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RESEARCH

Territorial Governance and Inclusive Development in Drâa-Tafilalet's Date-Palm Sector: Assessing the Green Morocco Plan

Laila Chiabri [1, *] and Abdellah Bentahar [1]

[1] Interdisciplinary Laboratory in Management of Organizations and Applied Economics (LIMOEA), Faculty of Legal, Economic, and Social Sciences, Moulay Ismail University, B.P. 3201 Toulal, Meknes, Morocco
[*] Author responsible for correspondence; Email: l.chiabri@edu.umi.ac.ma

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Abstract

The Green Morocco Plan (2008–2020) aimed to modernize agricultural value chains, yet its territorial implications for governance, inclusivity, and sustainability remain insufficiently explored. This study investigates its implementation in the Drâa-Tafilalet Region, a major date-palm area characterized by both agricultural potential and persistent socio-economic disparities. A mixed-methods approach was employed, combining a survey of producers, interviews with policymakers and stakeholders, and analysis of policy documents. The findings indicate significant improvements in agricultural performance, including an increase of more than 20% in average production and a marked rise in rural household incomes. However, these benefits were unevenly distributed across territories and social groups, with cooperative members capturing greater advantages and some provinces experiencing limited infrastructural progress. Qualitative evidence highlights persistent governance bottlenecks, such as centralized decision-making, weak participatory mechanisms, and insufficient integration of water management. These constraints limited the transformation of technical achievements into durable socio-ecological resilience. By linking agricultural modernization outcomes with territorial governance processes, this research contributes to the literature on agricultural policy and multilevel governance. It also formulates recommendations for the ongoing Generation Green strategy, emphasizing the need for regionally budgeted program contracts, inclusive territorial committees, and integrated resource management to reinforce equity, inclusivity, and sustainability in oasis-based agricultural systems.

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Statement of Sustainability: This research contributes to advancing the alignment of large-scale agricultural modernization programs with the United Nations Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 6 (Clean Water and Sanitation), SDG 8 (Decent Work and Economic Growth), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 15 (Life on Land). Drawing on quantitative and qualitative evidence from the date-palm sector in the Drâa-Tafilalet Region, it proposes governance and resource-management mechanisms that enhance local capacities, promote social inclusion, and secure the long-term ecological sustainability of oasis-based agricultural systems.

1. Introduction

Gully Morocco continues to display pronounced structural territorial disparities despite sustained development efforts over recent decades. The Casablanca-Settat region accounts for 31.4% of the national gross domestic product (GDP), whereas the Drâa-Tafilalet Region (DTR) contributes only 2.6% (HCP, 2023). GDP per capita in DTR, approximately MAD 15,000, remains far below the national average of MAD 35,000 (HCP, 2023). Paradoxically, DTR produces 85% of Morocco's date-palm output across 47,000 hectares, equivalent to around 140,000 tonnes per year, and generates more than four million person-days of agricultural employment annually. Despite this strategic role, the region faces a high poverty incidence of 14.6% and persistent deficits in basic social services (HCP, 2014; ONDH, 2021). These contradictions are often linked to a governance architecture that remains fragmented and centralized. Although Morocco has formally adopted decentralization, local authorities still lack sufficient fiscal autonomy, operational competencies, and territorial-engineering capacity, which perpetuates dependency on central government structures (Courtin and Guétat-Bernard,

2017; ONDH, 2020). In response to these structural weaknesses, the Green Morocco Plan (GMP; 2008–2020) and its successor, the Generation Green (GG; 2020–2030), were launched to modernize agri-food chains, foster youth entrepreneurship, create employment opportunities, and enhance product value. However, these frameworks have not been accompanied by robust mechanisms for decentralized decision-making, such as fiscal transfers, adjustable program contracts, or regional co-governance structures that could better align interventions with local priorities (World Bank, 2020). In DTR, significant investments have been mobilized, including the rehabilitation of approximately 48,000 hectares of oasis and the modernization of 17,000 hectares, yet their effects on governance, social inclusion, and ecological resilience remain contested. The governance of agricultural value chains in oasis environments involves formal and informal processes, actors, and instruments regulating production, distribution, and resource access within a given territory (Hooghe and Marks, 2003). In Morocco, governance remains predominantly vertical, with the state responsible for policy design while regional and local authorities are largely limited to implementation and operate with restricted discretionary power (ONDH, 2020; OECD, 2019). Comparative studies indicate that co-management, which refers to joint resource administration between the state and users, and polycentric arrangements, which involve coordination among community institutions, local authorities, and technical services, can adapt hydraulic infrastructure to local specificities. For instance, in Egypt, Water User Associations that combine state support with shared rule-making have enhanced both maintenance and equitable water allocation without generating conflict (El-Khair et al., 2021). Conversely, in Egypt's Dakhla Oasis, unregulated modernization has undermined fossil aquifers (Kimura et al., 2020), and inadequate cooperative monitoring has been identified as a cause of recurrent infrastructure breakdowns (Rossi et al., 2022).

Participatory planning, understood as the early engagement of producers and local organizations in project design and monitoring, strengthens the legitimacy, relevance, and social ownership of decisions (Pretty, 2018). Evidence from FAO (2021) and Singh and Sharma (2019) shows that watershed committees combining formal instruments such as fees and sanctions with localized technical support enhance both sustainability and equity. In Ethiopia, polycentric governance schemes have improved transparency and the quality of irrigation services (Mekonnen and Hoekstra, 2011), while in Spain, the co-production of water quotas and fee structures between irrigators and public authorities has increased fairness and efficiency (De Stefano et al., 2022). The concept of oasis resilience refers to the capacity of socio-ecological systems to absorb and adapt to disturbances (Folke et al., 2021). It includes agroecological diversification, such as maintaining complementary crops and agroforestry, integrated water management through hydrological monitoring and extraction limits, and the preservation of ecosystem services, including habitat integrity and biodiversity. Altieri (2020) advocates the adoption of agroecological practices in oases, while Zahidi (2024) proposes the establishment of territorial committees to oversee water monitoring and implement progressive pricing. Despite the richness of existing studies, no systematic comparative analysis has yet been conducted between cooperative and independent producers in Morocco's date-palm sector, and no detailed assessment has been made of spatial disparities among the provinces of Zagora, Tinghir, and Errachidia. Furthermore, little is known about the extent to which governance arrangements, including the distribution of decision-making authority, participatory planning processes, and inter-institutional coordination, mediate the technical gains of modernization.

This study addresses these gaps by assessing the socio-economic and technical impacts of the GMP on date-palm producers in DTR, with particular attention to differences related to cooperative membership and provincial location. It evaluates governance dynamics across five dimensions: institutional coordination, local capacity, producer participation, social inclusion, and territorial engineering. The analysis tests the propositions that modernization improved technical indicators, that cooperative membership amplified benefits relative to independent producers, that centralized allocation and weak participatory planning limited inclusivity and sustained territorial disparities, and that governance quality mediates the translation of technical gains into long-term socio-ecological resilience. By applying a mixed-methods design combining quantitative analysis (paired t-tests, multivariate ANOVA, and regression models) with qualitative thematic coding, the study provides a territorially differentiated evaluation of agricultural modernization and offers actionable recommendations for the Generation Green strategy.

2. Materials and Methods

2.1. Study Area

The research was carried out in the Drâa-Tafilalet Region (DTR) of south-eastern Morocco, encompassing the provinces of Zagora, Tinghir, and Errachidia. This predominantly arid territory is structured around oasis-based

agriculture, with date palms constituting the principal cash crop. Geographically, it lies between latitudes 29°00′ N and 32°00′ N and longitudes 3°00′ W and 5°30′ W. The climate is classified as arid to semi-arid, with average annual rainfall rarely exceeding 150 mm, very high evapotranspiration rates, and summer temperatures frequently surpassing 40°C. Socio-economic conditions are characterized by high poverty incidence, limited access to basic services, and a strong dependence on agriculture as the primary source of livelihoods.

2.2. Sampling Design and Data Collection

The study adopted a mixed-methods design, combining quantitative, qualitative, and documentary approaches to assess the territorial governance of the GMP in the date-palm sector. For the quantitative component, a stratified sample of 240 date-palm producers was selected to examine how governance mechanisms such as cooperative membership and access to public programmes shaped socio-economic and technical outcomes. Stratification criteria included province (Zagora, Tinghir, Errachidia), farm size (< 2 ha; 2–5 ha; > 5 ha), and cooperative status (120 cooperative members and 120 independent producers). Post-stratification weights were applied to correct for voluntary-response bias, using the actual distribution of holdings by province and size provided by the Ministry of Agriculture, Maritime Fisheries, Rural Development, Water, and Forests (MAPMDREF, 2024). Data were collected between October and December 2024 through a structured questionnaire addressing five dimensions of governance:

- Agricultural income, measured as annual income before and after the GMP;
- Infrastructure access, measured as the proportion of farms equipped for irrigation and the percentage with on-farm storage capacity;
- Public programme participation, captured through the number of grants received and training sessions attended;
- Perceived governance, assessed through transparency, coordination, and proximity ratings on a 1–5 Likert scale;
- Perceived inequalities, measured by a subjective inequality score for access to support on a 1–5 scale.

2.3. Statistical Analysis

Descriptive statistics were computed to characterize the sample. For repeated measures (pre- and post-GMP), paired t-tests were used, as normality assumptions were met. Multivariate analysis of variance (MANOVA) assessed the combined effects of farm size, cooperative status, and location, with Levene's test verifying variance homogeneity. To isolate the net effect of the GMP, linear regression models were applied for continuous outcomes and logistic regressions for binary variables, controlling for farm size, cooperative status, and province. Province fixed effects and robust standard errors were used to account for territorial heterogeneity. Statistical significance was set at $p < 0.05$, and inequality was analysed through Lorenz curves and the Gini index. The different dimensions, indicators, and statistical methods mobilized in this study are synthesized in Table 1, which provides a structured overview of the quantitative approach adopted.

Table 1. Variables, indicators, and statistical methods used in the study.

Dimension / Objective	Indicator	Statistical Method
Agricultural income	Annual income (pre- vs. post-GMP)	Paired t-tests; multivariate ANOVA (variance-homogeneity control)
Infrastructure access	% Equipped for irrigation; storage capacity	Descriptive statistics; paired t-tests
Public-program participation	Number of grants received; training attendance	Descriptive statistics; linear and logistic regressions (controls: farm size, cooperative status, location, province fixed effects)
Perceived governance	Transparency, coordination, proximity ratings (1–5 scale)	Paired t-tests; ANOVA
Perceived inequalities	Inequality score for access to support (1–5 scale)	Lorenz curves; Gini index
Characterize sample	Means, distributions	Descriptive statistics
Isolate the GMP effect.	Net effect controlling for size, status, and location	Linear and logistic regressions (robust SE; fixed effects)

Notes: GMP = Green Morocco Plan; SE = standard errors.

2.4. Qualitative Analysis

The qualitative component consisted of 30 semi-structured interviews with key stakeholders, including regional officials from the Ministry of Agriculture, Maritime Fisheries, Rural Development and Water and Forests (MAPMDREF, 2023) and the National Agency for the Development of Oasis and Argan Zones (ANDZOA, 2022), elected local representatives, agricultural chamber staff, cooperative leaders, and representatives of international donors such as

Enabel (2023), FAO (2021), and UNDP (2023). All interviews were transcribed verbatim and analysed using NVivo software. An inductive coding approach was adopted, with two independent researchers conducting the coding process. Discrepancies were reconciled through joint discussion to produce a shared thematic codebook. Inter-coder reliability was high (Cohen's κ = 0.82), and thematic saturation was reached by the 28th interview.

2.5. Documentary Analysis

A complementary institutional corpus was assembled, including regional GMP programme contracts (MAPMDREF, 2020), MAPMDREF (2023), and ANDZOA (2022) reports, and agricultural monographs. These documents were systematically reviewed to compare planned interventions, budgets, and strategic orientations with field-level observations. The triangulation of documentary, quantitative, and qualitative evidence allowed for the identification of discrepancies between institutional discourse and actual practices, thereby enhancing the robustness of the analysis and interpretation. Based on the mixed-methods approach described in the previous section, the results presented below combine quantitative evidence on socio-economic and technical changes with qualitative insights into governance processes, highlighting both convergences and disparities across provinces and producer categories.

3. Results and Discussion

3.1. Structural Profile and Key Indicators Before and After GMP

The socio-economic profile of the surveyed producers (n = 240) reflects the structural characteristics of Moroccan oasis agriculture, marked by pronounced land fragmentation and limited on-farm infrastructure. Small holdings dominate the agricultural landscape, with 64% of farms covering less than 2 ha, while only 12% exceed 5 ha. Cooperative membership remains moderate (50%), illustrating a partial integration of farmers into collective structures. Irrigation access emerged as a decisive driver of productive capacity. Coverage rose sharply from 25% before the Green Morocco Plan (GMP) to 60% afterwards, representing an increase of 35 percentage points. This expansion was accompanied by significant improvements in productivity and income. Production rose from 120,000 t/year to 149,000 t/year (+24.2%), while the average income index increased by 25%. Income distribution also improved moderately. The Gini coefficient for agricultural income declined from 0.50 to 0.42 (–0.08), suggesting a partial reduction in inequality among producers. These results are synthesized in Table 2, Structural profile and key indicators before and after the GMP, which provides a comparative overview of farm sizes, cooperative membership, irrigation coverage, production levels, incomes, and income inequality.

Table 2. Structural profile and key indicators before and after the GMP.

Characteristics / Indicator	Before GMP	After GMP	Change
Plot size < 2 ha (%)	64	64	0
Plot size > 5 ha (%)	12	12	0
Cooperative membership (%)	50	50	0
Access to irrigation (%)	25	60	+35 pts
On-farm storage capacity (%)	40	40	0
Production (t/year)	120,000	149,000	+24.2%
Average income (index, base 100)	100	125	+25%
Gini coefficient (agricultural income)	0.50	0.42	–0.08

Notes: Percentages refer to the share of surveyed farms. The income index is standardized to a base of 100 for the pre-GMP period. The Gini coefficient measures inequality in agricultural income (0 = perfect equality; 1 = maximum inequality).

These findings confirm the technical effectiveness of the Green Morocco Plan (GMP) in boosting productive capacity and improving access to irrigation in the Drâa-Tafilalet region. The increase in production (+24.2%) and incomes (+25%) aligns with the program's objective of modernizing agricultural value chains. The significant expansion of irrigation coverage (+35 percentage points) further reflects successful infrastructure deployment, consistent with the program's investment logic. However, this progress must be interpreted in light of the capability approach (Sen, 1992). Structural constraints, such as limited land size and insufficient storage capacity, continue to restrict the conversion of technical gains into sustainable improvements in livelihoods. The fact that 64% of producers still operate on less than 2 ha underlines the persistence of structural vulnerability. The modest reduction in the Gini coefficient (–0.08) suggests only a partial improvement in equity. Income disparities remain significant despite technical gains. According to the multi-level governance framework (Hooghe and Marks, 2003), the observed progress remains primarily technical rather than institutional, since it has not been accompanied by a redistribution of decision-making power or by structural changes

in local governance. From a policy perspective, these results highlight the importance of coupling infrastructure investment with institutional reforms. Devolving authority to local actors, strengthening cooperative governance, and addressing structural land constraints are essential to ensure that technical achievements translate into lasting socio-economic benefits.

3.2. Statistical Significance and Cooperative Effects

The statistical tests applied to the main indicators confirm that the changes observed after the Green Morocco Plan (GMP) are not only substantial in magnitude but also statistically significant. Paired t-tests show highly significant improvements in production volumes ($t(239) = 5.12$, $p < 0.001$) and in average agricultural incomes ($t(239) = 4.87$, $p < 0.001$). Similarly, ANOVA results indicate a strong increase in irrigation access across the sample ($F(2, 237) = 18.45$, $p < 0.001$).

The reduction in income inequality, measured through the Gini coefficient, is also statistically significant according to the Wilcoxon signed-rank test ($p = 0.02$). Of particular importance is the cooperative effect. Regression analysis shows that cooperative membership is associated with a 23% higher increase in income ($\beta = 0.23$, $p = 0.004$) compared to independent producers. In practice, cooperative members recorded an average income growth of +35%, against only +15% for non-members. These statistical results are summarized in Table 3, which provides a detailed overview of the significance levels associated with the main indicators.

Table 3. Statistical tests and cooperative impact.

Outcome / Comparison	Test	Statistic / Coefficient	p-value
Production (t/year), pre vs. post	Paired t-test	t (239) = 5.12	< 0.001
Irrigation access (%), across provinces	ANOVA	F (2, 237) = 18.45	< 0.001
Average income, pre vs. post	Paired t-test	t (239) = 4.87	< 0.001
Gini coefficient, pre vs. post	Wilcoxon signed-rank	–	0.020
Income gain, cooperative vs. independent	OLS regression	β = 0.23	0.004
Any grant received (≥1)	Logistic regression	OR = 2.05	< 0.001
Province effect on grant (ref. Tinghir)	Logistic regression	Errachidia OR = 2.50; Zagora OR = 1.80	< 0.001; 0.006
Trainings attended (count)	Linear regression	Coef member = +0.78 (SE = 0.12)	< 0.001
Governance scores (Transparency)	Two-way ANOVA	F_status(1,234) = 19.4; F_prov(2,234) = 28.5	< 0.001; < 0.001
Governance scores (Coordination)	Two-way ANOVA	F_status(1,234) = 22.1; F_prov(2,234) = 31.2; F_inter(2,234) = 3.2	< 0.001; < 0.001; 0.042
Governance scores (Proximity)	Two-way ANOVA	F_status(1,234) = 16.7; F_prov(2,234) = 24.9	< 0.001; < 0.001

OR = odds ratio; OLS = ordinary least squares; SE = standard error.

These results reinforce the hypothesis that organizational structures amplify the benefits of public agricultural programs. The stronger performance of cooperative members supports the argument that collective organization enhances farmers' bargaining power, facilitates access to subsidies, and reduces transaction costs in markets and inputs (de Janvry and Sadoulet, 2001; de Janvry and Sadoulet, 2022). However, the cooperative advantage must be interpreted with caution. As highlighted by Durand et al. (2018), cooperatives may face internal governance challenges such as conflicts over resource allocation, unequal participation in decision-making, or administrative overload.

These frictions can erode collective efficiency if not addressed through robust institutional design. From a governance perspective, the cooperative effect suggests that strengthening social capital is as important as investing in physical infrastructure. This calls for policies that not only promote cooperative membership but also reinforce their internal governance capacity through training, transparent management practices, and equitable participation mechanisms.

3.3. Territorial Disparities in Irrigation, Storage, and Program Participation

The analysis of irrigation access and storage capacity reveals pronounced territorial disparities across the provinces. Substantial progress is observed in Errachidia, moderate gains in Zagora, and only marginal improvements in Tinghir. Storage capacity remains consistently higher among cooperative members, highlighting a structural advantage in accessing productive resources. These territorial and organizational differences are illustrated in Figure 1, which presents the share of farms equipped with irrigation before and after the GMP, together with current on-farm storage capacity disaggregated by cooperative membership.

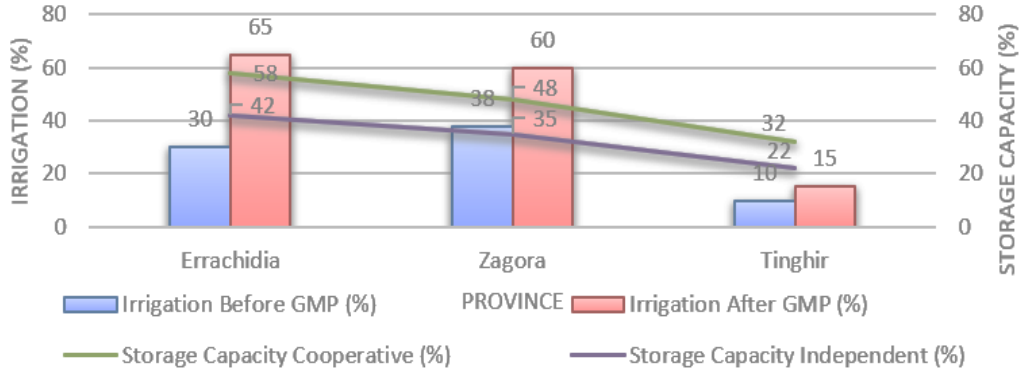

Figure 1. Irrigation access before and after the Green Morocco Plan (GMP) and current on-farm storage capacity by membership status. Values expressed as percentages of surveyed farms.

The combined reading of irrigation expansion and storage capacity levels suggests that hydraulic infrastructure diffusion has been concentrated in territories with stronger pre-existing organizational capacities. The thirty–five–percentage–point increase in Errachidia contrasts with twenty-two points in Zagora and only five points in Tinghir. Higher storage capacities among cooperative members further illustrate this structural advantage. In Errachidia, for example, 58% of members reported having storage facilities compared to only 42% of independent farmers, underlining the role of cooperative affiliation in mobilizing material resources. A more detailed picture emerges from program participation indicators, presented in Table 4, which distinguishes the average number of subsidies received, the probability of obtaining at least one grant, the average number of trainings attended, and the probability of attending at least one training.

Table 4. Program participation by province and cooperative status

Province	Status	Subsidies (mean)	Any grant (%)	Trainings (mean)	Any training (%)
Errachidia	Member	1.8	78	2.5	90
	Independent	1.1	60	1.6	75
Zagora	Member	1.5	70	2.2	85
	Independent	0.9	52	1.4	68
Tinghir	Member	0.8	45	1.3	58
	Independent	0.5	30	0.9	42

Notes: Means refer to the average number of subsidies or trainings attended; percentages indicate the share of producers receiving at least one subsidy or one training.

The data confirm a pattern of cumulative advantage, whereby Errachidia's cooperative members combine higher grant access rates with more intensive training participation. This configuration strengthens their ability to adopt and internalize public investments and illustrates a path dependence dynamic in which initial endowments and institutional density determine the absorptive capacity for public funding and support mechanisms (Pierson, 2000; Peters, 2020). Qualitative interviews help explain these quantitative differences. In Tinghir, producers frequently cited administrative delays, fragmented institutional responsibilities, and limited technical assistance as major obstacles to accessing programs. By contrast, in Errachidia, dense cooperative networks facilitate information sharing, streamline administrative procedures, and enable collective mobilization to meet eligibility criteria, thereby amplifying the uptake rates observed in the survey data. These findings are consistent with recent literature on spatial inequalities in agricultural modernization. Territories with stronger social capital and institutional infrastructure capture a disproportionate share of public investments, while less organized areas struggle to convert infrastructure into durable productivity gains (Barrett et al., 2021; Minot and Sawyer, 2022). This dynamic reinforces existing territorial hierarchies, a trend also highlighted in agricultural policy contexts (Hooghe et al., 2020; Kooiman, 2016). From a governance perspective, the results suggest that centralized allocation mechanisms under the GMP did not fully integrate equity-based targeting. Provinces with weaker baseline infrastructure, such as Tinghir, would have required more compensatory investment to close the initial gap but instead received only modest improvements. Without territorially sensitive allocation criteria that combine technical efficiency with social equity, modernization programs risk entrenching rather than reducing intra-regional disparities. In strategic terms, addressing these disparities requires embedding equity objectives into the design and implementation of regional agricultural policies. Recent frameworks on interactive and multi-level governance

emphasize that negotiated allocation criteria and localized decision-making authority are critical to ensuring that modernization contributes to balanced territorial development (Hooghe et al., 2020; Kooiman, 2016).

3.4. Income Distribution and Social Inclusion

Changes in income distribution before and after the Green Morocco GMP reveal a partial but significant improvement in equity. Figure 2 compares Lorenz curves for agricultural income, showing a shift towards a more equitable distribution. The share of total income captured by the poorest 40% of producers increased from 8% to 18%, while the share held by the wealthiest 20% declined from 58% to 33%.

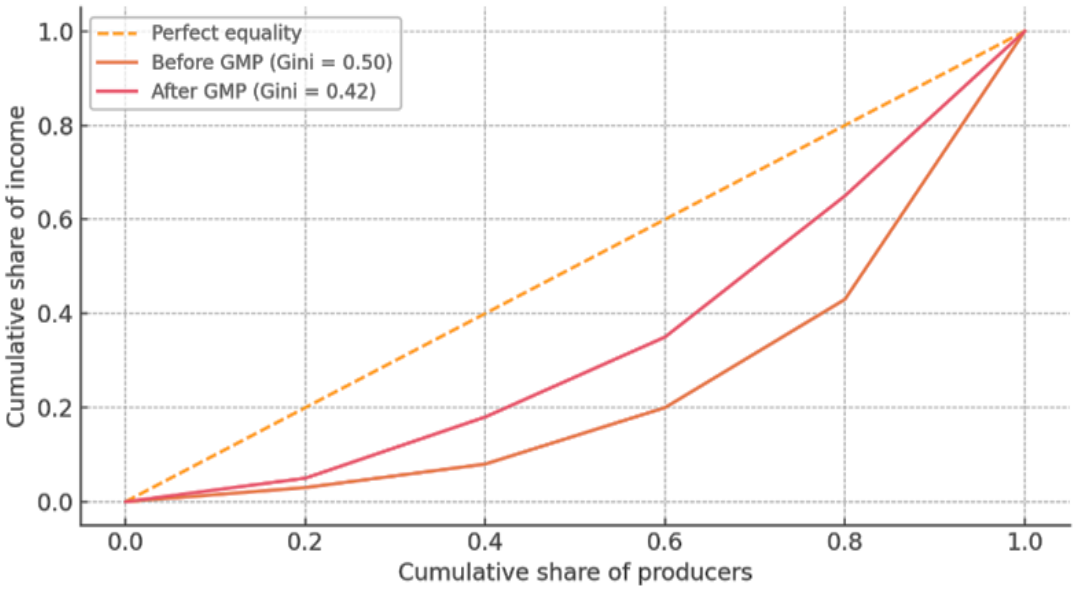

Figure 2. Lorenz curves of agricultural income before and after the implementation of the GMP. The curves illustrate income distribution among surveyed farmers.

GMP interventions contributed to lifting the economic floor for disadvantaged producers. This effect aligns with rural development research showing that targeted investments in infrastructure, credit, and technology can narrow income gaps by raising the productivity of low-income farmers (Christiaensen and Demery, 2018; Jalan and Ravallion, 2002; Barrett et al., 2021). Yet inequality reduction remains modest. The Gini coefficient declined only from 0.50 to 0.42 (–0.08), indicating poverty alleviation among the poorest but persistent structural disparities within the agricultural system. Qualitative interviews confirm that producers with stronger organizational ties, often cooperative members, could better leverage GMP-funded infrastructure by combining it with marketing channels, higher-value crops, and storage facilities. In contrast, isolated smallholders, especially in Tinghir, increased production but continued to face market access and income stability constraints.

These findings underline that social inclusion must be a core pillar of agricultural modernization. Productivity gains alone are insufficient without institutional mechanisms guaranteeing equal access to subsidies, markets, and decision-making (Berdegué et al., 2020; Minot and Sawyer, 2022). The persistence of inequality despite poverty reduction reflects the "selective modernization" dynamic described in development literature (Lipton, 2009; Otsuka and Fan, 2021). Addressing this requires moving beyond incremental redistribution toward structural parity, through equity-focused allocation criteria, stronger smallholder representation in organizations, and targeted capacity-building for marginalized groups.

3.5. Governance Bottlenecks, Perceived Governance, and Documentary Triangulation

Perceived governance outcomes differ significantly across provinces and between cooperative members and independent producers. Table 5 presents average scores and standard deviations for three governance quality dimensions (transparency, coordination, and proximity) by province and membership status. The table also reports mean differences between members and non-members for each dimension, providing a comparative perspective on organizational integration.

Table 5. Perceived governance quality by province and membership status.

Province	Status	T M	Δ vs. Indep.	T SD	C M	Δ vs. Indep.	C SD	P M	Δ vs. Indep.	P SD
Errachidia	Member	3.9	+0.5	0.6	4.0	+0.5	0.5	3.8	+0.5	0.6
	Independent	3.4	–	0.7	3.5	–	0.7	3.3	–	0.7
Zagora	Member	3.7	+0.5	0.6	3.8	+0.5	0.6	3.6	+0.5	0.6
	Independent	3.2	–	0.7	3.3	–	0.7	3.1	–	0.7
Tinghir	Member	3.2	+0.4	0.7	3.3	+0.4	0.7	3.1	+0.4	0.7
	Independent	2.8	–	0.8	2.9	–	0.8	2.7	–	0.9

Notes: T = transparency; C = coordination; P = proximity; M = mean; SD = standard deviation; Δ vs. Indep. = difference compared to independent farmers; Scores are based on a 1–5 Likert scale.

The consistent gaps between cooperative members and non-members suggest that affiliation facilitates stronger integration into coordination mechanisms and greater access to information and services. Governance quality scores are highest in Errachidia and lowest in Tinghir, mirroring earlier patterns in infrastructure development and program participation. These results reinforce the link between organizational density and perceived governance performance. Qualitative evidence adds further context to these quantitative patterns. Figure 3 presents a radial Treemap generated from NVivo coding of 30 semi-structured interviews, showing the relative salience of governance-related constraints identified by stakeholders.

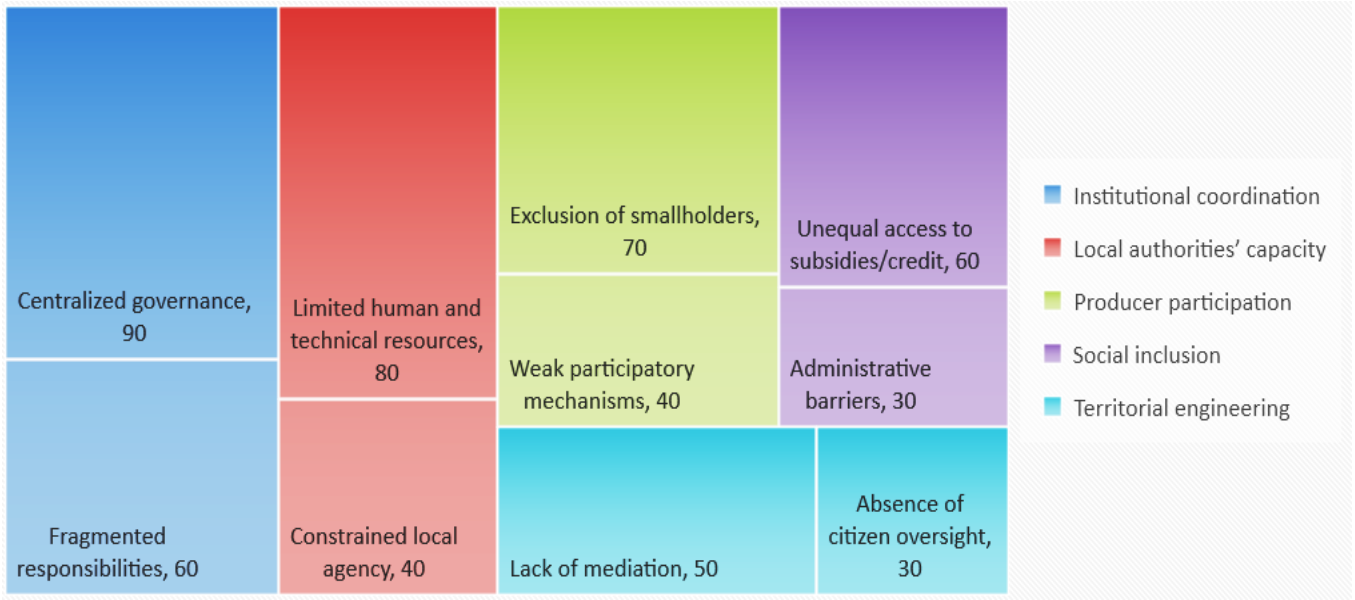

Figure 3. Tree map of governance themes emerging from qualitative interviews with policymakers and stakeholders (coding was conducted with NVivo software).

The most frequently cited constraint was institutional coordination, with respondents highlighting centralized decision-making and fragmented responsibilities across agencies. Local capacity was the second most salient theme, linked to limited staffing, restricted budgetary autonomy, and insufficient technical resources at the provincial level. Weak producer participation also emerged as a critical issue, particularly among non-cooperative members who reported exclusion from strategic planning processes. Social inclusion challenges persisted, as better-connected producers benefited disproportionately from subsidies, credit, and training. Finally, the absence of territorial engineering was noted, since no effective platforms existed to integrate socio-economic and environmental priorities into coherent, territorially based strategies. Taken together, these constraints form a sequential pattern. Centralization limits local capacity; diminished capacity reduces participation; weak participation reinforces unequal access; and the absence of territorial engineering perpetuates fragmented development. This progression is consistent with Pretty's (2020) typology of participation, which suggests that programs often remain at nominal or consultative stages rather than enabling genuine co-design and co-management. It also supports Kooiman's (2016) argument that excessive centralization undermines adaptive capacity and responsiveness to local conditions. From a policy perspective, these findings indicate that technical gains achieved under the GMP are unlikely to be sustainable unless governance arrangements evolve toward decentralized, participatory, and territorially integrated models. Strengthening local councils, institutionalizing participatory budgeting, and creating inclusive stakeholder forums could bridge the gap between infrastructure delivery

and community ownership. Comparative evidence from multi-level governance research (Hooghe et al., 2020; Berdegué et al., 2020) reinforces the conclusion that such institutional reforms are essential to ensure that public investment generates equitable and lasting development outcomes.

3.6. Integrated Interpretation: Resilience and Sustainability

The synthesis of quantitative and qualitative findings reveals both areas of alignment and points of divergence in the effects of the GMP on the date-palm sector in Drâa-Tafilalet. Figure 4 presents these patterns, distinguishing convergences, such as irrigation improvements reinforced by institutional coordination, from divergences, such as the limited uptake of innovations in the absence of participatory governance.

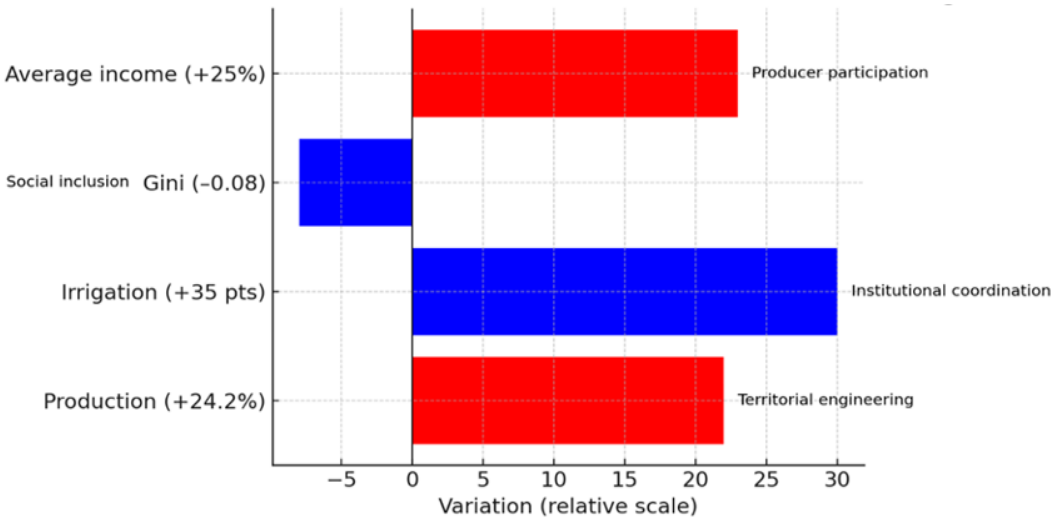

Figure 4. Convergences (blue) and divergences (red) between quantitative indicators and qualitative findings related to the implementation of the Green Morocco Plan (GMP).

The most evident convergence occurs where hydraulic investment is combined with organizational capacity. In such contexts, irrigation expansion coincides with production gains, income growth, and improvements in governance dimensions such as coordination and service proximity. By contrast, divergences arise when infrastructure is delivered without complementary measures such as adaptive water management, inclusive decision-making, and targeted support for small-scale producers. In these cases, technical gains remain vulnerable to climate shocks, groundwater depletion, and social tensions. From a resilience perspective, the GMP's impact is largely characterized by engineering resilience, which restores productive capacity, rather than transformative resilience, which requires adaptive governance, participatory planning, and socio-ecological safeguards (Folke et al., 2010; Meerow et al., 2016). This interpretation aligns with multi-level governance theory, which stresses that decentralization is insufficient without genuine autonomy and horizontal coordination (Hooghe et al., 2020). It also resonates with interactive governance frameworks that highlight the limitations of top-down systems in fostering adaptive and equitable development (Kooiman, 2016). The evidence also reflects mechanisms described by collective action theory. Cooperatives enhanced members' bargaining power, market access, and capacity to capture public subsidies. Yet benefits were unevenly distributed, and non-members frequently reported exclusion from decision-making and resource allocation (Ostrom, 1990; De Janvry and Sadoulet, 2022). Without reforms to address these gaps, modernization risks deepening social divides rather than building inclusive resilience.

Transforming the short-term technical gains of the GMP into long-term, territorially balanced, and climate-resilient outcomes requires both governance and policy innovation. One priority is the negotiation of regional program contracts that allocate budgetary authority to the regional level, allowing context-specific adaptation and performance-based renegotiation. Another is the institutionalization of participatory structures, including watershed committees and producer councils with balanced representation of cooperative members, independents, and marginalized groups, supported by targeted capacity-building programs. Finally, the adoption of integrated socio-ecological safeguards is essential. This includes enforcing groundwater extraction quotas, promoting agroecological diversification, and implementing climate-adaptive cropping systems to preserve fragile oasis ecosystems. These measures directly advance the Sustainable Development Goals, particularly SDG 2 (Zero Hunger), SDG 6 (Clean Water and Sanitation), SDG 8

(Decent Work and Economic Growth), and SDG 15 (Life on Land). By embedding them in the Generation Green 2020–2030 strategy, Morocco can shift from a model focused on restoring productive capacity to one that builds adaptive, inclusive, and territorially equitable resilience.

4. Conclusion

This study confirms that the GMP generated significant technical progress in the Drâa-Tafilalet date-palm sector. Irrigation coverage, production, and average income all increased, while inequality declined moderately. Cooperative membership further amplified these benefits, highlighting the strategic role of collective action in improving productivity and market integration. However, governance challenges limited the extent to which these technical achievements translated into inclusive and territorially balanced development. Centralized decision-making, weak local institutional capacity, and insufficient participation mechanisms restricted the integration of marginalized producers and provinces. Infrastructure investments tended to favor territories with stronger organizational capacity, which risks reinforcing intra-regional disparities. From a resilience perspective, the GMP mainly delivered engineering resilience by restoring productive capacity. Achieving transformative resilience requires adaptive governance, genuine participatory planning, and stronger socio-ecological safeguards. Addressing long-term vulnerabilities such as groundwater depletion and climate variability will therefore require systemic institutional reforms that embed equity and sustainability at the core of agricultural policy. Future strategies, particularly Generation Green 2020–2030, should integrate regionally negotiated program contracts, participatory governance, and ecological safeguards to consolidate technical gains, foster social ownership, and build long-term territorial resilience.

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Institutional/Ethical Approval: The study was conducted in compliance with applicable ethical standards. Informed consent was obtained from all participants involved in the interviews and surveys. No experiments involving humans or animals were performed that would require formal institutional ethical approval.

Data Availability/Sharing: The datasets used and analyzed during the current study will be made available from the corresponding author upon a reasonable request.

Supplementary Information Availability: Not applicable.

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