet user needs better and to enhance the capabilities of AI systems. But as lawyers can be innovative solution thinkers, embracing new technologies, their expertise is not on Artificial Intelligence.

The use of AI at Kadaster

At Kadaster, we implemented a tool called 'AkteAI' (in English: Deeds-AI). The whole process has taken Kadaster five years up until now, and we are still expanding daily. Kadaster processes deeds, attachments, and court rulings. We have excluded the latter two types of documents from the AI process by exclusively focusing on the deeds. By using an enormous dataset of deeds and the way these deeds have been processed in our key register, we were able to teach the tool which elements, which data, were important and which information we need to enter into the key register. The ground truth consists of a huge dataset that has been compiled, with all data labeled and validated, as previously explained above. The most important thing to mention here is that this dataset for creating the ground truth was not flawless. The datset consists of historical transactions, including the mistakes that were made in the past when processing the transactions contained in the deeds. The tool automatically carries over these errors unless the data is validated properly. This step may take the longest; it took Kadaster five years to reach the level where we can confidently say that certain data is recognized by the computer with higher quality than by humans.

It is not the case that we process all types of deeds with this tool. The chosen solution is to categorize deeds by complexity, where - given the learning process for AI and the number of these transactions - simple deeds of transfer and simple mortgage deeds were prioritized over complex structures such as a division into apartment rights, a merger of legal entities, or the description of an inheritance acquisition in a declaration of inheritance.

It is also not the case that we process all the data from specific deeds. We focused on a number of aspects where the staff can be well supported by the AI tool, saving time (and thus costs). The focus was on recognizing objects and subjects in the deeds. By recognizing and highlighting these in the deed using colors and entering this data as a mutation proposal in the registration, the employee can check if the correct persons have been selected and then confirm this data in the registration system with the push of a button (attestation). The same applies to the object mentioned in the deed. Due to the notary's editorial freedom in the deed, an infinite number of

possibilities arise to mention objects and subjects. As an infinite series of characters and words is difficult to automate it is equally difficult to predict the correct output for AI tooling.

The third part of exclusing was with regard to number of cadastral numbers, mentioned in the deeds. The focussed on deeds where no more than one object is mentioned.

The result of these various exercises (exclusions) is that the tool can currently recognize that there is only one object mentioned in the deed. This makes it possible to automatically signal (announce) all documents related to one object in the registration, which, as only deeds where more than one object are mentioned in the deed need to be signalled mannualy, can lead to faster signaling and thus extend the opening hours for submitting documents. A second result is the aforementioned recognition of persons, which helps the employee, as they no longer have to retype the data and can bring the data of persons into the registration automatically by checking and confirming. The same goes for the object, mentioned in the deed. Currently, it is being investigated whether, in addition to objects, subjects, and the purchase price or mortgage amount, more data can be automatically recognized and whether the various legal facts from the deeds can be extracted, so that it is known what type of legal act is described, allowing process control and automated control rules, which apply per type of legal act, to be invoked. These are small but significant steps forward in a very detailed landscape of registration actions and requirements.

Lack of high-quality data & Synthetic data

To be able to process all types of deeds and support all possibilities through the digital transformation that AI seems to bring about, a huge amount of deeds, training time, data labeling, and validation of this data is needed. And this is where the problem seems to lie. The development of new AI models is not (any longer) going as hoped: Google's new Gemini model is disappointing internally, Anthropic's chatbot Claude Opus 3.5 is delayed, and OpenAI's new language model, named Orion, does not meet the desired performance, especially in terms of programming skills.[17] The main cause is that it is becoming increasingly difficult to find enough high-quality data to train these systems. Almost the entire internet has already been used as training data. This has taught what could be learned up to the point of AI development. It is another signal that AI is not as creative as assumed and perhaps will not become as conscious as autonomous humans (and therefore should not be assigned human rights or be protected by legal personhood, as suggested[18]). Manually labeling data by human experts or generating synthetic data could be a solution to continue making progress with the further development of large language models. Synthetic data simulates characteristics of relationships between people and objects (for example, a school or a neighborhood, but perhaps also a street or an individual house, which touches the core of land registration (sic!). This way it allows reality to be mimicked[19] without identifying the person or object. Would this mean that land registries should feed these large language models with their true data, in order to develop them? Do we need to feed deep learning models with land registry data, even though, according to ABAY, Et. Al. (2019) data anonymization approaches do not always provide rigorous privacy guarantees? One of the key findings of Gartner (2024) is that market awareness of synthetic data for software testing has been very low and its potential has not yet been realized by software engineering leaders. Does this imply that

[17] https://www.bloomberg.com/news/articles/2024-11-13/openai-google-and-anthropic-are-struggling-to-build-more-advanced-ai

[18] https://theweek.com/tech/ai-rights-technology-artificial-intelligence.

[19] https://www.syntho.ai/ai-generated-synthetic-data/.

land registries should support this development? As generating and managing synthetic data is complex and resource-intensive, another key finding of Gartner, it does not seem wise to do so, also because of the related costs that can quickly spiral out of control. These important decisions cannot be made by registrars as they encompass much more than just a legal judgment. For this reason, it is recommended to appoint an algorithm officer to, alongside officials from other disciplines, contribute to and participate in the decision-making process regarding these kind of issues.

Algorithm Officer

In the section on innovation and technology of the previous chapter, it was already mentioned that AI intersects with various fields of research and therefore requires a broad understanding of multiple disciplines. This is also why it would be rather shortsighted to let lawyers or decisionmakers make decisions on AI on their own. Lawyers simply do not know (everything about) AI. Deep expertise in one area of AI might not translate to other areas, necessitating collaboration and continuous learning. Yet, it is advisable to involve lawyers, decisionmakers and legislators at an early stage with AI.

The regulatory environment for (generative) AI is continually evolving, while keeping up with the ethical implications of AI advancements, such as bias, privacy, security and fairness. These elements of a regulatory environment are crucial but complex. It also concerns integration issues into existing systems and scalability issues when effectively deploying AI solutions in real-world scenarios.

It is advisable for any organisation to have an Algorithm Officer who is responsible for the above mentioned advancements and who has a strong background in computer science, data science, or a related field. This person should also understand ethical issues related to AI and algorithms, is familiar with legislation and regulations governing AI and data use and has strong analytical and problem-solving abilities. That is why the Algorithm Officer is crucial in ensuring that algorithms are developed and used in a way that is fair, transparent, and beneficial to all stakeholders.

Just like blockchain: GIGA

As described earlier when describing the principles on blockchain in reference to the feasibility of the use of blockchain in Land Administration (VOS, J. 2017-I), a correct functioning, the responsible manner, of modern technologies highly depends on the input. For the use of AI, there is no difference in this perspective. The output of Artificial Intelligence tooling depends on the input with which the system is trained. When the system is fed with incorrect information or fake news, it will also generate such information. At the same time, these AI models need to be extensively retrained by humans to prevent inaccuracies, biases, fake news, and offensive and inappropriate output. The output depends on the training data, and when training texts are taken from the internet, they can contain all kinds of incorrect information.

Modern models can be finetuned for specific tasks, or be guided by prompt engineering. ZIEGLER & BERRYMAN (2023) describe prompt engineering as ‘the art of communicating with a generative AI model’. It therefore is the process of structuring an instruction in natural text describing the task that can be interpreted, understood and performed by a (generative) artificial intelligence (AI) model. RADFORD, Et. Al. (2019) demonstrate how language model scan perform ‘down-stream tasks’in a ‘zero-shot setting’, without any parameter or architecture modification. According to MANNING (2022), for these tasks these models acquire predictive power regarding syntax,

semantics and ontologies inherent in human language corpora, but they also inherit inaccuracies and biases present in the data on which they are trained.

Preconditions for implementing AI

In general, but certainly also for the registrar, it applies that trusting Artificial Intelligence, especially Generative AI, multiple points of attention are to be considered. Only a few of them will be addressed. One of the key points is transparency. AI systems should clearly communicate their capabilities and limitations, as more and more people rely on these technologies. It is of the utmost importance to know what an AI can and cannot do, in order to (help) set realistic expectations.

The next is explainability. AI models, especially complex ones like Generative AI, should provide explanations for their outputs. This helps users understand how decisions are made. The decisions made by AI models should also be consistent. AI systems should perform consistently across different scenarios. Regular updates and maintenance are crucial to ensure reliability, as we will lalso see later on, when discussing the use of AI in Land Administration. In order to be able to rely on AI technology extensive testing and validation against diverse datasets are needed. Perhaps this is one of the elements by which trust in these technoligies is created. Furthermore ethical considerations are of importance. Besides the protection of user data and ensuring privacy is paramount, AI models should be designed to minimize biases and ensure fairness. This involves using a high amount of diverse training data and implementing fairness checks.

But perhaps one of the utmost point of attention – or precondition – when starting to use (Generative) AI, is accountability. There should always be a level of human oversight and participation in the training of AI models, but also to monitor AI systems and intervene when necessary. This is also called Human in the Loop (abbreviated as HITL). Developers and organisations using (Generative) AI should take responsibility for the AI systems they create and use, ensuring they are used ethically and responsibly.

AI Transparency Hubs

Every AI system should come with an interactive transparency hub: a platform or initiative aiming to make AI systems more – and idealy: fully – understandable and accessible to the public and its stakeholders. These hubs[20] and legal provisions[21] allow users to see exactly how the AI makes decisions, with visualizations and explanations that are easy to understand. Users can ask questions and get real-time explanations, making the AI's thought process as clear as a human's.

Perhaps a very accessible and understandable way to make AI more transparent could be the implementation of a trust score for every AI system, similar to a credit score, that reflects its reliability, transparency and ethical behaviour. These scores should be publicly available and regularly updated based on user feedback, performance metrics, and independent audits.

For if AI is not transparent, reliable, and explainable, some contemporary views of reality will be further reinforced, and, taken into account, the what is called illusory truth effect by HASHER's,

[20] To mention just a few of these initiatives : https://ainowinstitute.org/ (advocating for transparency and accountability) and https://partnershiponai.org/ (promoting responsible AI development and use).
[21] The Regulation of the European Parliament and of the Council on harmonised rules on artificial intelligence and amending Regulations (in short: Artificial Intelligence Act) EC 2024/1689 https://eur-lex.europa.eu/eli/reg/2024/1689/oj, came into force in 2024 and will regulate AI in the EU by 2026.

Et. Al. (1977), it does not seem unimaginable that illusion will take over reality. And when illusion takes over reality, the lie becomes the new reality.

The carbon footprint of AI / AI and sustainability

Earlier VOS, J. (2022) it was mentioned that land administrations should and embrace and utilize modern technologies wherever and whenever possible. Some years before that, in VOS, J. (2017-II) the registrar is in this sense compared with a (cardiac) surgeon who has taken an oath to save as many people as possible. Surgeons do this by responsibly using as much modern science and technology as possible and so should lawyers. But as described in Chapter one, Land Administration is also to be seen as a socially responsible and sustainable institution. It there needs to take into account many facets of life. We have to adapt to societal developments. One of the most important and current problems in society is climate change. And here we meet the increasing use of Artificial Intelligence and the concerning energy consumption of data centers, needed to suffice with the demand for the use of AI.

AI systems, especially those based on deep learning and large-scale neural networks, require substantial computational power. This computational demand translates into significant energy consumption, which in turn contributes to the carbon footprint of AI. As the energy consumption of data centers is skyrocketing and the trend is that this consumption will accelerate in the coming years due to the growing use of artificial intelligence (AI), this may cause polluting power plants to remain open longer and to put more pressure on decreasing our carbon footprint.

The Three Mile Island nuclear power plant, known for the nuclear accident in 1979 with its sister reactor, closed in 2019, seemingly for good as it was no longer profitable. Yet, in September 2024, there were plans announced (VALINSKY, 2024) to restart the plant in order to sell the power to Microsoft. This demonstrates the immense power needs of the tech sector as they build data centers to support artificial intelligence. The energy consumption of data centers is soaring. In order to train smart AI models and to subsequently answer the questions of people who use smart chatbots or search engines.

Walsh, et al. (2020) stated that: “Optimizing actions for a restricted set of parameters (profit, job security, etc.) without consideration of the [...] wider impacts can lead to consequences for others, including one’s future self as well as future generations.” According to research by Goldman Sachs[22], the power consumption of data centers doubled between 2020 and 2023, while the energy consumption of data centers had been rising slowly for years. The use of AI most certainly costs significantly more energy than browsing on the internet or using electronic banking applications. Calculating the energy costs of all the processes needed for artificial intelligence is not so simple. This is very clear and impactful explained by CRAWFORD & JOLER (2018) in a visual essay, using a blueprint of a smart speaker. When giving the speaker a command, it sends your message to a data center, using an entire infrastructure of production processes, materials, and data transport, while analyzing and learning from recorded voice messages. Although tech giants keep the exact figures of their AI models a secret, Altman[23] stated that an energy breakthrough is necessary for future artificial intelligence, which will consume vastly more power than people have expected.

[22] https://www.goldmansachs.com/insights/articles/AI-poised-to-drive-160-increase-in-power-demand.
[23] https://www.reuters.com/technology/openai-ceo-altman-says-davos-future-ai-depends-energy-breakthrough-2024-01-16/.

The use of AI has already led to gas and even coal plants running more frequently world wide, resulting in additional CO2 emission. And this while we now need to reduce the carbon footprint. It is high time that we protect nature and thereby ourselves.

With this in mind, the question arises to what extent land registration can contribute to the reduction of our carbon footprint, in addition to, of course, reducing the use of AI by companies that offer 'energy-guzzling technologies' without offering a carbon-neutral program. This can be done by using Green Data centers. These are data centers that adopt energy-efficient designs and practices (e.g.: advanced cooling technologies such as energy-efficient hardware and the use of renewable energy sources by smartly controlling batteries or heat pumps). Amongst others, Google[24], OpenAI[25] and Microsoft[26] embraced and committed themselves to Carbon Neutrality in datacenters. According to Google, they reduced their cooling costs by 40 percent between 2006 and 2016.[27]

It is good that we are all being encouraged to purchase emission-free energy. This way, we also support the construction of new wind and solar parks or nuclear power plants. By only using market-based figures, companies can obscure their true impact on the climate. To prevent *green*-washing location-based figures are necessary. These figures show that there is still energy consumption associated with emissions.

Apart from being alert to carbon-neutral data centers, land registries could embrace algorithms that require less computational power without compromising performance (e.g. model pruning, quantization, and knowledge distillation). Next to that, we should scrutinize the deployment of multi-purpose generative ML systems (for rather simple tasks), and should more intentionally weight its use against increased costs in terms of energy and emissions (LUCCIONI, et.al. 2023).

Possibly AI applications in future will increasingly run on smart devices without needing a connection to a data center. STRUBELL, E. et al. (2019) provided a comprehensive analysis of the energy consumption and carbon emissions associated with training large AI models. Their findings underscore the need for more energy-efficient algorithms and hardware. With regard to those more energy-efficient soft- and hardware, VRIES, DE, A. (2023) warns for a rebound effect whereby increasing efficiency leads to increased demand for AI. The energy requirement varies depending on the type of AI and the complexity of the tasks. Large-scale AI models like GPT-3 and its successors consume significantly more energy than smaller, specialized models.

Given the significant energy consumption of AI technologies, it is crucial to balance technological advancements with environmental sustainability. VRIES, DE, A. (2023) mentions regulators might consider introducing specific environmental disclosure requirements to enhance transparency across the AI supply chain. This way there may be a better understanding of the environmental costs of this emerging technological trend. Recognizing the rights of nature can be a powerful approach to ensure that technological progress does not come at the expense of ecological health. By granting legal rights to nature, we possibly may create a framework that holds both individuals and corporations accountable for environmental impacts, promoting a more sustainable coexistence with our natural world.

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[24] https://sustainability.google/operating-sustainably/net-zero-carbon/
[25] https://openai.com/blog/ai-and-compute/
[26] https://blogs.microsoft.com/on-the-issues/2024/05/15/microsoft-environmental-sustainability-report-2024/
[27] https://deepmind.google/discover/blog/deepmind-ai-reduces-google-data-centre-cooling-bill-by-40/

CHAPTER 3 Rights of Nature

Rights of Nature is a millenia-old concept, yet nowadays revolutionizing our relationship with nature. Granting rights to nature is done in many countries, regions and on local levels. As Nature around the world gains increasing rights as a 'person' or 'living entity', we, as land registrars, need to understand what this means and what this could mean for the functioning of land registries.

The concept of 'Rights of Nature'

Mineral King, a glacial valley in the southern part of Sequoia National Park, California, was planned to be sold to Walt Disney Company for building a resort on public land in California. To prevent this from happening, environmental organization Sierra Club sued the Secretary of Interior. In a 4 -3 decision in April 1972, the justices concurred[28] with an appeals court ruling that the Sierra Club did not have standing to sue. But in a famous dissent[29], Justice William O. Douglas stated: "*Contemporary public concern for protecting nature's ecological equilibrium, should lead to the conferral of standing upon environmental objects to sue for their own preservation.*"

With this dissenting opinion judge Douglas referred to the argument of STONE, Ch.D. (1972), who referred in his essay to the case then being considered by the United States Supreme Court, the case mentioned as Sierra Club v. Morton.[30] This paper argues that natue should have protection without directly benefiting us as humans. Therefore, this protection requires a more holistic world view, a perspective in which everything is connected. Man is not separate from nature, but is part of it. Within this holistic worldview we cannot see nature as 'property'.

Recognizing nature as a 'legal person' means that the interests of nature are guaranteed for a longer period of time and that the protection of nature is no longer dependent on which political wind blows. The intended protection goes further than the protection that is good for people.

Rights of nature is about balancing what is good for human beings against what is good for other species, what is good for the planet as a world. It is the holistic recognition that all life, all ecosystems on our planet are deeply intertwined.

How to give Rights of Nature

Rights of Nature is a radpidly growing trend toward truly including nature as ecosystems are the basis of our existence en we are only part of them. The way this is done, differs in many countries and sometimes even within a country, although there are similarities and some shared characteristics in many cases.

By giving rights to natural entities such as rivers, mountains, forests, wetlands and animals (species), these entities can decide on their future, based on their own interests, just like we do ourselves, as well as companies and governments. But as natural entities cannot think or represent themselves, just as companies and governments can't, nature is institutionalised as stakeholder in our decisionmaking models by representation with legal personality. The representatives of nature have to examine the questions and decisions presented to them from the intrinsic interest of the nature they represent. The concept of Rights of Nature has been implemented world wide in different ways. An extensive and actual overview of these worldwide

[28] https://www.nytimes.com/1972/04/20/archives/supreme-court-sets-aside-suit-of-sierra-club-to-block-resort.html
[29] https://en.wikisource.org/wiki/Sierra_Club_v._Morton/Dissent_Douglas
[30] https://supreme.justia.com/cases/federal/us/405/727/

implementations (and initiatives) is shared by the Global Alliance for the Rights of Nature[31] which is committed to the universal adoption and implementation of legal systems that recognize, respect and enforce 'Rights of Nature'. Some of the most striking implementations or briefly described below.

United States

In the United States, a growing number of municipal and tribal governments — including those of Pittsburgh[32], Santa Monica[33], California and the Yurok and the Ponca Nation tribes — have sought to protect local natural resources by granting them rights. In Pittsburgh Fracking used to be extract oil and gas, but this way of gas and oil extraction has a heavy impact on the quality of drinking water, air quality and soil as it can dislodge methane, oil or gas from the ground, which can then seep into and polute drinking water sources. In Pennsylvania, state law says municipalities aren't allowed to regulate the gas and oil industry anymore strictly than the state is. So there was a problem for Pittsburgh. In 2010 Pittsburgh former city councilman and afterwards mayor Bill Peduto, sent out an email to environmental groups, land use experts, environmental lawyers and whoever more to ask for advice on how to protect the residents from fracking. The idea was to declare a right to clean air and water and soil for all citizens of Pennsylvania. That way, fracking could be banned in Pittsburgh (at least). So the Rights of Nature doctrine worked out well.

New Zealand

Differing to a large extend from the United States' cases are the developments made by New Zealand. In the 19th Century the Crown committed land grabbing from the indigenous people, the Maori. The Maori and New Zealand's government have argued for years over guardianship of the country's natural features. The issue was resolved by taking the Maori mind-set into account.

As in the worldview of the Maori the saying "I am the river and the river is me" is elementary, the law begins by recognising the river as an indivisible and living being called 'Te Awa Tupua' and outlines four core principles from the tribes' perspective, including their inalienable connection to the river. Then, it states this being "has all the rights, powers, duties and liabilities of a legal person". The indigenous people get significant influence over the future of the river.

Yet, the case of Te Awa Tupua is not unique as in 2014 New Zealand gave the same rights to a former national park, called 'Te Urewera' and soon after that 'Mount Taranaki' as well. In 2014 the Te Urewera Act[34] was implemented. In this Act there are specific legal provisions made with regard to the land register. It is stated that a computer freehold register must be created 'for the establishment land as soon as is reasonably practicable after the settlement date, but no later than 24 months after that date'[35]. The Registrar-General must create one computer freehold register for the fee simple estate in Te Urewera establishment land and record on this register any interests that are registered, notified or notifiable[36].

Ecuador

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[31] https://www.garn.org/.

[32] https://www.businessinsider.nl/rights-for-nature-preventing-fracking-pittsburgh-pennsylvania-2017-7?international=true&r=US.

[33] https://www.smgov.net/departments/council/agendas/2013/20130312/s2013031207-C-1.htm.

[34] https://www.legislation.govt.nz/act/public/2014/0051/latest/whole.html.

[35] Te Urewera Act 2014, article 89 (4).

[36] Te Urewera Act 2014, article 89 (1).

Ecuador's Rights of Nature embodies the indigenous *sumak kawsay* (good living) principles, giving 'Pachamama' (mother earth) constitutional rights to protect and restore its environment.

With the adoption of a new Constitution in 2008, Ecuador became the first country in the world to enshrine a set of codified Rights of Nature Articles 10 and 71–74 (Title II, Chapter 7) of the Ecuadorian Constitution recognize the inalienable rights of ecosystems to exist and flourish, give people the authority to petition on the behalf of nature, and requires the government to remedy violations of these rights.

It is the task of the judges to give meaning and effect to these articles. The Constitutional Court is establishing a line of jurisprudence that imposes a higher legal standard for rights of Nature than that of existing environmental protections. Over 60 court cases have been completed, which can be seen as a-typical, since Ecuador is a civil-law country. In one of these cases the Court decided that the Aqueoi River[37] has a right to flow. This has been the first time that rights of Nature has included such a standard for riverine rights. The first case was filed in 2011 by two residents, citing the violation of the rights of nature, rather than property rights, for the damage done to the river Rio Vilcabamba. The case was important because the Provincial Court of Loja stated that the rights of nature would prevail over other constitutional rights if they were in conflict with each other, setting an important precedent. In Bolivia Rights of Nature have also been implemented in the Constitution and in Colombia the evolution of rights of nature is also left by judgment.

India

This is the same elsewhere, e.g. in India , where In 2017, the high court of the Indian State of Uttarakhand gave the rights of personhood to two rivers and cited[38] New Zealand as a model. But the Surpreme Court annulled this ruling, deciding a State Court cannot decide on a case of national importance, as these rivers are streaming through other states as well.

Spain

In Spain the largest salt water area in Europe is a coastal saltwater lagoon in the Iberian Peninsula located south-east of Murcia and called 'Mar Menor'. At this point in time Spain is the only European country where rights of nature have been acknowledged by law. In Nothern Ireland and the United Kingdom rights of nature are realized on a local administrative level, but within Europe the Spanish are the only people with a specific law, the Mar Menor Act[39].

Mar Menor has been suffering from pollution and irrigation issues. The Ley Mar Menor acknowledges the right to litigate for every citizen in case the rights of the lagoon have been violated. There is a financial provision to do this, so no citizen should feel impeded by the costs of a legal procedure. As is the case in New Zealand, there is a very extensive representation scheme that has been stipulated in the Mar Menor Act.

Various legal frameworks

As described above, rights of nature have been codified on various levels and have been implemented in legislation in various ways at different levels, each with a different outcome or approach and depending on the various jurisdictions. These jurisdictions have different legal norms, cultural contexts, political institutions and histories. Next to that, each ecosystem is more

[37] https://ecojurisprudence.org/initiatives/rights-of-aquepi-river-case/
[38] https://indianexpress.com/article/opinion/columns/once-upon-a-river-ganga-yamuna-legal-rights-uttarakhand-high-court-4651659/.
[39] Ley 3/2020, juli 27, BOE-A-2020-9793. https://www.boe.es/eli/es-mc/l/2020/07/27/3.

or less distinct. For those two reasons, nature's rights have been stipulated in local law, in court rulings, in national (civil or administrative) legislation but also in Constitutional law. Those provisions vary from specific rights to Nature as a whole (Ecuador), to a living person (India), a living entity (Australia) and to legal personhood (Spain and New Zealand). In the cases of legal personhood cooperative consultative bodies have been established, through which rights of nature are being effectuated.

The common denominator of these different implementations seems to be that often, if not always, some form of representation is used. This can be done through a representation scheme of nature or a group of people united in a legal entity, thus representing Nature as a legal subject (and, nature as the object). In some cases, however, the rights of nature can also be shaped in a different approach by (from the perspective of criminal law or ecoside[40]) invoking the constitutional or human right to a clean, healthy and sustainable environment as recognized by the UN General Assembly[41] or (from the perspective of private law), as in the case of the Mar Menor Act in Spain, by granting every citizen the right to litigate while a financial provision has been made available for this. It is debatable how successful this legal representation can be, as it needs to be acknowledged by everyone and executed on a very high level.

According to ARSTEIN-KERSLAKE, A. Et Al, (2021). the expansion of legal personhood over the past decade to explicitly include people and natural entities whose claims to be legal subjects have been historically excluded from models of personhood. The researchers acknowledge that Euro-Western ways of knowing and being have largely failed (so far) to learn from Indigenous Peoples' laws and philosophies. The authors developed a concept of 'relational personhood', building a bridge between Euro-Western legal concepts (such as legal personhood) and Indigenous Peoples' law and protocol that governs the relationship between people and place. In the end, the utility of a conception of legal personhood needs to encompass the reality of the interdependence of all individuals and entities. The recognition of legal personhood is critical for overcoming historical and can be a powerful response to dominance (in a specific market).

The (possible) implications for Land Registries

As described in VOS, J. (2016) every system of a well functioning land registry consists of a triangle, as these systems reflect on and are in accordance with property law and (for a long time) the law of property is (or has been) the law of things (SMITH, 2012) that with a relationship between a person and a physical object, despite the a relational approach to property law arose in which property rights were increasingly construed as a relation between the owner and the rest of the world with respect to an object (SAGAERT, 2005), which might even enhance the (legal) value of a well functioning land registry system.

There is always a connection between the object, the subject and the right in rem related to the object and its rightholder, the subject. But by acknowledging that the object of nature is assigned rights to itself, the object (nature) does become a subject as well. As the object also becomes the

[40] The term 'ecocide' was coined by Arthur W. Galston at the Conference on War and National Responsbility in Washington (1970) and proposed to be added to the Genocide Convention in 1978 (https://digitallibrary.un.org/record/663583?ln=en&v=pdf#record-files-collapse-header). It can be defined as the unlawful or wanton acts committed with knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment being caused by those acts (https://ecocidelaw.com/#:~:text=%E2%80%9CEcocide%E2%80%9D%20means%20unlawful%20or%20wanton,Definition%20of%20Ecocide%2C%20June%202021).

[41] https://digitallibrary.un.org/record/3983329?ln=en&v=pdf.

subject, the triangle can no longe rexist. This might result in a land registry system that cannot function the way it used to. From a land registry perspective this does not seem feasbile. For this reason we have to think differently, if there is a need to make changes to the current modus operandi.

Depending on the situation per country, it might perhaps be useful to register not only the titleholder, being the subject, but to introduce a new phenomenon, such as a guardian, a tutor or whatever title is provided to the representative (mostly a legal person) of Nature, defending the interests and rights of nature.

There may be the possibility to continue the registration of rights, restrictions and responsibilities in our current land registry systems the way it is done for many years. Perhaps it is possible to register limitations, restrictions, proxy's, representations, rightholders et cetera, just the way registrars do this in their systems nowadays. There may just be sufficient measures and possibilities to outline the representation of Nature as a subject by the guardian in the current registration systems.

Crossborder objects

Natural objects do not adhere to national borders. Mountain ranges often form the physical boundaries between countries, but they actually consist of a 'functional unit,' an ecosystem, which cannot be separated by an administrative (national) border. The same applies to open waters (e.g. oceans, seas, and rivers). These ecosystems, these and possibly other natural objects as well, are (almost) inherently transboundary. In this sense, nature does not stop at a national border. One might question whether Rights of Nature can stop at a national initiative or a local or national implementation of Rights of Nature.

So the question arises what will happen if the Finsteraarhorn, the highest mountain in the Bernese Alps of Switzerland and part of the Aletsch Glacier region (which is a UNESCO World Heritage site) does not have rights by itself, but the river Rhine, that has its source in the Finsteraarhorn neighbourhood, does? From that neighbourhood, the Rhine starts flowing and flows through Switzerland, Liechtenstein, Germany, France, Austria, Luxembourgh and Belgium and finally flows in the North Sea, which is openly connected to the Wadden Sea, also recognized as UNESCO World Heritage. Wadden Sea by itself is a topic of interest for the acknowledgement of Rights of Nature. Although the question[42] whether Rights for the Waddenzee would be necessary was declined by the responsible Ministers of Infrastructure & Water Management and Agriculture, Nature and Food Quality as legal personhood was not to be seen as a necesarry condition[43] to protect nature, it is still an ongoing debate in politics.[44]

What would happen if some countries do adopt rights of nature and some others do not? In 1950 the Council of Europe signed the European Convention for the protection of Human Rights and fundamental freedom of association with others (ECHR).[45] This international treaty protects human rights and fundamental freedoms in Europe.

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[42] Parliamentary document 29 684, no. 163, official publications. https://zoek.officielebekendmakingen.nl/kst-29684-163.html.
[43] Parliamentary document 29 684, no. 185, official publications. https://zoek.officielebekendmakingen.nl/kst-29684-185.html.
[44] https://www.tweedekamer.nl/kamerstukken/moties/detail?id=2022Z04938&did=2022D10027.
[45] https://www.echr.coe.int/documents/d/echr/convention_ENG.

CHAPTER 4 Rights of Nature: erosion of property rights?

Baring in mind the shift towards Rights of Nature, it might be an idea to acknowledge natural phenomena and natural ecological systems, such as rivers, 'fed' by mountains by law. If would be suggested that this would be of help in cross border cases, when one element of such a natural ecosystem needs legal representation and it would be decided to have such a convention, besides many other (practical) questions that have to be answered, two main questions remain. There are perhaps more solutions to be considered. In this chapter the introduction of Ownership for Nature and the implementation of obligations to owners is mentioned.

Introducing a concept of Ownership for Nature

As traditional concepts of ownership do consist of a right between an object and a subject this does not really seem to function with regard to climate change and nature. VAN ERP (2023) does recognize a comparable type of problem with regard to ; ownership' of data, as data or not sufficiently specific, while legal objects have to be unique when talking about ownership and data can be copied (almost) at any time and in any case. With regard to Ownership of Nature, more broadly: Rights of Nature, the first question would be: what could possibly happen with the civil-law right of ownership/ proprietorship in case the Council of Europe should then decide to follow the New Zealand principle that Nature is not owned by any person or institution, so Nature is owned by Nature itself? As States have become subject to international and supranational obligations (e.g. the Paris Climate Agreement and the European Green Deal) the (rights of the) citizens of these States are sometimes affected by these international agreements[46], despite the formal exclusion of the effect of these agreements on direct private property rights[47].

Ownerships from the common law perspective would mean that the concept of ownership would change into a system with possibly multiple appearances. It than should perhaps no longer be an individual unitary concept of ownership. The true owner would no longer be the Crown, but Nature itself. State interference is regulated by constitutional protection by restricting the circumstances under which property can be limited by the State. Nevertheless, as if the right of ownership (sometimes) according to Mansfield (2018) has a fluid character, private owners sometimes are forced to surrender their rights in the general interest.

In general, including civil law countries, the big change would be that proprietorship by a natural person would be influenced by (and would even be derived from) the ownership of nature by Nature itself. Part of this ownership, kept by a natural person, could imply certain restrictions and obligations in favor of Nature. This could (possibly) imply the introduction of the so-called bundle of rights in jurisdictions that are not familiar with this concept.

The second question would derive from the first question and concerns the question what the effect to the current land registry legislation and land registry systems would be. Would there be a need to change these systems? Or could this new concept of 'owned by Nature' be neglected by the land registry system, adding a clause as some kind of warning or exemption clause that in

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[46] A striking example is the mandatory Minimum Energy Performance Standards (MEPS) and the accompanying certificates for residential and non-residential buildings, as mentioned in the Energy Performance of Buildings Directive (EPBD), see: https://ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_24_1966/QANDA_24_1966_EN.pdf.

[47] Art 345 of the Treaty on the Functioning of the European Union (TFEU) (ex Article 295 TEC).

all cases addressed the principle right of proprietorship is affected by the right of proprietorship by Nature?

By introducing a dominant or primary right of proprietorship for Nature (as a subject) with respect to nature itself (nature as an object) that overrules any other type of right with regard to proprietorship or otherwise by a natural or legal person, a most comprehensive, a top-layer right in rem, should perhaps be implemented. This would have an effect on probably all legal (and therefore all land registry) systems, whether these systems use the numerus clausus principle or the numerus apertus principle.

Both of these questions are not easy to be answered and demand a social, legal and technical deep dive. In case this principle would be embraced and established by the European Council in a European Convention, this would have an effect on any European land registration process. Perhaps the most important question is: is Rights of Nature truly a solution to the reduction of the carbon footprint, energy reduction and preserving Nature for the future, or is it just another Chocolate Laxative? VAN DEN BERGE, L. (2023) describes Rights of Nature as a concept that is not really a shift, but 'only a further extension of a legal paradigm' and urges to thoroughly reconsider the concepts of legal personhood and rights themselves.

There are perhaps also other possible measures to spare nature and prevent the consumption of all natural resources.

Implementing obligations for owners

Do States have obligations in respect of climate change? The International Court of Justice is requested for an advisory opinion by the United Nations General Assembly at its 64th plenary meeting held on 29 March 2023. If a State would have obligations, could a state oblige its citizens to take energy-saving measures? What would this mean to the concept of ownership (and its related concepts of expropriation and the right to respect your home as stipulated in article 8 of the European Convention on Human Rights)? This would effect the most absolute right legal systems acknowledge and therefore might have impact on Land Administration processes.

The implementation to impose obligations to climate-proof buildings on owners by governments would be quite a different approach. It is questionable whether governments are legally allowed to entirely or partially impose obigations to climate-proof buildings with or without compensation by these governmental organisations, or these obligations are precluded by the protection of property under national Constitutions and international and supranational provisions, such as Article 1 of the First Protocol (A1P1) to the European Convention of Human Rights (ECHR). According to HOOPS, B., et al. (2024) obligations to do something (with respect to reducing the carbon footprint: to take measures to minimize the impact on the climate as much as possible), so-called positive obligations, are underexplored whereas, referring to ALTERMAN, R. (2010), negative obligations (obligations not to do or tolerate anything) are well researched.

Imposing obligations to owners of buildings may be considered. Besides the possible negative affects of acceptance by owners of buildings would be the limited effect to minimize the protection of Nature, as this does not only concern home owners and legal entities owning buildings, but also other citizens that do not own property but still can cause damage or harm Nature. In such cases ecoside, as mentioned before can be a complementary way to limit these negative effects and to hold the responsible persons liable. Trying to close the loop, Nature could perhaps be represented by implementing rights of nature as mentioned in the previous chapter. Additionally, we could also take a look at collecting the needed information with regard to the

object itself (building information), creating an international Legal Framework and ultimately leaving or moving the object in order to support a recovery of Nature (Managed Retreat).

Registration of building information

To be able to build climate-neutrally, materials are needed that leave no carbon footprint. Materials that are free of toxins and leave no or as little residual material as possible. It seems advisable to document the materials used in a building. RAU, T. et al (2021) invented the building materials passport, a passport containing the description of the materials that are used building the object. This passport can also be used when demolishing the object, dismounting these materials. In other words, it is a tool for documenting circular construction, a tool or method for documenting circular construction practices. Circular construction focuses on minimizing waste and maximizing the reuse of materials, creating a more sustainable building process. This does concern environmental friendly building constructions, but not it does not concern nature itself. Nevertheless, it reduces the carbon footprint and therefore has a role in preserving Nature.

The downside of the building material passport, is that they are not (yet) universal. Many different parties are developing their own passports, with different types of documentation, different visions, and goals. In other words, there is a lack of a unified approach, although there are initiatives[48] to unify the process of creating a building passport. The lack of a unified approach is not an inherent problem as long as these passports are able to communicate with each other.

When these materials and substances are recorded in a building passport, it is advisable to carefully preserve this building passport and document it for the future, so that during renovation or demolition of the building, it is clear which materials were used and can possibly be reused. To this end, a land registry or cadastre of materials, a Madaster, could provide a solution. Moreover, this Madaster could introduce a technical standard for this passport, so that it is recorded uniformly and in a generic way. Such a Madaster has been established and can be utilized in The Netherlands. Dutch Land Registry is not involved in the establishment and implementation of this register.

International Legal Framework

McAdam (2017) outlines the scope of existing international legal frameworks to assist people displaced in the context of disasters and climate change as mentioned in this paper's Chapter one, and suggests a variety of different tools that are required to address the phenomenon. He comes to the conclusions that identifying the need for a broad, complementary set of policy strategies necessarily affects how international law should be progressively developed in this area. Adopted in 2018, the Global Compact for Safe, Orderly and Regular Migration[49] includes provisions related to climate-induced migration. It encourages states to develop strategies to address the drivers of migration, including climate change, and to enhance cooperation on this issue.

It is the first inter-governmentally negotiated agreement, prepared under the auspices of the United Nations, covering all dimensions of international migration in a holistic and comprehensive manner, a manner as mentioned by McAdam. Yet, it is a non-binding document that respects states' sovereign right to determine who enters and stays in their territory and demonstrates commitment to international cooperation on migration. Nevertheless, it presents

[48] https://platformcb23.nl/#paspoorten-voor-de-bouw & https://www.digigo.nu/digideal-materialen-paspoort/

[49] https://www.iom.int/global-compact-migration.

a significant opportunity to improve the governance of migration, to address the challenges associated with today's migration, and to strengthen the contribution of migrants and migration to sustainable development.

Next to the Global Compact for Safe, Orderly and Regular Migration, there are some regional Conventions, agreements and frameworks that address climate-induced displacement. One of them is the Kampala Convention[50] from 2009 that recognizes the need to protect people displaced by natural disasters and climate change and the Kampala Declaration[51]. This first legally binding regional instrument, originally signed and agreed upon by 15 African states in 2022 and convened one year later by 48 African countries, is initiated to protect and assist internally displaced persons in Africa.

Still, there is a need for specific international legal framework that directly addresses the status and rights of climate refugees. Kawajiri (2018) concludes that, despite the increasing number of Cross-border Climate Displaced Persons (CCDPs), current international legislation does not provide sufficient protection for these persons; the use of (only) existing labour migration and refugee protection schemes is not sufficient. There are several initiatives and discussions aimed at filling this gap, but none has currently been put into place. Despite the fact that the United Nations High Commissioner for Refugees (UNHCR)[52] has acknowledged the impact of climate change on displacement and advocates for the protection of people displaced by environmental factors, their mandate is limited by the definitions in the primary international treaty for refugees, the 1951 Refugee Convention.[53] The Convention does not explicitly include climate change as a ground for seeking asylum and therefore the acknowledgement perhaps has limited value (APAP, 2019).

There are some countries that have begun to develop national policies to address climate-induced migration. For instance, Norway and Switzerland introduced the 'Nansen Initiative' in 2012 to address the potential legal and protection gaps for people in cross border migration induced by environmental change and extreme weather conditions.[54] Its successor, the Platform on Disaster Displacement (PDD)[55] is led by Kenya and Costa Rica and focusses on the implementation of the recommendations of the Protection Agenda, a toolbox to better prevent and prepare for displacement and to respond to situations when people are forced to find refuge within their own country or across the border. In 2017 New Zealand introduced an 'experimental humanitarian visa' for people who were being displaced from Pacific Island countries due to the adverse effects of climate change. This experimental special visa category for Pacific Islanders, as described by Kawajiri, has been stalled after Pacific people have expressed desire to continue to live in their own countries and to focus on mitigating the impacts of climate change. Accordingly, in November 2019 New Zealand passed a Zero Carbon Act[56] to help reduce global warming and lessen the impacts of climate change on vulnerable communities.

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[50] African Union convention on the Protection of and Assistance to Internally Displaced Persons, 22 October 2009, available at: https://www.refworld.org/legal/agreements/au/2009/fr/70535 [accessed 20 October 2024)

[51] Kampala Ministerial Declaration on Migration, Environment and Climate Change (KDMECC).

[52] https://www.unhcr.org/about-unhcr/who-we-are/high-commissioner

[53] https://www.unhcr.org/media/convention-and-protocol-relating-status-refugees

[54] https://environmentalmigration.iom.int/nansen-initiative.

[55] https://disasterdisplacement.org/.

[56] https://www.legislation.govt.nz/act/public/2019/0061/latest/LMS183736.html.

While there is growing recognition of the need to protect climate refugees, significant legal and policy gaps remain. International cooperation and continued advocacy are essential to developing comprehensive frameworks that address the unique challenges posed by climate-induced displacement.

Managed Retreat

A strategy used to address the impacts of climate change, particularly sea level rise and coastal erosion is called managed Retreat. It involves the planned, strategic relocation of infrastructure, communities, and ecosystems away from vulnerable coastal areas to safer locations. The goal is to reduce risk and enhance resilience to environmental changes. The key aspects of Managed Retreat are the reduction of risk, a long-term planning, environmental benefits and last but not least involvement of the community.

The aim of managed retreat is to minimize the potential for damage and loss due to natural phenomena and disasters, e.g. floodings, storms and erosion or earthquakes, by moving people and assets away from high-risk areas. It requires careful planning and coordination, where governmental agencies, communities and other stakeholders are in charge to ensure the smooth transition of people and assets. Teh effected communicties must be engaged, in order to address their concerns and ensure that the relocation process is fair and equitable. By using the strategy of managed retreat opportunities for restoring natural habitats and improving coastal ecosystems can be created. This may provide additional protection against climate impacts.

Nevertheless, managed retreat is often seen as a last resort due to its complexity and the social, economic, and emotional challenges it presents. However, it can be a necessary and effective approach in areas where other adaptation measures are insufficient. It is a holistic, cross-cutting, and coordinated approach across governments and international organizations. By using this holistic approach, different policy areas are connected and recognized. Using this holistic approach temporary, McAdam (2017) concludes that planned evacuation may provide a pathway to safety and emergency support, while long-term, sustainable development projects may enhance community resilience over time, creating new labour opportunities and technologies, and building capacity for self help. Managed creating opportunities for migration, away from at-risk areas, can open up new livelihoods, skills, knowledge, and remittances while simultaneously relieving demographic and resource pressures. Planned relocation can move people out of harm's way, but it must be undertaken with extreme care and sensitivity. The application of planned relocation – or managed retreat – faces challenges, given the projected scale of climate-induced displacement and the difficulties of resettlement. HINO et al (2017), evaluated the drivers, barriers and outcomes of 27 recent cases of managed retreat and created a conceptual model, based on two key factors: who benefits from retreat and who initiates it. This conceptual model may be of help in case of climate-induced displacement. Managed retreat is of course a very emotional and sometimes radical method of safeguarding the lifes and wellbeings of people and live stock. Governments should preferably invest in measures to adapt to climate change. Some countries have already been planning and investing in such measures.

With proactive planning, investment, and community involvement, countries can effectively adapt to the challenges posed by climate change. Some of the (most) successful examples of countries and communities adapting to climate change are mentioned below.

The first example does concern Bangladesh. This country has made significant strides in adaptation, despite being highly vulnerable to climate change by developing early warning systems for cyclones, constructing cyclone shelters, and promoting the cultivation of salt-

tolerant crops. Additionally, floating gardens have been introduced to ensure food security during floods.

The second example is Costa Rica. The hosting country of the 23rd IPRA Cinder Conference has focused on reforestation and sustainable agriculture to combat climate change. The country has implemented payment for ecosystem services (PES) programs, incentivizing landowners to conserve forests and restore degraded lands. As a result, Costa Rica has doubled its forest cover in the past 30 years.

In the Mekong Delta, Vietnam has adopted various measures to adapt to rising sea levels and saltwater intrusion. These include building salinity-resistant infrastructure, promoting the use of salt-tolerant rice varieties, and implementing integrated water resource management practices.

Also Rwanda has invested in climate-resilient agriculture and reforestation projects. The country has implemented terracing and agroforestry techniques to prevent soil erosion and improve water retention. These efforts have enhanced food security and increased farmers' resilience to climate impacts.

The fifth and final country is The Maldives, an island nation highly vulnerable to sea level rise, has undertaken several adaptation initiatives, including constructing artificial islands and elevating infrastructure to reduce flood risks. The country is also exploring coral reef restoration to protect its coastlines.

CHAPTER 5 Conclusions

Land administration is more than an administrative function; it is a pillar of social responsibility and sustainability. By protecting property rights, promoting inclusivity, preventing conflicts, supporting environmental management, facilitating urban planning, and promoting economic sustainability, land administration plays a crucial role in fostering a just and sustainable society.

The integration of artificial intelligence offers new opportunities but also brings challenges, such as high energy requirements and the need for accurate and ethical applications. We could conclude that the use of AI can be a welcome addition to the Registrars' toolkit. The Registrar must be willing to embrace new technological possibilities, but at the same time, must look at the minimum conditions that must be set for the responsible use of AI, as Land Administration has to be a sustainable and responsible institution. As part of the Land Administration process, the registrar should only use AI if it is transparant, understandable and explainable, the outcome is consistent, privacy is ensured and the accountability is in place. This can only be done when the Human is kept In The Loop (HITL).

These conditions must be set to maintain quality, promote the speed of action, but not at the expense of one of human's most vulnerable and valuable 'assets': nature. Nature must be strengthened. Whether Rights of Nature is the most appropriate method for this is a question is debatable. The effect of granting Rights of Nature on the operation of a land registration system can, depending on how these rights are granted, be relevant and possibly even significant. It remains important that whoever owns which rights and whatever (environmental burdens) may rest on those properties, their registration is of fundamental importance. Without proper registration, there is no legal certainty. That certainty can be promoted with the responsible use of modern technologies.

The combination of all kinds of new technologies can possibly be of help of land registrars, notaries and surveyors, but the rule of law is to be protected by its custodians: trusted third parties, (e.g.) notaries, land surveyors and especially land registrars. Being one of these new technologies, AI should be used in a very responsible way, as AI is known to place a heavy burden on energy consumption, thereby exerting significant pressure on reducing our carbon footprint.

Nature is further stressed as energy consumption increases. Recognizing the rights of nature can help balance technological progress with environmental sustainability, ensuring a harmonious coexistence with our natural world. As the call for and recognition of Rights of Nature could increase, it is (still) questionable to what extent recognizing these rights is practically useful if enforcement of these rights and the effects of enforcement remains limited. Nevertheless, assigning rights to nature (also) has a social function (e.g. the acknowledgement of indigenous people). In this matter, Rights of Nature differ from the idea of granting (human) rights to AI.

Rights of Nature it may not have the desired effect on the preservation of nature. The possible acknowledgement of the right for States to oblige homeowners to take measures to combat climate change will possibly have more impact. It may also impact Land Administration, especially when the concept of ownership would be transformed into a less absolute right. If that should be the case, property law and accordingly registration law has to be changed. Next tot hat, possibly land registry systems have to b e changed and the registrar has to make adaptations from the legal perspective and translate these into comprehensive information for non-lawyers, but by making these adaptations the Legum Magister (L.LM) will not become (responsible for) the Large Language Model (LLM).

Key words:

Land Registry, Land Administration, sustainable, responsible, Artificial Intelligence, large language model, ground truth, human-in-the-loop, climate change, Social Development Goals (SDG's), Carbon Footprint, Rights of Nature, building information model (BIM), managed retreat, Concept of ownership.

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