



Property rights and wrongs: Land reforms for sustainable food production in rural Mali

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ABSTRACT

Agricultural land reforms are crucial to promote investments in sustainable land management and food production amidst accelerating urbanization and increasing population growth. However, notable gaps remain in the literature regarding how land reforms designed at the national level are implemented in localized contexts, especially as they interplay with customary tenure regimes. Adopting an institutional bricolage perspective, we explore interactions between local tenure arrangements and government land reforms and the resulting implications for food production in rural Mali. We show that specific market-based land tenure arrangements in the study area emerged from a combination of urbanization pressures and government-designed land reform. We find that tenure security is linked to agricultural investment decisions, as also documented by previous studies. We likewise show that anxieties and ambiguities stemming from state-mandated land registration foster the emergence of monetized forms of access to collective land. These new market-based systems drive greater out-migration of productive community members, leading to labour shortages and weakening the social cohesion and mutual support systems upon which the most vulnerable depend. The findings show that top-down land reforms in rural Mali lead to disruptions of the social fabric, along with re-organizations of tenure systems to accommodate social norms and priorities. We illustrate how, in the context of centralized policy making with limited local consultation, community members resist cooperating and creatively search for alternatives to achieve their social goals. Empirical investigations of socio-institutional challenges such as land tenure arrangements are critical for effective scaling of agricultural innovations and sustainable food production.

1. Introduction

Africa is the most rapidly urbanizing region in the world, with an annual urban population growth rate of 3.6% for the periods 2005–2010 and 2010–2015 (Forster and Ammann, 2018). Accelerating urbanization, the conversion of large tracts of prime agricultural land to urban land uses, and growing populations pose challenges for many African countries as they strive to meet the food needs of their growing populations (Naab et al., 2013). Widespread conversion of agricultural lands

to urban development negatively affects availability and access to farmland for smallholder farmers. Subsequent losses of income threaten to aggravate the entrenched vulnerability of these farmers who deal with multiple climatic and non-climatic stressors (Mubaya et al., 2010; Serdeczny et al., 2017). Ensuring adequate, sustainable supplies of food in this rapidly shifting context requires transformations of the agricultural sector to meet increasing demands (Smith and Gregory, 2013). While some scholars, including Peerzado et al. (2019), recommend government policies to protect agricultural land, others recognize that

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urban expansion is irreversible and call for integrated interventions that simultaneously address the challenges of supplying food to an increasingly urbanized population as well as coping with agricultural risk and production shortfalls associated with climate change (Cohen, 2006; Godfray et al., 2010). Sustainable intensification of food production through the adoption of climate-smart agricultural practices is considered as a promising option.

In Mali, successive governments have embraced integrated approaches to food production, combining agricultural reforms with promotion of agricultural innovations. Since the early 1990s, they have elevated agricultural land reform as a critical strategy for securing investments aimed to increase food production (Roudart and Dave, 2017; Skidmore et al., 2016). Nonetheless, availability and access to farmland remain a significant driver of food insecurity. This is a relevant concern given the combined effects of climatic stressors and population growth, which fuel the development of a modern land- market centred on the transfer of property out of customary tenure systems into commoditized systems of buying, selling, and leasing (Becker, 2013).

A recent scenario exercise conducted in rural Mali by a multi-disciplinary team illuminates societal concerns over land scarcity and food production, conflict over land-tenure, and increased cultivation of ecologically fragile land (Totin et al., 2018, 2021). Further, the scenario outcomes point to a persistent knowledge gap relating to how land reform—intended to secure investments and boost food production—is enacted in the context of complex customary tenure systems. In this article we explore the implications of land reform in Mali from a multi-scalar perspective, with a focus on local and sub-national levels. In so doing, we are guided by an "institutional bricolage" framework, conceptualized as "a process by which people consciously and unconsciously draw on existing social and cultural arrangements to shape institutions in response to changing situations" (Cleaver, 2001; P26). The framework illustrates how institutions may combine 'formal' and 'informal' - or traditional and modern - features that are borrowed from different contexts to guide decisions and actions (Mosha et al., 2016). We understand "institutions" as formal and informal rules, implicit cultural norms, and values and symbols that are embedded in community relations and practices (North, 2005). Through a lens of institutional bricolage, this study explores how land reform designed at the national level is enacted through local practices in particular field settings and the resulting implications for food security. Specifically, it examines the interplay between land reform, the emergence of new tenure arrangements, and related impacts on social organization and farming systems. The following research questions are addressed: (i) how and why do local people understand, respond to, or implement land reform in managing their farming operations? (ii) How do changes resulting from land reform affect household structures and food production? And (iii) to what extent does land reform achieve the goal of promoting investments in the agricultural sector?

After delineating the conceptual framework, the article presents the background of tenure arrangements and household structures in the field site. The research setting and methods are subsequently outlined. The core of the article reflects on land-use practices that result from land reforms and their implications for food production. Finally, we point to conceptual insights and lessons, which can inform future design of land reforms for sustainable food systems in Africa.

2. Land governance as a practice of institutional bricolage

A great deal of research has been devoted to understanding the factors enabling effective and sustainable natural resources management. Ostrom's classic work builds on the 'mainstream institutionalist' premise that "people rationally pursue goals that they believe will lead to benefits for themselves" (Merrey, 2013; P142). This assumption is pervasive in community-based natural resource management (CBNRM) approaches (Brockington, 2007; Ostrom and Nagendra, 2006; Pagdee et al., 2006), which have, however, registered mixed results (Bennett

and Dearden, 2014; Gibson et al., 2000; Kellert et al., 2000).

The major criticism of the mainstream institutionalist premise pertains to its focus on formally designed institutions, which fails to account for the role of informal influences and processes in community-based management of natural resources. In contrast, 'critical institutionalists'—like Cleaver (2002)—emphasize the linkages and tensions that occur between formal and informal institutions, pointing to the key role that social and cultural contexts play in shaping the way communities engage with formal institutions (Merrey, 2013). The concept of institutional bricolage is proposed as an analytical lens to unpack the dynamic interfaces of informal and formal institutions involved in natural resource management (De Koning and Cleaver, 2012). Cleaver's use of the term *bricolage* draws on the classic anthropological work of Claude Levi-Strauss, who first developed the concept of 'intellectual bricolage' to describe the characteristic patterns of mythological thought. In Levi-Strauss' formulation, bricolage refers to the ability to select fragments of existing cultural configurations and re-deploy them in novel ways, including redirecting their original intent or goal (Johnson, 2012). The concept has been adapted and applied by Cleaver in the context of CBNRM institutional arrangements to refer to local people's ability to recombine or re-negotiate formal institutions to bring about desired transformations. Cleaver outlines three potential options defining community responses to introduced natural resource management institutions: (i) creative recombination or re-interpretation of newly introduced regulations with different types of institutional and socio-cultural elements (*aggregation*), (ii) change or modification of either local informal norms or introduced formal rules so that they align with local livelihood goals or cultural identities (*alteration*), and - in some cases - (iii) community resistance to newly introduced institutions expressed in passive or active ways, possibly resulting in normative pluralism or selective adherence to the new regulations (*articulation*) (Cleaver, 2002; Cleaver and Franks, 2005).

The concept of institutional bricolage has attracted significant interest among CBNRM researchers and practitioners seeking to distil lessons from experiences of community responses with introduced institutions and initiatives. The bricolage framework has been applied across a range of contexts, but seems to have been particularly productive in the field of water resource management to (i) understand how institutions affect water allocation systems (Mosha et al., 2016), (ii) explore the complexities of irrigation institutions (Gutu et al., 2014), and (iii) examine community engagements with water governance reforms (Sehring, 2009). The institutional bricolage approach has also enabled the analysis of institutional and biophysical interactions in urban flood management in Ghana (Frick-Trzebitzky et al., 2017). In agricultural development, the framework has been used to examine how overlapping land tenure regimes shape access to and control of farmland (Yemadje et al., 2014), and to examine how the embedded rules in agricultural interventions shape the responses of beneficiaries (Sidibe et al., 2018; van Mierlo and Totin, 2014). These studies shed light on the challenges and opportunities for better integrating formal institutions with pre-existing local institutional arrangements (Faggin and Behagel, 2018; Hassenforder et al., 2015).

This ability to elucidate the complexity and fluidity of local arrangements is both a strength as well as a limitation of the institutional bricolage approach, as its localized focus does not account for the fact that, community responses and informal institutions can also be influenced by broader forces and contexts (Cleaver and De Koning, 2015). Another limitation of the bricolage approach is its tendency to over-emphasize local people's adaptability and resilience: for example, in navigating the contradictions and ambiguities of different land regimes, the model tends to overlook any potential path dependence that may occur with respect to national and global governance frameworks.

Our study seeks to address this disconnect between national policies and local practices of land tenure by considering the broader context that shapes local communities' livelihood and possible implications of the land reforms for food production and household structures. We

adopt an 'institutional bricolage' perspective as a theoretical lens for exploring how national land reforms translate into localized practices. As a set of formal rules regulating land property, such policies constitute an institutional arrangement that was introduced and intended to stimulate investments in agriculture. Community response to this introduced land arrangement constitutes a *bricolage*, that is a multiplex configuration of local norms and institutions (Moshia et al., 2016; Mzembe et al., 2019), infused with micro-dynamics of power (Bersaglio and Cleaver, 2018).

3. Research context and design

3.1. Dynamic of land-use rules

In many African communities, land tenure regimes are often shaped by multiple legal principles and systems, which can lead to ambiguities about landholding status and conflicts over land resources (Guirkingner and Platteau, 2014; Skidmore et al., 2016). A review of land tenure in Mali illustrates how customary and statutory norms and practices have evolved overtime (Camara, 2013; Hughes, 2014). Historically, rural communities in Mali had shared norms that guided land use (Lalumia et al., 2010). Access to and use of agricultural land were mediated by first occupancy principles and lineage affiliation. According to local land tenure regimes, those who first clear and cultivate land must perform rituals to solicit the earth spirits' blessing and protection (Becker, 1990). Thus, the elders of those firstcomers' lineages are believed to have spiritual endorsement and, therefore, authority, over the land they settled on. Nonetheless, overtime those "landowning" families have continued to encourage in-migration and settlement by other lineages and households as a way of recruiting political support and farm workers (labour services being often required by landowners to grant access to land under their jurisdiction). (Becker, 2001).

This customary land tenure system remains highly influential, with local lineages who have longstanding occupancy rights still exercising control over conditions for settlement and land use by migrant households. In Mali, as in many African countries, land continues to have significant symbolic and social values and its ownership remains under the authority of lineage elders and family heads. Women's access to land is mediated by their relationship to men, either a male relative or their husband (Chimhowu, 2019; Hughes, 2014). According to the patrilineal kinship systems that predominate in Mali, women may have land use rights but are not allowed to inherit land.

Colonial and post-colonial governments intervened to shape land tenure arrangements as a way to assert control over local natural resources and consolidate their territorial holdings (Benjaminsen et al., 2009). The new land regulations, modelled upon European property

regimes, were superimposed upon customary land tenure systems, resulting in a stratified land tenure system, characterized by a plurality of different, often contradictory, norms and values (Benjamin, 2008; Skidmore et al., 2016). Adding to this plurality were pressures and opportunities stemming from modernity and monetization, which over time encouraged and enabled certain community members to disregard and contest customary land tenure statutes to pursue their own individual interests (Anafo, 2015; Guirkingner and Platteau, 2017). The resulting heterogeneity was further complicated by land policies enacted by the post-colonial state in subsequent decades.

Since the early 1990 s, the Malian government has launched a series of rural land reforms, partly as a way of reconciling customary regimes with a new, state-centred legislative logic. These include the 2000 Land Tenure Code (*Code Domaniale et Foncier*), the Agricultural Framework Law (*Loi d'Orientation Agricole*), and the Pastoralist Charter (*Charte Pastorale*) as shown in Fig. 1. These reforms have developed alongside a number of development policy changes—inspired by neoliberal principles and mandated by global donor agencies, which sought to significantly curtail the role of the state in public affairs and move the country toward a less centralized free-market system (Konadu-Agyemang, 2018). In 2002, the Land Tenure Code was revised to align with the decentralization policy launched and implemented by the Mali government in the late 1990 s (Mousseau and Granate, 2011). The changes included provisions for decentralized authorities to manage lands within their jurisdictions and stipulated that land transaction agreements between individuals or communities can be governed based on customary rights. However, these amendments, and the other stipulations of the Land Tenure Code, are not actually enforceable because the Code was only formulated as a general directive and was never rendered actionable by an "implementation decree" ("*decr e d'application*") (Hughes, 2014), which requires approval by the Council of Ministers. Such situation is not uncommon, particularly with legislation addressing politically or culturally sensitive issues (see for example the case of Pastoralist Charter discussed by Roncoli et al., 2007): by deferring the signing of the implementation decree, the state avoids exacerbating tensions among opposing parties or appearing as embracing one side against the other.

In the absence of a decree operationalizing the Code, each stakeholder group tends to interpret and invoke the legislation as it fits their purposes. Discrepant understandings and uncertainties about the applicability of different tenure regimes opens spaces for conflicts, particularly among landowners and migrants. For example, migrants maintain that after cultivating a certain landholding for a number of years, customary tenure systems allow it to become their private property, provided that the landowner agrees. However, the Land Tenure Code only stipulates migrants' land use rights, without any reference to opportunities for acquiring land ownership.

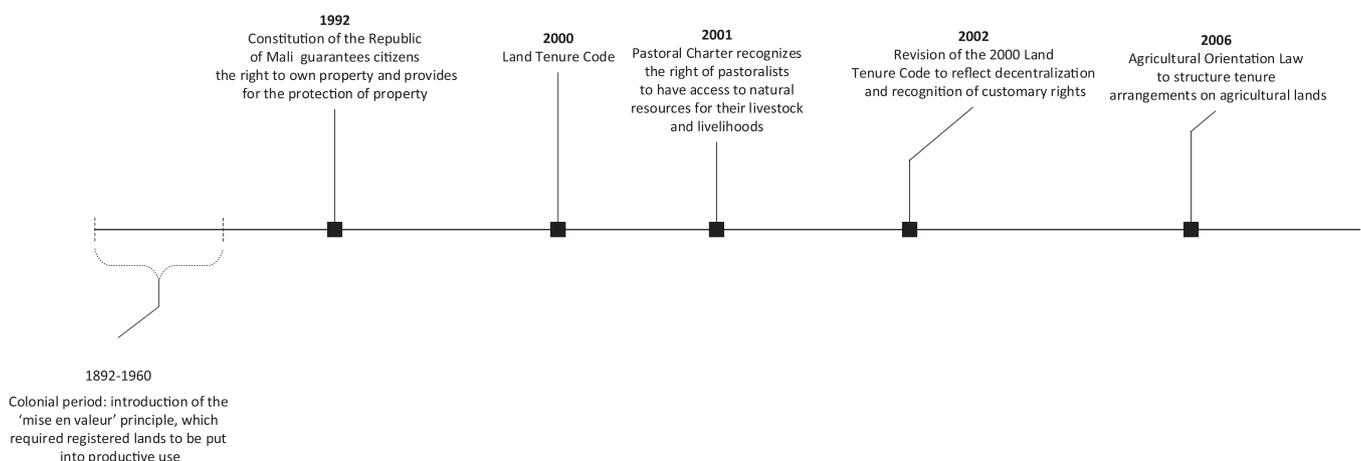


Fig. 1. Timeline of the critical land policies in Mali.

In 2006, a comprehensive agrarian policy, *Loi d'Orientation Agricole*, was adopted by the Mali government, reflecting a vision for agricultural development and food security driven by sustainable and competitive family farming (Sidibe et al., 2018). The agrarian policy supports farmers' access to farm equipment, fertilizer, and inputs, but also paid particular attention to land tenure issues, aiming to clarify land titling in order to foster investments in farmland. However, this new agrarian policy, which stated that all cultivated land should be registered as private property, rested on the problematic assumption that each landholding is owned and/or used by an individual farmer, thereby disregarding collective farming systems.

3.2. Structure of family farming in Mali

Family farming arrangements in Mali vary across ethnic groups. Among the Minyanka, the prevalent ethnic group in the research area, collective family farms dominate (Colleyn and Jonckers, 1983). Members of extended families—composed of the nuclear households of brothers or fathers and sons—live together in a compound and work under the authority of the compound head. The latter is typically the most senior man (not by age but in terms of kinship structure) and controls the collective fields, where all family members work. Junior males, who head their own nuclear households, cultivate individual fields to meet their own needs or those of their wives and children. According to the patrilineal kinship system that characterizes Minyanka society, women do not have customary rights to land but gain land access through marriage, being granted use rights on plots that are part of their husbands' landholdings (Rivers III et al., 2018). Farm management and resource allocation decisions pertaining to the collective plots are made by either the compound head or one of his most senior brothers or sons (Becker, 2013; Guirking and Platteau, 2014). The harvest from collective fields is distributed to each household unit and/or compound members according to their needs as determined by the compound head, while harvest from individual plots farmed by male and female members is controlled by them.

As in many African contexts, agriculture in Mali is embedded in social relations and continues to be driven primarily by goals of collective wellbeing and risk management (Roudart and Dave, 2017; Skidmore et al., 2016). Farm work and land rights are organized in ways that aim to ensure that at least basic consumption needs are met, even in a context where food production is subject to significant fluctuations due to rainfall variability and other production risks (Becker, 2001; Grigsby, 2002; Guirking and Platteau, 2014). Recent empirical work in similar dryland farming systems of neighbouring Burkina Faso has documented that, in fact, the persistence of extended forms of household organizations is a mechanism for climate adaptation (West, 2009).

3.3. Research design

Located in the southwestern part of Mali, the Koutiala “*cercle*” (henceforth district) comprises 36 “*communes*”, with Koutiala being its main urban centre. The district rests within the ‘North Guinea Zone,’ a sub-humid forested area characterized by an annual rainfall ranging from 400 to 800 mm, which falls during a single rainy season spanning from May to October (Segnon et al., 2020). The area is one of the main agricultural production zones in Mali (Benjaminson et al., 2009), also known as the ‘southern Mali cotton basin’ (Camara, 2013) because it produces most of the country’s main export crop. Koutiala is also the second-largest maize production area in Southern Mali, contributing to about 14% (56,714 t) to the national maize output (Diallo et al., 2020). However, this productivity is under threat, partly due to rapid demographic growth - estimated at 3% per year in 2018 (World-Bank, 2018) - which translates into intense pressure on farmland (Roudart and Dave, 2017). In addition to population pressure, in Koutiala district, competition for and conflicts over land has been exacerbated by growing urban expansion (Jayne et al., 2014; Jedwab et al., 2015) as well as the

shift from customary to market-based land tenure regimes (Becker, 2013).

This article elucidates that process, drawing upon the Adaptation at Scale in Semi-Arid Regions (ASSAR) project, a five-year (2014–2018) multi-institutional and multi-scale project aimed at improving understandings of the dynamics of effective climate adaptation in dryland regions of Africa and India (<http://www.assar.uct.ac.za/>). In Mali the project conducted participatory scenario workshops with key stakeholders to identify barriers and enablers for agricultural adaptation and food production (Padgham et al., 2015). In the course of these exercises, access to farm land and irrigation water were identified as critical drivers shaping the future of food production in Koutiala (Totin et al., 2021). These outcomes were used to develop priorities for project interventions, which focused on building capacity for soil fertility and water management. However, follow-up meetings revealed that farmers did not feel confident and capable to invest in those technologies because of the uncertainties surrounding land tenure. This feedback prompted the project team to specifically direct their attention to land tenure dynamics in the area and, particularly, on the impacts of the national land reforms on local agricultural and livelihood systems.

The research reported in this article, including semi-structured interviews and focus group discussions, was conducted in the second half of 2017 to explore land access and management practices, perceptions and responses to land reforms, and implications for food production systems in the Koutiala area. A first set of semi-structured interviews was held in August 2017 with 25 respondents (20 men and 5 women). The sample included 17 farmers (10 members of landowning families and 7 recent immigrants), 5 customary chiefs, and 3 agricultural extension officers. To better understand the evolution of land-use practices, we purposely followed an urban-rural gradient in selecting research sites: the 8 research villages were located respectively at 5 km (peri-urban Koutiala), 10 km (Koumbè), 25 km (Sorobasso and N'golonianasso), 45 km (Konséguéla and N'togonasso) and 55 km (Kouniana and Bamana) from Koutiala town (see Fig. 2). Participant recruitment centred on combined purposive and snowball strategies, whereby interviewees were selected by asking an initial set of key respondents to identify suitable others. This preliminary round of 25 interviews was completed after reaching saturation (Biernacki and Waldorf, 1981).

In August 2017, the team conducted focus group discussions (FGDs) (Kitzinger, 2005), involving about 3–5 participants each, for a total of 19 participants (15 men and 4 women). They included 12 farmers (8 landowners and 4 migrants), 3 customary chiefs, 2 land title officers, and 2 extension officers. The FGDs were intended to corroborate and elaborate upon information collected in the course of the first round of exploratory interviews. They likewise enabled the team to elicit the FGD participants' knowledge and perceptions of the land tenure shifts occurring in the districts as well as their implications for the viability of local food production systems. Each group discussion lasted 30–60 min and was digitally recorded with the participants' permission. The recordings were transcribed and translated in English.

A second round of individual interviews was carried out in December 2017 with 15 farmers (12 men and 3 women), including 4 of those who had been interviewed in August. The goal was to elicit more in-depth information about the implementation of the 2006 land reform in the district and the strategies whereby farmers engaged with and adapted to those new regulations. In addition to these activities, this article also draws upon the project's baseline studies (Becker, 2013; Kaiser Hughes and Knox, 2011; Lalumia et al., 2010; Mousseau and Granate, 2011) and reports from the government land services.

4. Results

4.1. Modalities for land access in Koutiala district

In rural Mali, historically, land has not been commodified. There has been, however, a gradual shift in tenure arrangements with the

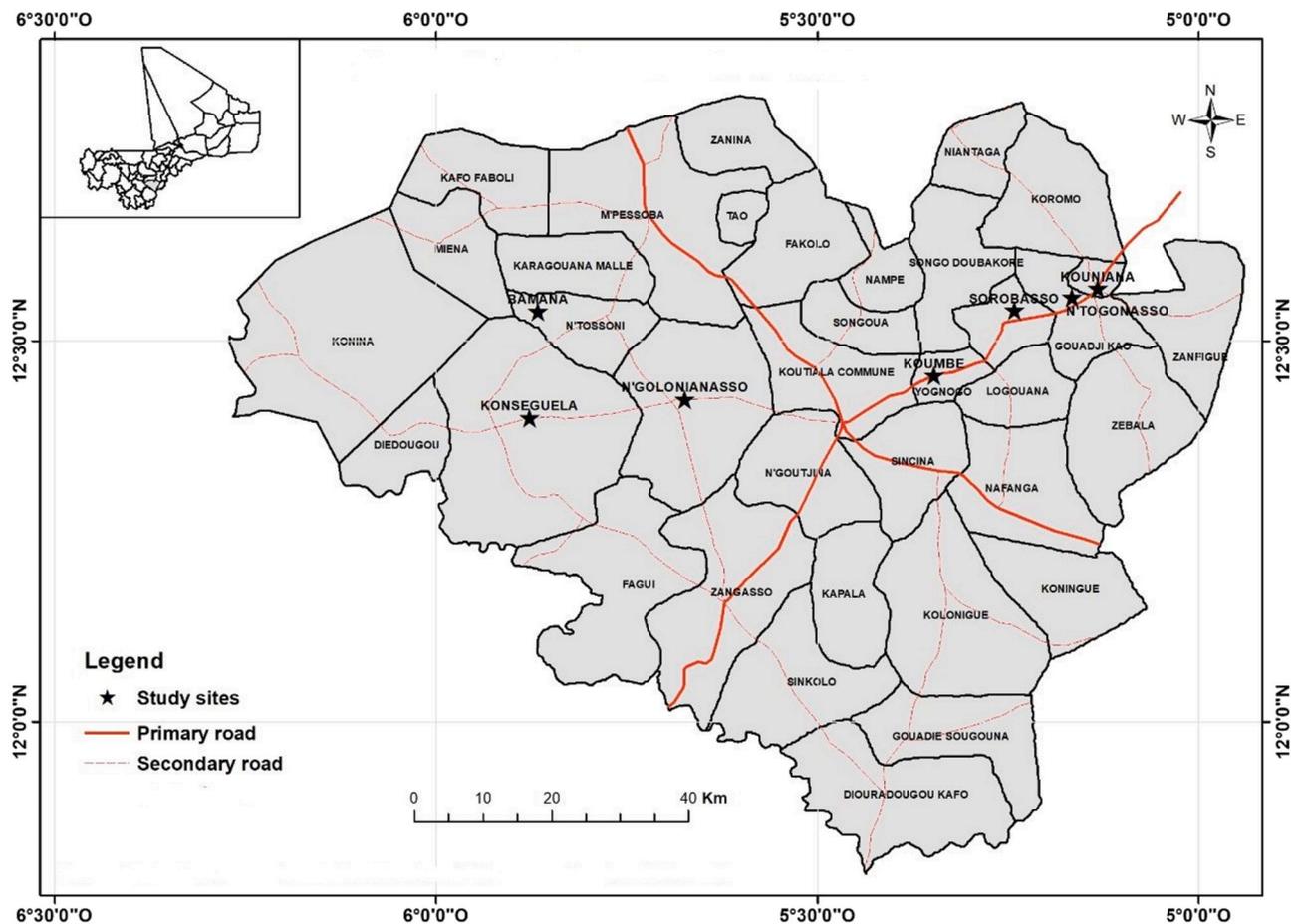


Fig. 2. Map of Koutiala district showing the location of research sites relative to the largest town.

emergence of market-based modalities for accessing land (Becker, 2013). These arrangements include (i) purchasing, often using capital accumulated over time; (ii) annual leasing with users accessing land by paying rent to the owner; (iii) sharecropping, or gaining land use rights in return for paying a portion of the harvest; and (iv) inheritance. In most rural areas, these different modalities are present and used by farmers simultaneously. The market-based land access prevails in urban

and peri-urban contexts (see Fig. 3).

In the peri-urban area around Koutiala, different modalities for accessing land are practiced, though the purchase was becoming the most dominant during the time of our study (see Fig. 3). Among interview respondents, those who had bought land were mostly businessmen or men with diversified sources of income. During the FGDs, both migrants and resident farmers with limited farm assets reported that short-term leasing is the most common way of accessing farmland. Rent typically ranged between XOF10,000 and 20,000/hectare (approximately USD16 and 32) annually, though rates varied based on soil fertility, with higher rents being charged for more fertile clay soils than for poorer sandy soils. On average, rental arrangements were established for three years, with no legal or written agreement between the landlords and tenants. According to the farmers interviewed, the lack of a formalized agreement meant that landowners could breach the agreement and retrieve their land at any time, thereby discouraging tenants from making long-term investments in land management. On the other hand, sharecropping was less common, being mostly practiced by resource-poor migrants, who typically pay one-third of their production to landowners. One of the traditional leaders explained that today the proportion of farmers who inherited land had significantly declined in Koutiala compared to when he was young because of the monetization of land transfers.

In rural areas, market-based modalities for land access are less common or absent (see Fig. 3). In Konséguela, Kouniana, and Bamana – the most distant villages (located about 45–55 km from town), land transactions remain regulated by customary norms and cultural values, with the first-come principle still widely practice. Inheritance is the most common land access modality for all resident farmers, while migrants mostly practice sharecropping. In the intermediary villages of

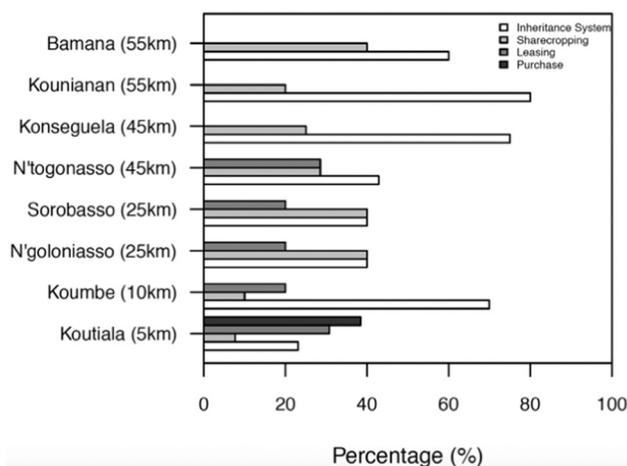


Fig. 3. Land access modalities in the research areas as reported during individual interviews, with the peri-urban to rural gradient of the villages shown from bottom to top. Distances from the town of Koutiala are shown in parentheses next to each village's name.

Koumbè, Sorobasso, N'golonianasso, and N'togonasso, located between 10 km and 45 km from Koutiala, the prevailing modalities are leasing, sharecropping, and inheritance. In the village of Koumbè, located in a remote area with no urban infrastructure and facilities, most farmers interviewed accessed their farmland through patrilineal inheritance. According to custom, after a family head dies, land under his authority is divided among his younger brothers and sons, the oldest of whom is entrusted with allocation and oversight responsibilities. Traditionally, women cannot inherit land but may have use rights through their relationship to men as wives, mothers, sisters, or daughters. In Koumbè, Sorobasso, N'golonianasso, and N'togonasso, market-based land transactions mainly occur through leasing and among migrants. Such transactions are becoming the norm in the peri-urban area of Koutiala. According to one of the traditional chiefs interviewed, the proportion of farmers who access land through inheritance had significantly declined compared to the days of his youth.

4.2. From customary to commodified land regimes

Urbanization is a primary driver of the current shift from non-market customary tenure systems to market-based regimes in Mali (Becker, 2013). However, policy reforms have also contributed to such a trend, resulting in significant impacts on poor farmers' access to land. For example, the 2006 land policy mandated agricultural land registration, a requirement that was in part initiated to align a regional land reform framework prescribed by the Organization for the Harmonization of Business Law in Africa (OHADA) as a way of securing commercial loans by way of land titles (Djiré, 2007). The land reform's goals and implications for land access and land management have been interpreted and evaluated differently across stakeholder groups. For example, a land title officer based in Koutiala reflected that "[...] some people are reluctant to invest in agriculture because there is no security over the land. The reform will solve the land ownership problem, and it will create conditions for innovations and private investments" (K7 –; 28 August 2017). Likewise, according to a farmer leader, "[...] the land reform is a way for the government to promote private properties and collect taxes on private lands" (K2 – A family head from Kouniana; 28 August 2017). Still, for some resident farmers, land reform has introduced additional ambiguities and confusion surrounding tenure security. At Bamana—one of the sites most distant from Koutiala—migrant farmers and land-poor farmers did not find that the land reform benefited them because landowners retrieved the fields they had been cultivating.

Many farmers remain sceptical and confused about the real motivation for the land registration requirement and it is not entirely clear whether such provisions actually result in long-term investments in land management. Local farmers are concerned about the registration policy, arguing that it may aggravate rather than resolve uncertainties surrounding land access and land use. Consequently, landowners opt to sell their land rather than having to face the anticipated risk of taxation and/or state expropriation. According to a traditional leader interviewed, land registration may also transform family farming by accelerating the fragmentation (and, possibly, monetization) of family farms into individually owned plots. He noted that a substantial increase in land sales and leasing arrangements has already been occurring in Koutiala, a trend corroborated by our research: for instance, between 2006 and 2016 individual land titles in the peri-urban area of Koutiala grew from 223 to 1004. While the land reform created an enabling environment for the expansion of land titling, other socio-economic factors may also partly account for the trend, notably the growth in population and emergence of a middle-class with disposable income to invest in land (Becker, 2013).

According to migrants and resident land-poor farmers interviewed, the land reform of 2006 did not result in greater ability to invest but rather led to more livelihood insecurity. In particular, some migrants reported that the land registration policy has caused landowners to be reluctant to lend or lease plots to newcomers, fearing that the latter may

end up establishing claims on the land they cultivate. As a result of the growing uncertainties and difficulties in accessing land, migrants and land-poor farmers have resorted to diversifying their income sources, particularly investing in off-farm activities. In sum, there is a broad consensus among land-poor farmers in Koutiala that the land reform was not beneficial to them. Rather, they would have needed the policy to include government subsidies or loans to enable migrants and tenants, and sharecroppers to purchase their own land. Because no such provision was included in the 2006 legislation, the reform did not bring about any tangible improvement to their livelihood or productivity.

4.3. Effects of land arrangements on food production

In this section, we explore whether land reform aimed at enhancing tenure security, strengthening agricultural investments, and greater equity in land access have achieved the intended goals. In particular, we explore how the evolution of land tenure arrangements in relation and response to the land reform affected food production as well as the division of labour and responsibilities within households.

4.3.1. Implications of the land reform on agriculture

Neoliberal thinking assumes that there is a strong positive correlation between land tenure security and agricultural investments, based on the premise that farmers may only be willing to invest in farming if they have secure rights and, especially, private ownership of their land (Ayanga et al., 2016; Ma et al., 2015; Moges and Taye, 2017). However, there is evidence that, in some cases, factors other than tenure security (e.g., market conditions, population density) may play greater roles in fostering agricultural investments (Grigsby 2002). In our research sites, land tenure seemed to have determined investments through crop choices: in many cases, farmers produced cash crops (e.g. cotton or maize) – which require greater investments – on lands for which they had secure property rights. The following quote exemplifies this decision logic:

"I only produce maize on the land that I purchase. In our village, the maize crop requires a lot of investment [...] fertilizer and improved seed. We use organic manure. When you buy land, you can incorporate the organic fertilizer in the soil for at least one year by keeping your cattle there, after which you can start producing maize. You can't make this investment in a rented land, because the owner can claim his land back at any time. Cotton also requires high inputs such as labour, fertilizer, and herbicide, that is why we use the collective property for cotton production, with the support of all family members. It is quite hard to deal with cotton production alone as a single farmer. We use rented land for a crop that needs few inputs, such as sorghum and millet. Those crops are easy to produce, and they do not require any intensive investment. You will not see anyone here producing either maize or cotton on rented land. It is a waste of money..." (K1 – Male farmer, Koutiala; 25 August 2017).

There was broad consensus among farmers interviewed that investing in crops grown on fields on which they have precarious tenure rights is not advisable. A migrant farmer from Koumbè explained that he could not be sure to reap the benefits of manure application to his sorghum fields, because improved soil fertility would encourage the landowner to retrieve the plot. This disincentive to invest in crop production has implications for crop yields, particularly for staple grains. Even though sorghum is considered by farmers in Mali to be a low-input crop, evidence from the region shows that application of either chemical fertilizer or organic manure can increase yields by nearly half (Traore et al., 2016). Therefore, by discouraging soil fertility investments, tenure insecurity may be dampening productivity, though other constraints, such as limited access to manure or cash to purchase inputs, are also at play, even more so among resource-poor farmers. Particularly when resources are scarce, farmers are more inclined to direct them towards cash crops, such as maize and cotton, which not only demand greater

soil fertility and application of inputs and labour but are also grown on fields characterized by greater tenure security. Therefore, to promote investments in soil fertility and crop productivity, land tenure reforms must be complemented by supports for farmers' access to credit and inputs. An extension officer interviewed in the peri-urban area of Koutiala outlines these challenges and dilemmas:

"In many villages, farmers do not follow the recommendations. The extension service always recommends the application of fertilizer in cereal plots to increase the yield. Farmers only do it for maize but hardly in sorghum and millet plots. This happens, especially with farmers who have relatively limited land assets. Since they do not have any guarantee that they will still use the plot where they cultivate, they are not willing to invest in soil fertility management. I believe that agricultural intensification with innovation options should start with negotiation for alternative land tenure arrangements among all farmers, especially for migrants and land poor-farmers. Our office suggested a package of agroforestry innovation, but because there are strict rules on leasing, farmers can't use these technologies. Tenants are not allowed to plant trees, even nitrogen-fixing trees that improve soil fertility. In many communities, tree planting is a way to claim land ownership." (K6 – Extension officer, Koutiala; 28 August 2017).

The land registration mandate particularly affected sharecropping migrant households, prompting landowners to revoke those arrangements to cultivate the land themselves or sell it to others. In some cases, these arrangements had spanned several generations since the 1980s when many households migrated into the region from southwest Burkina-Faso, pushed by ethnic tensions and political disruptions and attracted by the availability of farmland and economic opportunities in southern Mali and Cote d'Ivoire (Speirs, 1991). Some of those migrants settled in Koutiala district, where they were able to secure land use rights from land-rich resident households through leasing and sharecropping agreements. In more recent years, gold mining has emerged as a prominent source of income for rural households in the region, including some of the research sites such as Koutiala, Kombè, and Bamana. Mining activities have attracted a diversity of people into the area, especially young men, to either work for mining companies or to engage in artisanal mining, even though the latter is illegal. About one third (35%) of migrant farmers interviewed for this study explained their decision to migrate as a strategy for coping with land shortage, since they had lost the fields they had been cultivating as a result of the land reform. Since mining companies tend to employ young men, their out-migration depletes their households and communities of the labour that is needed to respond to land scarcity by agricultural intensification. It likewise aggravates the work burden faced by those left behind, particularly women, children, and the elderly. During interviews, respondents explicitly linked the impacts of land reform on land access, male migration to mining sites, and the viability of local food production, as illustrated by this quote:

"[...] we have been in this village for seven years. We got a plot of land to cultivate from the traditional chief. For two years now, this land was taken away from us because of the government land reform, and we are left with no alternative. My husband was obliged to move to the mining site in Sikasso. He only came back twice since he left [...] I am now the only one cultivating, and providing foods for the entire family [...] In our community, because of the massive move of young people to mining sites, it is not easy to get the labour for farming." (B4 – Female farmer, Bamana; 19 December 2017).

Furthermore, the living and working conditions these youth encounter in migration sites are onerous and, even, dangerous. Mining work entails significant health hazards, which can further deplete their families' resources, as explained by a community leader in Koutiala: *"our youths work in a very bad condition in the mining sites, which exposes them to environmentally-related diseases such as respiratory tract diseases. Most of*

them end up with tuberculosis and skin diseases [...], and the family resources that they haven't contributed to are used to treat them" (K4 – Traditional chief, Koutiala; 27 August 2017).

4.3.2. Implications of the shift from collective to individualized land ownership

Though market-based land transactions have not yet become a common practice in most rural areas, in the peri-urban area of Koutiala market-based transactions have intensified after the land tenure reform, and there has been a growing pressure towards individual control of land. On the one hand, this tendency reflects the new influences and incentives stemming from a commodified economy. On the other hand, family heads fear that allowing members to have individual land titles, rather than only use rights, could open the floodgates for land sales resulting in loss of the family landholdings they are entrusted safeguard for their descendants, as shown in this quote *"[...] without individual titling, people cannot sell the plots they are cultivating, which even though is used by individual household members are still under the control of family heads. If we have allowed people to get individual titling, for sure, they would have sold the land, and we could not have control of anything or leave anything to the next generation" (N3 – Family head, N'Goloninasso; 27 August 2017).*

During interviews, over a third of respondents (36%; n = 9) – but particularly older ones – referred to the individualization of landholdings as a major concern. They attributed this trend to their son's desire for economic independence and aspirations to establish their own nuclear households: *"[...] young adult household members have a preference for private ownership. They request private plots for their use when they decide to leave the big family, to set up their household." (K2 – Family head, Kouniana; 28 August 2017).* Furthermore, about 40% (n = 10) of respondents, mostly elders, lamented that such intent translated into young men's decreasing willingness to contribute their labour to collective farms: *"now that family members produce on their private farms, they are less concerned with what happens in the extended family. They only think about themselves and their close relatives (nuclear households). The main idea of having a collective farm is to keep a network, which allows family members to get social support in times of challenge. These days, those social structures are no longer there, and our young people only think about their close families" (ibid.).*

Traditionally collective landholdings were divided into a number of small holdings as a way to ensure that all adult men in the household would have some land. The land allocation is based on the seniority in the household. All adult men do not have the same size and type of land. Often, seniors receive the most fertile plots. However, this strategy is increasingly insufficient to provide for the needs of growing families in a changing rural society and economy. In Sorobasso and N'Goloninasso, most young men use the plots allocated to them by the family heads, but also seek to complement them by acquiring additional land – through either leasing or sharecropping – in order to grow staple grains. From the perspective of a young man, investing in individually-cultivated is more advantageous because *"crop yields are significantly higher on individual plots than on common plots [...] In the collective plots, the temptation to free-ride on other members' efforts was perceptible, and there was a lot of frustration. For this reason, I wanted to put just the minimum effort in the collective farm. But with my land, I know that I am the only owner of what it produces [...]" (S4 – Young male farmer, Sorobasso; 27 August 2017).* However, other farmers recognize that the fragmentation of family landholdings into individually-cultivated plots has drawbacks, as one of them explained, *"Since the shift to more individual production, some people have to travel far to their farms, and because of the long-distance, they are obliged to stay there during the farming season. [...] In the collective plots, the work was shared among household members, and we were obliged to comply because of the social pressure. Now, with individual plots, sometimes when people do not have enough resources, it is quite challenging to do everything alone..." (S3 – Male farmer, Sorobasso; 27 August 2017).*

In addition, while younger household members may be granted use

rights to individual plots, they still lack formal titles attesting to their ownership. This prevents them from using such land as collateral to secure credits from local banks, and consequently, constrains their ability to invest in productivity-enhancing inputs and technologies. In sum – in the absence of formal land titles, individualized use rights are not sufficient to improving farmers' access to credit and to creating incentives for investment in soil fertility management and improved crop productivity (Holden and Ghebru, 2016; Lipton and Saghai, 2017; Roudart and Dave, 2017).

5. Discussion

Through the lens of institutional bricolage this study has shown how local communities recombine traditional and modern systems in response to government-designed land reform and increasing urbanization in southern Mali.

Resistance or "articulation" can be seen clearly in the Koutiala area, where about 70% of the landowners interviewed reported that they did not register their land (as required by the land policy) and do not plan to do so. Land registration was meant to serve as a way to promote private land ownership, but landowners claimed to have been excluded from the process of designing the 2006 land reform, using this grievance to explain their non-compliance with land registration. However, the actual reason was their fear that registration would provide the government with a clear map of land ownership in rural areas, making them vulnerable to taxation and, possibly, expropriation. In the case of collective family landholdings, registration raised questions as to which individual – whether the household head or his eldest son – would be responsible for or entitled to registering jointly-held land on his name.

Changing practices - or "alteration" - is evident in the recent phenomenon of young farmers choosing to engage in mining as an alternative to farming. This new livelihood strategy is a response to combination of factors, including land tenure rules that prevent young farmers to secure land holdings, as well as growing urbanization, which increases pressure on and competition for land. Additionally, while urbanization in the peri-urban areas of Koutiala certainly contributed to the rise of land purchase and leasing, the latter were also reactions to land registration requirements. According to the landowners, new market-based land transactions emerged as a preventative strategy to minimize potential negative consequences of the land policy. Even though land leasing is common in rural areas of Mali that host communities of migrant farmers and are subject to land pressure (Camara, 2013; Djiré, 2007; Lalumia et al., 2010), it is recognized as a relatively recent phenomenon. It occurs, in particular, when landholders are unable to sell their farmlands due to lack of formal titles to their land, but can lease it to derive some revenue from it. Land leasing approximates an *alteration* practice in the sense that it provides a way of coping with the pressures that stem from the land reform, while at the same time also allowing landholders to abide by cultural prescriptions against selling land.

"Aggregation" also occurs in rapidly urbanizing Koutiala, with the move away from collective farming and towards individualized land use rights and, especially among young farmers who favour farming on their own, or with their nuclear households, even though they may still live with their extended household. Thus, to retain the young men in the extended family units and maintain the pattern of the large family, family heads were induced to loosen the rigid structure of traditional collective farming to allow for greater consideration of the interests of individuals and their nuclear households.

These examples of institutional bricolage suggest that continuous feedback and consultation with stakeholders are critical (though not a guarantee) for effective institutional changes, and that, in the absence of such consultative process, the outcomes of top-down legislation are highly uncertain (Butler et al., 2020; Gebara, 2019; Sidibe et al., 2018). Land reform legislation has been considered as an important tool in promoting and securing private investments in rural development. To

some extent, the effects of land tenure security may vary across contexts. In some cases, tenure security is an important enabler of investments (Asaaga et al., 2020; Jayne et al., 2014), and in other cases, it can even undermine willingness to invest (Holden and Ghebru, 2016). The recognition of customary tenure under formal land law seems to be a pre-condition to achieve viable land reform. Formal land registration cannot achieve those goals if it neglects the complexities of land management at the local level. Rather, what is needed are flexible mechanisms that can accommodate both customary and formalized processes for accessing, using, and transferring land. Development and experimentation of such mechanisms will require an enabling and flexible policy environment and active involvement of district officials and local elites entrusted with land management. Consultative processes and the articulation of customary tenure and formal land law can support more consensual land reforms.

The current loan requirements of individual land titles as collateral is a lingering barrier to investment in agriculture, mainly for young farmers with limited assets. The promotion of group lending can be a potential option for decoupling credit and title, and for empowering young and land-poor farmers. Farmers co-sign each other's loans and the model does not require them to provide collateral or evidence of their ability of re-payment prior to being granted the loan (Lassana and Thione, 2020; Totin et al., 2012). This group lending approach could also contribute to promoting private investments in agriculture and supporting rural development. Such model has been applied in Mali and other countries where cotton companies have organized farmers into producers' groups to provide them with inputs on credit ahead of the farming season while reducing the risk of default payment after the harvest, (Castaing, 2020; Lassana and Thione, 2020). Experience in these regions, however, shows that the group lending model is not without problems. In some cases, there have been free-riding practices – with some farmers failing to keep their commitments to the group (Lassana and Thione, 2020; Sidibe et al., 2018). Careful selection of group members – informed by attention to differential interests and socioeconomic disparities (Gray and Dowd-Urbe, 2013), along with institutional and technical capacity building, are enabling conditions for a viable group lending approach (Castaing, 2020; Hermes et al., 2005).

The study results also document that a gradual shift - from the traditional practice of collective landholding to smaller farming family units – is partly propelled by growing land scarcity due to urbanization. By mandating individual registration of land ownership the land reform has also contributed to the fragmentation of extended family-based farming that was typical of southern Mali (Becker, 2001). Although West (2010) shows that extended household farming remains a reliable social support system, particularly in light of the impacts of climate change, in some African countries, we see this support is being increasingly eroded by neoliberal-inspired policies (Giordano, 2018; Rivers III et al., 2018). This disintegration has many causes, including labour migration to more productive economic sectors (e.g., mining) and the expansion of commercial agriculture. This shift in family farming arrangements has implications for the social organization of extended family units. Minyanka families were historically characterized by close ties among extended family members, although inherently unequal, with male elders controlling the allocation of resources, especially lands and labour (Colleyn and Jonckers, 1983). The land reforms, in conjunction with rapid urbanization, weakened the elders' power, by facilitating the emergence of new land tenure arrangements, individualized use land rights, and separation of nuclear household units from extended families. This increasing individualism is also manifested in Koutiala in growing prevalence of individual initiatives over collective actions. For instance, the building of collective infrastructures – schools, water reservoirs, etc.- with the contribution of community members is no longer a priority in Koutiala as documented by Sidibe et al. (2018), which undermine social cohesion and mutual support among villagers.

6. Conclusion

Land tenure arrangements in Mali are complex and pluralistic, consisting of modern laws - which empower the state to control who can and cannot own and use the land - and customary regimes - whereby traditional chiefs and elders have broad jurisdiction over land and its use. This study shows that market-based land tenure arrangements have emerged from a combination of urbanization and government-designed land reforms. Government land reform was initiated to improve tenure security, access to credit, and reduce conflict over agricultural land. In practice, it appears to have undermined tenure security and has not facilitated the long-term agricultural investments as it had been envisioned. In the research area in rural Mali, land reforms seem to have exacerbated land-related tensions and social inequalities, particularly in the case of migrants and land-poor farmers, while also contributing to a gradual shift from collective farming to individualized practices. This case reinforces critiques of centralised policy development by illuminating the unanticipated outcomes that result from the disregard of local needs, realities, and aspirations. Meaningful and transparent engagement of local perspectives is, therefore, central to designing successful land reform. Such lessons are applicable beyond the specific context of Mali since lack of legal recognition of customary tenure occurs across African countries, even though in practice both tenure systems continue to co-exist side by side. This situation increases the vulnerability of those who hold only customary rights. This insecurity is, in turn, a major barrier to investments in the agricultural sector, at a time when robust and secure food production systems are needed, due to the interacting effects of climate change and other stresses. A deep understanding of the socio-institutional embeddedness of food production (e.g., existing land tenure arrangements and their impact on food production) is a prerequisite for successful agricultural intensification in Africa, where small-holder farmers operate in dualistic land tenure regimes.

CRedit authorship contribution statement

Conception and design of study: Edmond Totin. Acquisition of data: Edmond Totin, Amadou Sidibé. Analysis and/or interpretation of data: Edmond Totin, Carla Roncoli, and Alcade Segnon. Drafting the manuscript: Edmond Totin, Mary Thompson-Hall, Alcade Segnon and Carla Roncoli. Revising the manuscript critically for important intellectual content: Mary Thompson-Hall, Carla Roncoli, Edward R. Carr. Approval of the version of the manuscript to be published: Edmond Totin, Alcade Segnon, Mary Thompson-Hall, Carla Roncoli, Edward R. Carr and Amadou Sidibé.

Conflicts of interest statement

The authors have no affiliation with or involvement in any organization or entity with a direct or indirect financial interest in the subject matter discussed in the manuscript.

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References

- Anafo, D., 2015. Land reforms and land rights change: a case study of land stressed groups in the Nkoranza South Municipality, Ghana. *Land Use Policy* 42, 538–546.
- Asaaga, F.A., Hiron, M.A., Malhi, Y., 2020. Questioning the link between tenure security and sustainable land management in cocoa landscapes in Ghana. *World Dev.* 130, 104913.
- Ayamga, M., Yeboah, R.W.N., Ayambila, S.N., 2016. An analysis of household farm investment decisions under varying land tenure arrangements in Ghana. *J. Agric. Rural Dev. Trop. Subtrop. JARTS* 117, 21–34.
- Becker, L.C., 1990. The collapse of the family farm in West Africa? Evidence from Mali. *Geogr. J.* 156, 313–322.
- Becker, L.C., 2001. Seeing green in Mali's woods: colonial legacy, forest use, and local control. *Ann. Assoc. Am. Geogr.* 91, 504–526.
- Becker, L.C., 2013. Land sales and the transformation of social relations and landscape in peri-urban Mali. *Geoforum* 46, 113–123.
- Benjamin, C.E., 2008. Legal pluralism and decentralization: natural resource management in Mali. *World Dev.* 36, 2255–2276.
- Benjaminsen, T.A., Holden, S., Lund, C., Sjaastad, E., 2009. Formalisation of land rights: Some empirical evidence from Mali, Niger and South Africa. *Land Use Policy* 26, 28–35.
- Bennett, N.J., Dearden, P., 2014. Why local people do not support conservation: community perceptions of marine protected area livelihood impacts, governance and management in Thailand. *Mar. Policy* 44, 107–116.
- Bersaglio, B., Cleaver, F., 2018. Green grab by bricolage—the institutional workings of community conservancies in Kenya. *Conserv. Soc.* 16, 467–480.
- Biernacki, P., Waldorf, D., 1981. Snowball sampling: problems and techniques of chain referral sampling. *Sociol. Methods Res.* 10, 141–163.
- Brockington, D., 2007. Forests, community conservation, and local government performance: the village forest reserves of Tanzania. *Soc. Nat. Resour.* 20, 835–848.
- Butler, J.R.A., Bergseng, A.M., Bohensky, E., Pedde, S., Aitkenhead, M., Hamden, R., 2020. Adapting scenarios for climate adaptation: practitioners' perspectives on a popular planning method. *Environ. Sci. Policy* 104, 13–19.
- Camara, B., 2013. The Dynamics of Land Tenure Systems in the Niger Basin, Mali. *Africa* 83, 78–99.
- Castaing, P., 2020. Joint liability and adaptation to climate change: evidence from Burkina Faso cooperatives. *Eur. Rev. Agric. Econ.* 48, 502–537.
- Chimhowu, A., 2019. The 'new' African customary land tenure. Characteristic, features and policy implications of a new paradigm. *Land Use Policy* 81, 897–903.
- Cleaver, F., 2001. Institutional bricolage, conflict and cooperation in Usangu, Tanzania. *IDS Bull.* 32, 26–35.
- Cleaver, F., 2002. Reinventing institutions: bricolage and the social embeddedness of natural resource management. *Eur. J. Dev. Res.* 14, 11–30.
- Cleaver, F., De Koning, J., 2015. Furthering critical institutionalism. *Int. J. Commons* 9, 1.
- Cleaver, F., Franks, T., 2005. How Institutions Elide Design: River Basin Management and Sustainable Livelihoods. Bradford Centre for International Development, University of Bradford, Bradford, United Kingdom, p. 21.
- Cohen, B., 2006. Urbanization in developing countries: current trends, future projections, and key challenges for sustainability. *Technol. Soc.* 28, 63–80.
- Colleyn, J.-P., Jonckers, D., 1983. 'Ceux qui refusent le maître': la conception du pouvoir chez les Minyanka du Mali. *Africa* 53, 43–58.
- De Koning, J., Cleaver, F., 2012. Institutional bricolage in community forestry: an agenda for future research. In: Arts, B. (Ed.), *Forest-people interface: Understanding community forestry and biocultural diversity*. Wageningen Academic Publishers, Wageningen, pp. 277–290.
- Diallo, A., Donkor, E., Owusu, V., 2020. Climate change adaptation strategies, productivity and sustainable food security in southern Mali. *Clim. Change* 159, 309–327.
- Djiré, M., 2007. Land Registration in Mali-No Land Ownership for Farmers?: Observations from Peri-urban Bamako. IIED.
- Faggin, J., Behagel, J., 2018. Institutional bricolage of sustainable forest management implementation in rural settlements in Caatinga biome, Brazil. *Int. J. Commons* 12, 275.
- Forster, T., Ammann, C., 2018. African cities and the development conundrum. *Int. Dev. Policy* 10, 3–25.
- Frick-Trzebitzky, F., Baghel, R., Bruns, A., 2017. Institutional bricolage and the production of vulnerability to floods in an urbanising delta in Accra. *Int. J. Disaster Risk Reduct.* 26, 57–68.
- Gebara, M.F., 2019. Understanding institutional bricolage: what drives behavior change towards sustainable land use in the Eastern Amazon? *Int. J. Commons* 13, 637.
- Gibson, C.C., McKean, M.A., Ostrom, E., 2000. *People and Forests: Communities, Institutions, and Governance*. MIT Press, Cambridge, Mass.
- Giordano, A., 2018. Sub-Saharan agriculture and migrations. *J. Agric. Environ. Int. Dev.* 112, 185–237.
- Godfray, H.C.J., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M., Toulmin, C., 2010. Food security: the challenge of feeding 9 billion people. *Science* 327, 812–818.
- Gray, L., Dowd-Urbe, B., 2013. A political ecology of socio-economic differentiation: debt, inputs and liberalization reforms in southwestern Burkina Faso. *J. Peasant Stud.* 40, 683–702.
- Grigsby, W., 2002. Subsistence and land tenure in the Sahel. *Agric. Hum. Values* 19, 151–164.
- Guiringer, C., Platteau, J.-P., 2014. The effect of land scarcity on farm structure: empirical evidence from Mali. *Econ. Dev. Cult. Change* 62, 195–238.

- Guirkinge, C., Platteau, J.-P., 2017. Transformation of African farm households: a short survey of economic contributions. *J. Demogr. Econ.* 83, 41–50.
- Gutu, T., Wong, S., Kinati, W., 2014. Institutional bricolage as a new perspective to analyse institutions of communal irrigation: Implications towards meeting the water needs of the poor communities in rural Ethiopia. *pinnacle agricultural research & management*.
- Hassenforder, E., Ferrand, N., Pittock, J., Daniell, K.A., Barreteau, O., 2015. A participatory planning process as an arena for facilitating institutional bricolage: example from the Rwenzori region, Uganda. *Soc. Nat. Resour.* 28, 995–1012.
- Hermes, N., Lensink, R., Mehrteab, H.T., 2005. Peer monitoring, social ties and moral hazard in group lending programs: evidence from Eritrea. *World Dev.* 33, 149–169.
- Holden, S.T., Ghebru, H., 2016. Land tenure reforms, tenure security and food security in poor agrarian economies: causal linkages and research gaps. *Glob. Food Secur.* 10, 21–28.
- Hughes, O., 2014. Literature review of land tenure in Niger, Burkina Faso, and Mali: Context and opportunities. Catholic Relief Services, Baltimore, MD, USA.
- Jayne, T.S., Chamberlin, J., Headey, D.D., 2014. Land pressures, the evolution of farming systems, and development strategies in Africa: a synthesis. *Food Policy* 48, 1–17.
- Jedwab, R., Christiaensen, L., Gindelsky, M., 2015. Demography, Urbanization and Development: Rural Push, Urban Pull and... Urban Push? The World Bank.
- Johnson, C., 2012. Bricolage and bricolage: from metaphor to universal concept. Paragraph 35, 355–372.
- Kaiser Hughes, A., Knox, A., 2011. *Tenure insecurity in urban Mali*, Brief, <http://www.focusonland.com/countries/tenure-insecurity-in-urban-mali/>. ed. p. 5.
- Kellert, S.R., Mehta, J.N., Ebbin, S.A., Lichtenfeld, L.L., 2000. Community natural resource management: promise, rhetoric, and reality. *Soc. Nat. Resour.* 13, 705–715.
- Kitzinger, J., 2005. Focus group research: using group dynamics. *Qual. Res. Health Care* 56, 70.
- Konadu-Agyemang, K., 2018. IMF and World Bank Sponsored Structural Adjustment Programs in Africa: Ghana's Experience, 1983-1999. Routledge.
- Lalumia, C., Alinon, K., Roberge, R., Freudenberger, M., 2010. Mali Land Tenure Assessment Report, Property Rights and Resource Governance. United States Agency for International Development (USAID).
- Lassana, T., Thione, D.I., 2020. Analysis of determinants of access to credit for cotton producers in Mali. *South Asian J. Soc. Stud. Econ.* 44–59.
- Lipton, M., Saghai, Y., 2017. Food security, farmland access ethics, and land reform. *Glob. Food Secur.* 12, 59–66.
- Ma, X., Heerink, N., Feng, S., Shi, X., 2015. Farmland tenure in China: comparing legal, actual and perceived security. *Land Use Policy* 42, 293–306.
- Merrey, D., 2013. Book review of cleaver, Frances, 2012. Development through bricolage: rethinking institutions for natural resources management. *Water Altern.* 6, 142–144.
- Moges, D.M., Taye, A.A., 2017. Determinants of farmers' perception to invest in soil and water conservation technologies in the North-Western Highlands of Ethiopia. *Int. Soil Water Conserv. Res.* 5, 56–61.
- Mosha, D., Vedeld, P., Kajembe, G., Tarimo, A., Katani, J., 2016. Reflections on evolving water management institutions and institutional bricolage: a case of irrigation schemes in Iringa Rural and Kilombero districts, Tanzania. *Water Policy* 18, 143–160.
- Mousseau, F., Granate, S., 2011. Understanding Land Investment Deals in Africa: Country Report Mali, Presentation, October. The Oakland Institute, Oakland, USA, p. 51.
- Mubaya, C.P., Njuki, J., Liwenga, E., Mutsavangwa, E.P., Mugabe, F.T., 2010. Perceived impacts of climate related parameters on smallholder farmers in Zambia and Zimbabwe. *J. Sustain. Dev. Afr.* 12, 170–186.
- Mzembe, A.N., Novakovic, Y., Melissen, F., Kamanga, G., 2019. Institutional bricolage as an antecedent of social value creation in a developing country's tourism and hospitality industry. *Corp. Soc. Responsib. Environ. Manag.* 26, 997–1008.
- Naab, F.Z., Dinye, R.D., Kasanga, R.K., 2013. Urbanisation and its impact on agricultural lands in growing cities in developing countries: a case study of Tamale in Ghana. *Mod. Soc. Sci. J.* 2, 256–287.
- North, D.C., 2005. *Understanding the Process of Economic Change*. Princeton University Press, Princeton.
- Ostrom, E., Nagendra, H., 2006. Insights on linking forests, trees, and people from the air, on the ground, and in the laboratory. *Proc. Natl. Acad. Sci. U.S.A.* 103, 19224–19231.
- Padgham, J., Abubakari, A., Dietrich, K., Fosu-Mensah, B., Gordon, C., Habtezion, S., Lawson, E., Mensah, A., Nukpezah, D., Ofori, B., Piltz, S., Sidibe, A., Sissoko, M., Totin, E., Traoré, S., 2015. Vulnerability and adaptation to climate change in the semi-Arid Region of West Africa, ASSAR Working Paper. ASSAR. <http://www.assar.uct.ac.za/west-africa-0>, p. 142.
- Padgee, A., Kim, Y.-s., Daugherty, P., 2006. What makes community forest management successful: a meta-study from community forests throughout the world. *Soc. Nat. Resour.* 19, 33–52.
- Peerzadeo, M.B., Magsi, H., Sheikh, M.J., 2019. Land use conflicts and urban sprawl: conversion of agriculture lands into urbanization in Hyderabad, Pakistan. *J. Saudi Soc. Agric. Sci.* 18, 423–428.
- Rivers III, L., Sanga, U., Sidibe, A., Wood, A., Paudel, R., Marquart-Pyatt, S.T., Ligmann-Zielinska, A., Olabisi, L.S., Du, E.J., Liverpool-Tasie, S., 2018. Mental models of food security in rural Mali. *Environ. Syst. Decis.* 38, 33–51.
- Roncoli, C., Jost, C., Perez, C., Moore, K., Ballo, A., Cissé, S., Ouattara, K., 2007. Carbon sequestration from common property resources: Lessons from community-based sustainable pasture management in north-central Mali. *Agricultural Systems* 94, 97–109.
- Roudart, L., Dave, B., 2017. Land policy, family farms, food production and livelihoods in the Office du Niger area, Mali. *Land Use Policy* 60, 313–323.
- Segnon, A.C., Totin, E., Zougmore, R.B., Lokossou, J.C., Thompson-Hall, M., Ofori, B.O., Achigan-Dako, E.G., Gordon, C., 2020. Differential household vulnerability to climatic and non-climatic stressors in semi-arid areas of Mali, West Africa. *Clim. Dev.* 1–16.
- Sehring, J., 2009. Path Dependencies and Institutional Bricolage in post-Soviet wwater governance. *Water Altern.* 2, 61–81.
- Serdeczny, O., Adams, S., Baarsch, F., Coumou, D., Robinson, A., Hare, W., Schaeffer, M., Perrette, M., Reinhardt, J., 2017. Climate change impacts in Sub-Saharan Africa: from physical changes to their social repercussions. *Reg. Environ. Change* 17, 1585–1600.
- Sidibe, A., Totin, E., Thompson-Hall, M., Traoré, O., Traoré, P.S., Schmitt Olabisi, L.K., 2018. Multi-scale governance in agriculture systems: Interplay between national and local institutions around the production dimension of food security in Mali. *NJAS Wagening. J. Life Sci.* 84, 94–102.
- Skidmore, M., Staatz, J., Dembélé, N., Ouédraogo, A., 2016. Population growth, land allocation and conflict in Mali. *Area Dev. Policy* 1, 113–131.
- Smith, P., Gregory, P.J., 2013. Climate change and sustainable food production. *Proc. Nutr. Soc.* 72, 21–28.
- Speirs, M., 1991. Agrarian change and the revolution in Burkina Faso. *Afr. Aff.* 90, 89–110.
- Totin, E., van Mierlo, B., Saidou, A., Mongbo, R., Agbossou, E., Stroosnijder, L., Leeuwis, C., 2012. Barriers and opportunities for innovation in rice production in the inland valleys of Benin. *Njas Wagening. J. Life Sci.* 60–63, 57–66.
- Totin, E., Butler, J.R., Sidibé, A., Partey, S., Thornton, P.K., Tabo, R., 2018. Can scenario planning catalyse transformational change? Evaluating a climate change policy case study in Mali. *Futures* 96, 44–56.
- Totin, E., Thompson-Hall, M., Roncoli, C., Sidibé, A., Olabisi, L.S., Zougmore, R.B., 2021. Achieving sustainable future objectives under uncertain conditions: application of a learning framework to adaptation pathways in rural Mali. *Environ. Sci. Policy* 116, 196–203.
- Traore, K., Aune, J.B., Traore, B., 2016. Effect of organic manure to improve sorghum productivity in flood recession farming in Yelimane, Western Mali. *Am. Sci. Res. J. Eng. Technol. Sci. ASRJETS* 23, 232–251.
- van Mierlo, B., Totin, E., 2014. Between script and improvisation: institutional conditions and their local operation. *Outlook Agric.* 43, 157–163.
- West, C.T., 2009. Domestic transitions, desiccation, agricultural intensification, and livelihood diversification among rural households on the Central Plateau, Burkina Faso. *Am. Anthropol.* 111, 275–288.
- West, C.T., 2010. Household extension and fragmentation: investigating the socio-environmental dynamics of mossi domestic transitions. *Hum. Ecol.* 38, 363–376.
- World-Bank, 2018. Mali: Growth and diversification. The World-Bank, Macroeconomics Trade and Investment (MTI) Global Practicel Africa Region, Washington, p. 123.
- Yemadje, R.H., Crane, T.A., Mongbo, R.L., Saidou, A., Azontonde, H.A., Kossou, D.K., Kuyper, T.W., 2014. Revisiting land reform: land rights, access, and soil fertility management on the Adja Plateau in Benin. *Int. J. Agric. Sustain.* 12, 355–369.