

# Land reforms

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## Summary

The Ph.D. dissertation explores the impact of land tenure security on sustainable agricultural productivity. Agricultural productivity has been declining in SSA and remains low in comparison to the rest of the world. Moreover, the region is often cited as the most vulnerable to adverse effects of climate change resulting in a significant 34% decrease in agricultural production. Given that the agricultural sector contributes an average of 15% of GDP to SSA countries; a decline poses a substantial threat to the overall economy. The fact that over 50% of the population and at least 80% of the rural population relies on agriculture directly and indirectly for their livelihoods and income makes the scenario even more critical. Promoting sustainable agricultural productivity is paramount for building resilience across the continent particularly in light of the high reliance on agriculture, poverty and food insecurity. While sustainable agriculture has been a focal point in development agendas, farmers' uptake or rather participation in initiatives remains notably low. Hence, further research using an interdisciplinary approach is required to create scientific references for increased policy efficiency and efficacy.

Historically, land tenure security has been a key pillar for promoting social justice and economic well-being reforms in SSA. Research points towards tenure security being a key incentive for farmers to invest in sustainable agricultural production. However, approximately 90% of rural land in SSA remains under communal tenure which is often considered as lacking secure land rights. To rectify this, land registration programmes have been implemented across the region. Typically, land tenure security in SSA is created through the conversion of communal land to freehold titling through land registration. Notably, impact studies in Ethiopia and Rwanda have demonstrated that land certification programmes translate to significant increases in agricultural investment.

This intersection between agriculture and land reforms opens up questions on the extent and impact of their linkage. It opens up possibilities for decision-makers and stakeholders to leverage on land reforms and collaborate towards meeting SDG goal 2 among other global policies to end hunger and increase agricultural productivity on a global scale. However, despite the abundance of research on this interlinkage, there remains inconsistency in the literature on whether land registration increases agricultural productivity. The existing studies are yet to reach a conclusive agreement on how and which land reforms effectively support sustainable agriculture, creating a knowledge gap. Particularly in systems that are dominated by small-scale and subsistence farmers understanding this interlinkage is essential. This dissertation aims to bridge this gap by assessing the impact of land registration on agricultural productivity.

The main idea of this dissertation's approach is to provide empirical evidence beyond crop yield models and profit maximization models to improve the accuracy and replicability of the study findings in areas that are dominated by subsistence farming. Previous studies have also shown that even though initiatives educating farmers on climate resilience agriculture have indicated increased adoption, they have been found unlikely to raise farmers' willingness to adopt sustainable practices. To enhance the effectiveness of policy design for sustainable agriculture, it is crucial to delve into the behavioural drivers and barriers that shape farmers' decision-making.

By providing a comprehensive approach, this dissertation fills a crucial knowledge gap by evaluating if land registration creates security of tenure which motivates farmers to increase sustainable agricultural production. The following sub-questions are addressed;

- 1) What are the psychological factors that influence farmers' intentions to adopt climate resilience farming?
- 2) What is the impact of land registration on crop intensification in Kenya?
- 3) What is the impact of land registration on farmers' decision-making on the uptake of short and long-term on-farm investments?

To address the research questions, the study used a case study of Tharaka Nithi County in Kenya. Tharaka Nithi County reflects diverse agricultural systems and tenure systems found in SSA; this includes but is not limited to subsistence, semi-commercial and commercial farming systems, large-scale and small-scale systems, semi-arid and arid land (ASALs) agro-ecological zones, private and communal land tenure, registered and unregistered farmland. The county has two main ecological zones namely the highlands (Upper zone), and the Semi-arid zone (Lower Zone). It experiences a bimodal rainfall pattern with long rains falling from March to May (MAM), and short rains from October to December (OND). Agriculture in the county is predominantly small-scale and subsistence and reliant on rain. Small-scale farming has an average landholding of 2.9 hectares, while the average landholding for large-scale farmers is 6.7 hectares. Additionally, Tharaka Nithi County has similarities in population characteristics as to the country and SSA in general. The County has a 77% rural population with 80% of this population relying on agriculture for food, income, and livelihood. This is reflective of Kenya and SSA's average population which have roughly 71% and 69% rural populations respectively.

The dissertation uses primary data collected from Tharaka Nithi County in Kenya, and remotely sensed data, due to the unavailability of data. A structured questionnaire was administered to a sample of 446 farmers to collect cross-sectional data. To obtain acceptable county representation, farmer sampling was based on sub-locations which are the smallest administrative units. Systematic random sampling and snowballing techniques were used during data collection to minimize biases. Systematic sampling was applied in the densely populated sub-locations where data collection would be done on every fifth farmer. Snowballing was used in sparsely populated areas, whereby the farmer would advise on the location of the next farmer. Data on land registration status was acquired from the Ministry of Lands and digitized while landmarks were used to identify land ownership on unregistered land. Remote sensed data for the Normalized Difference Vegetation Index (NDVI) dataset used in analysis covered 7 years and was acquired from an online database, Copernicus Global Land Service. Climate conditions were generated from national satellite spatial datasets under the World Resources Institute site.

The dissertation is composed of an introductory chapter, three main chapters and a concluding chapter. The chapters are summarized as follows:

**Chapter 1** introduces the study background of the main issues of interest: agricultural productivity and land registration. The chapter gives a brief context and explores the study's analytical goal. A review of the literature on the relationship between sustainable agricultural productivity and land registration in SSA is presented. The section then gives a detailed

chronological review of land reforms in Kenya. Based on the literature, a relevance and research gap is identified and explained.

The study is relevant due to food insecurity and low agricultural productivity in SSA which can be attributed to rapid population growth, urbanization and climate change, diminishing arable land and resources. There are also frequent land conflicts that have been associated with land use competition due to population explosion. Kenya is one of the countries experiencing low agricultural productivity with over 5.4 million under severe food insecurity. Despite policy intervention, SSA countries have been slow in adopting agricultural and land reforms. Existing studies have recommended land reforms as a key component in promoting sustainable agricultural productivity but they are inconclusive. The study identifies a research gap based on the inconsistency in findings on this relationship and this can be attributed to methods used that are limited in accounting for heterogeneity and spatial components.

This study seeks to fill the gap using a different methodological approach. The study uses spatial econometrics and behavioral models that capture the dynamics of heterogeneous regions such as Kenya and farmer dynamics beyond cost-benefit models. This is driven by the knowledge that Kenya and SSA at large are characterized by subsistence farming and smallholder farming systems. The dissertation's conceptual framework is grounded in neoclassical theories that posit land registration creates incentives to invest, promotes access to credit, promotes land market and minimizes land conflict. An overview of the materials and methods used in the three empirical chapters is given but the detailed methodology is discussed individually in the subsequent relevant chapters. The chapter further details the study's context and scope by giving a background on Kenya's agricultural context and Tharaka Nithi County context. The chapter lastly summarizes the structure of the study.

**Chapter 2** is a baseline analysis aimed at identifying factors that influence farmers' decision-making in the adoption of climate resilience agriculture (CRA). The chapter includes a literature review, theoretical framework for the study, detailed materials and methods section, results, discussion of the statistical findings, policy recommendations and recommend further areas of research.

The study uses an extended TPB framework to examine farmers' intention to adopt CRA. The framework evaluates the influence of TPB constructs (attitude, perceived behavioral control, and subjective norm) and additional variables (Actual Behavior Control, farm, and farmer characteristics) on farmers' intentions. Attitude entails the degree to which a person evaluates the behaviour in question favourably or unfavourably. Subjective norms enquire about perceived social pressure to perform or not to perform the behaviour. Perceived behaviour control measures the perceived ease or difficulty of performing the behaviour. The additional TPB construct is actual behavior control refers to the resources that may affect a farmer's behaviour such as lack of money, local politics, and family commitments. Other additional variables used are farm and farmer characteristics (gender, land size, marital status, age, and education level).

A descriptive analysis shows that the majority of the farmers had positive intention to adopt CRA. Farmers' intention was highly significant on PBC; the perception that CRA adoption is under the farmers' volitional control, followed by age (51-64yrs), then resources and professional guidance respectively. The findings contribute to the existing literature in two

ways. First, the results indicate the suitability of the TPB framework for the study context and demonstrate that socio-psychological variables can provide insight into farmers' decision-making process on adopting CRA. Secondly, it extends studies that have recommended the TPB framework because it allows for the inclusion of additional variables. Notably, the findings show the provision of professional advice as a key additional predictor of farmers' intention in agricultural productivity in Kenya. The variable can be explored in future studies.

Findings indicate that policies aimed at increasing agricultural productivity should focus on government intervention to build farmers' capacity. This includes the provision of subsidies on agricultural inputs, and providing professional advice at local levels through government experts, agricultural advisors and farmer discussion groups. This is in line with existing agricultural and land reform policies in the country. Further research that would enrich the findings should assess the relationship between farmers' intention and land size in adopting sustainable agriculture. Past studies have shown that there is a difference between intended and actual behavior as such this study recommends further studies to establish the actual behavior after the agricultural subsidies and professional guidance are provided.

**Chapter 3** evaluates crop intensification in registered and unregistered farms using an agronomic approach. The chapter includes literature review, theoretical framework for the study, detailed materials and methods section, results, discussion on the statistical findings, policy recommendations and further areas of research. Cropping intensity is used in this study as a proxy for crop productivity. The paper uses Normalized Difference Vegetation Index (NDVI) as the dependent variable and also a proxy for cropping intensity. The NDVI dataset used for analysis covers 7 years (2014-2020) acquired from Copernicus Global Land Service. The use of remote-sensed data from online databases is a cost-effective and time-efficient alternative to field surveys. Additionally, this approach addresses data limitations in regions with predominant subsistence farming systems, where crop yield models may be hindered by data unavailability and unreliability. Climatic and farm characteristics; rainfall, temperature, elevation, and soil quality are used as explanatory variables. The study employs Ordinary Least Squares (OLS) and Geographically Weighted Regression (GWR) analysis. NDVI is used as the dependent variable while Land registration is used as an explanatory variable together with farm and climatic characteristics, temperature, rainfall, elevation and soil quality. The GWR technique accounts for spatial heterogeneity, enhancing the accuracy and replicability of the study findings. A hot-spot analysis on GWR residuals to evaluate density distribution at a localized level affirms the findings. Unregistered land and especially in the semi-arid zone had cold spots significant at 99% confidence and hotspots significant at 99% confidence were mainly in registered land. An indication that GWR results were reliable.

The paper conclusively finds that land registration has a positively significant impact on cropping intensity particularly in arid and semi-arid lands (ASALs). Interestingly, land registration impact on cropping intensity is greater than climatic and farm characteristics. Practical implications for policy-makers and researchers are fast-tracking land registration with priority given to ASALs, creating and improving open-access land management information systems for public use. Further research is recommended using agronomic models and spatial econometrics to expand understanding of factors that can further increase sustainable agricultural productivity

**Chapter 4;** the chapter seeks to address the research question on the impact of land registration on short- and long-term investments using an extended TPB framework. In addition to the TPB constructs, the study uses additional farm and farmer characteristics including land registration. The chapter has a detailed literature review, theoretical framework and materials and methods section. The chapter then discusses the results from the statistical analysis, and policy implications and recommends further areas of research. In the logistic regression, intention is used as the dependent variable. Explanatory variables include TPB constructs and additional variables include, utility (USE), land registration status, and farm and farmer characteristics. The analysis is based on fertilizer use, adoption of CRA, and planting trees. The use of fertilizer is classified as a short-term investment, while climate resilience agriculture (CRA) and planting of trees are classified as long-term investments.

A descriptive analysis of intention showed that the majority of the farmers had positive intention to uptake both short and long-term on-farm investments. All TPB constructs were found positively statistically significant on farmers' intention to invest in long-term investments but attitude, subjective norm, barriers and drivers were statistically insignificant on short-term investments. On farm and farmer characteristics, education level is statistically significant to farmers' intention on short-term investments while land registration and age have a significant correlation to intention to adopt long-term investments. Average Marginal Effects analysis indicated that education level, followed by PBC had the highest impact on farmers' intention to adopt short-term investments. On the other hand, land registration has the highest magnitude on long-term investments, followed by PBC and professional guidance.

The results provide insight into farmers' decision-making on on-farm investments by proving the hypothesis that land registration creates tenure security that increases farmers' willingness to uptake sustainable investments. Policies that seek to promote sustainable agricultural investments in the country should advocate for land registration as it creates security of tenure motivating farmers to uptake sustainable on-farm investments. The study also found professional advice from agricultural advisors on sustainable farming should be tailored to local levels that provide extension agricultural officers and incentivizing farmer-led learning centers and discussion groups.

The chapter recommends further studies in other counties in the country to affirm the findings. Such findings would build a strong case to fast-track land registration. Further research is also recommended to assess the actualization of farmers' behavior vs intention concerning land registration and sustainable agricultural practice, to analyze policy efficacy and impact on farmers' behavior. Due to the lack of secondary data, there is a need for a data collection center to build a reliable database platform for use by farmers, researchers and the public in future.

**Chapter 5** summarizes the main results, draws conclusions and discusses the limitations, implications and further areas of research;

- 1) *What are the psychological factors that influence farmers' intentions to adopt climate resilience farming (CRA)?*

The findings from this study show that farmers' decision-making to adopt CRA has several determinants. Farmers' intention is positively influenced by the perception that CRA adoption is under their volitional control, being in the base age category (51-64yrs),

availability of resources and provision of professional guidance. For these results to translate into increased willingness to adopt sustainable agricultural practices it is important to tailor policies at the local level by providing agricultural officers, government experts and farmer-led learning models. It is equally important to build the capacity of farmers and the rural community to enable access to financial resources.

2) *What is the impact of land registration on crop intensification in Kenya?*

The study conclusively finds that land registration has a positive significant relationship to cropping intensity particularly in ASALs. The study also finds that land registration has a higher positive correlation to cropping intensity than farm and climatic characteristics. Since these findings are from one county, further research is needed using a similar methodological approach in other counties and SSA at large.

3) *What is the impact of land registration on farmers' decision-making to invest in short and long-term on-farm investments?*

The findings indicate that land registration has the highest magnitude of positive impact on farmers' intention to undertake long term on-farm investments. Additionally, some of the positively significant TPB constructs such as attitude and barriers/drivers are linked to tenure security. In sum, land registration incentivises farmers to adopt sustainable agriculture farming that would increase agricultural productivity. However, the TPB framework does not measure the actual behaviour implementation hence the study recommends further research to address this knowledge gap.

The main objective of this research is to find out if land registration creates security of tenure which motivates farmers to uptake sustainable agricultural production. Overall, the findings affirm the study hypothesis and recommends fast tracking of land registration in the country. The study however recognises that land registration in isolation is unlikely to yield strong impacts on farmers' adoption of sustainable agricultural production, it should be coupled with complementary interventions such as provision of professional advice, capacity building to improve farmers' livelihood status and lowering costs of farm improvements.

The policy implications derived from this study are summarized as follows;

- 1) Fast-tracking of land registration with priority in ASALs. Policies that seek to promote sustainable agricultural investments in the country should advocate for addressing land registration as a priority to other hindrances.
- 2) Creation of a digital land management information system. Digitization of land data for future research and public access is vital to fully implement Vision 2030 flagship projects on land tenure that point towards creating a GIS-based national land information system and modernizing land registries and land adjudication programs.
- 3) Given that resources and professional guidance were influential to farmers' intention to invest in sustainable practices, government initiatives should focus on promoting farmers' capacity building through training and economic empowerment. Incentives can be built based on discussion groups and subsidized inputs at local levels.

- 4) The study also recommends tailoring policies towards the local level to increase efficacy and efficiency. This can be achieved through the provision of government experts, agricultural advisors and farmer discussion groups.

Further studies are recommended focusing on;

- 1) Evaluation of the actualization of farmers' behaviour vs intention regarding land registration and sustainable agricultural practice. The study has conclusively found that land registration creates security of tenure and motivates farmers to increase agricultural investments.
- 2) In Kenya, a study on the impact of the policy and legal initiatives on farmers' behaviour is crucial. Tree planting has been a strictly regulated sector in the country. In 2010, the government passed legislation to ensure 10% of agricultural land is forested. However, implementation by the farmers has slacked. In Chapter 4, subjective norm (pressure from others) was significantly correlated to tree planting but AME results revealed it had no significant effect. Past studies have found SN to significantly impact mandatory policies. Thus, further research would reveal farmers' psychological factors causing the low uptake.
- 3) Further studies are also recommended to establish the rate of conflicts in registered lands on both highlands and ASALs farms and the impact of conflicts on agricultural productivity.
- 4) The study has found that the base age group (51-64) had a positive impact on on-farm investments. Further studies are recommended to establish socio and psychological factors that drive each age group to adopt sustainable agriculture.
- 5) Further studies are recommended to establish the impact of parks and conservation areas on land tenure security. In Chapter 3, the thesis highlights an anomaly that was attributed to the study area's complex interactions with Meru National Park as its buffer zone exacerbating land tenure insecurity
- 6) Lastly, further studies are recommended to assess the impact of land tenure security on agricultural productivity in Kenya and SSA using agronomic models. Few studies have used agronomic models in this area, if more are done, they can capture the crop diversity that exists in mixed farming systems.