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Empowering women through agricultural cooperatives: a multilevel analysis in Morocco's Marrakech-Safi region

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Abstract
This study investigates the impact of female agricultural cooperatives on women's empowerment in Morocco, with a focus on the rural Marrakech-Safi region. The research evaluates the effectiveness of these cooperatives in enhancing women's empowerment through economic opportunities, participatory governance, and leadership roles. The Global Empowerment Index (GEI) was adopted to measure empowerment across five key dimensions: personal decision-making, economic decision-making, household decision-making, freedom of mobility, and participation in community activities. A multilevel analysis was performed using data from 225 cooperative members, selected through a combination of convenience and purposive sampling. The findings reveal that cooperatives fostering leadership roles, economic opportunities, and participatory governance significantly enhance women's autonomy and control over resources. However, persistent challenges such as limited market access and insufficient resources continue to hinder the full potential of these cooperatives. By examining the interplay between cooperative models and regional factors, this research offers actionable recommendations. These include improving access to training programs tailored to women in cooperatives, establishing mentorship initiatives to foster long-term empowerment and skill development, expanding targeted microcredit, investing in sustainable infrastructure, and promoting digital integration for direct market access. Nevertheless, the study's regional scope and reliance on cross-sectional data represent limitations, underscoring the need for future research to explore diverse contexts and longitudinal perspectives.

Keywords Women's empowerment · Female agricultural cooperatives · Global Empowerment Index · Multilevel analysis · Morocco

1 Introduction

Rural women in many developing countries face significant barriers to economic participation and decision-making. Women's cooperatives, defined by the International Labour Organization (ILO) as "autonomous associations of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled enterprise" ([32], p.2), offer a proven solution by providing access to resources, training, and governance opportunities [59]. In Morocco, women's agricultural cooperatives empower women to generate economic value and assert autonomy [1], aligning with the United Nations Sustainable Development Goals (SDGs) as part of the government's strategy to combat social exclusion and promote sustainable development.

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To fully harness the transformative potential of cooperatives, it is crucial to understand the factors that drive women to join and how these organizations shape their empowerment. Women's empowerment, as conceptualized by Kabeer [37], involves gaining the ability to make strategic life choices in contexts where such opportunities were historically limited, encompassing resources,[1] agency,[2] and achievements.[3] This perspective, grounded in Sen's Capability Approach [64] emphasizes expanding freedoms and opportunities for individuals to lead lives they value. Within cooperatives, this multidimensional empowerment is evident as women transition from passive beneficiaries to active contributors, influencing household financial decisions and community leadership. However, realizing these outcomes depends on how cooperatives are structured and managed, as well-governed cooperatives offer leadership opportunities, access to markets, and pathways to greater economic and social agency [15].

Existing research has often been limited in scope, focusing predominantly on economic participation while neglecting broader dimensions of empowerment. Studies such as Ferguson and Kepe [22] and Masabo [44] have explored cooperatives' roles in enhancing livelihoods but have overlooked critical aspects like mobility, household decision-making, and systemic barriers, including entrenched gender norms. Similarly, more recent works, including Anderson et al. [7] and Onditi and Odera [57], have emphasized economic benefits but have relied heavily on descriptive methodologies, which have constrained their practical relevance. Research on Moroccan cooperatives, such as that by Ibourk and Aynaoui [4], has shed light on rural development but has also highlighted the lack of gender-sensitive frameworks and the need for a multidimensional analysis of empowerment.

Over the past two decades, Morocco has significantly strengthened its cooperative sector through targeted government initiatives and strategic programs designed to empower women and foster rural development. The National Initiative for Human Development (NIHD),[4] has been pivotal in supporting over 22,900 projects between 2005 and 2020, benefiting more than 5.2 million people and involving 6000 cooperatives [67]. By providing funding, capacity-building opportunities, and infrastructure development, the INDH has enabled many women in rural areas to engage in economic activities and improve their livelihoods. However, its impact has been uneven, as entrenched socio-cultural norms and fragmented institutional coordination have limited its ability to fully empower women within cooperatives. The Green Morocco Plan[5] (GMP) (2008–2020) complemented these efforts by modernizing agriculture and integrating women into value chains, particularly in high-potential sectors such as argan oil and artisanal crafts. Women's cooperatives were directly supported through technical training, financial incentives, and market access initiatives, promoting their participation in income-generating activities. Nonetheless, challenges such as unequal access to resources and limited representation in decision-making roles hindered women's ability to achieve full empowerment within these frameworks [50].

A more recent initiative, Mourafaka, introduced by the Office for the Development of Cooperation[6] (ODCO), focuses specifically on the sustainability of newly established cooperatives. The program offers post-creation support, including technical assistance and financial aid, to help women's cooperatives stabilize and grow during their early stages. While this program provides critical support, its limited resources and reach have restricted its impact, leaving many cooperatives unable to overcome systemic challenges [17]. Despite the progress achieved, challenges such as inadequate access to financing, limited representation in decision-making, and systemic barriers continue to hinder the transformative potential of these initiatives, particularly in regions like Marrakech-Safi, where infrastructural and institutional limitations are pronounced [31].

This study addresses these gaps by adopting a multidimensional approach to understanding empowerment within cooperatives. It introduces the Global Empowerment Index (GEI), which evaluates empowerment across five interconnected dimensions: personal decision-making, economic agency, household authority, freedom of mobility, and community participation. By focusing exclusively on women-only cooperatives in the Marrakech-Safi region, the

[1] which include material, human, and social assets.

[2] referring to the capacity to act on personal goals.

[3] representing the outcomes of these actions.

[4] National initiative for Human development (NIHD), launched in 2005, is a Moroccan government program aimed at improving the quality of life for the most disadvantaged populations. Its primary objective is to support local development projects, enhance social inclusion, and reduce poverty through targeted interventions in areas such as education, health, and economic empowerment. INDH focuses on promoting community participation and sustainable development to address socio-economic disparities.

[5] The Moroccan green plan is a national agricultural strategy launched by Morocco in 2008. Its primary goal is to transform Morocco's agricultural sector by increasing productivity, promoting sustainable practices, and improving rural livelihoods.

[6] The Office de Développement de la Coopération (ODCO) was established in 1967 in Morocco. Its primary objective is to promote the development and support of cooperatives across various sectors, including agriculture and crafts. ODCO aims to enhance the capacity and effectiveness of cooperatives by providing training, financial assistance, and technical support.

research examines how gender-specific contexts and both inter- and intra-cooperative variations shape empowerment dynamics areas often overlooked in existing studies.

Additionally, the study explores how regional disparities, such as infrastructural limitations, market constraints, and institutional challenges, influence cooperative outcomes in underdeveloped rural areas. Using a multilevel analytical framework, the research provides a nuanced understanding of empowerment mechanisms and offers actionable recommendations for enhancing cooperative governance, improving market integration, and addressing systemic barriers to foster long-term sustainability and equitable development.

Building on these considerations, this paper is organized as follows. We begin by presenting the analytical framework for understanding women's empowerment within cooperatives, with a focus on its multidimensional aspects. Next, the methodology section details the survey conducted with 225 female cooperative members in the Marrakech-Safi region and introduces the Global Empowerment Index (GEI), which serves as a key tool for evaluating empowerment. The results and discussion sections follow, analyzing the impact of cooperatives on women's empowerment while addressing regional disparities and systemic barriers. Finally, the paper concludes with actionable recommendations aimed at enhancing cooperative governance and promoting sustainable empowerment outcomes.

2 Literature review

2.1 The role of women's cooperatives in empowering women's

Gender inequalities, deeply rooted in socio-cultural norms and institutional structures, limit women's access to decision-making power, economic resources, and opportunities for social mobility [38, 65]. In Morocco, women's cooperatives have emerged as a critical mechanism for addressing these inequalities, offering a pathway to economic integration and social advancement. By pooling resources, fostering collaboration, and providing access to training. Cooperatives enable women to transition from unpaid domestic labor to formal economic participation, thereby reshaping traditional gender roles.

Since gaining independence in 1956, Morocco has leveraged cooperatives as a tool to combat social exclusion and promote sustainable development, particularly among women and youth in rural areas [12, 23]. The cooperative sector's effectiveness is evident in its capacity to generate income and facilitate small savings, thereby improving the quality of life for vulnerable populations [55]. Women constitute 29% of cooperative members in Morocco, with approximately 14% participating in women-only cooperatives [27].

Among these, over 39% are concentrated in the agricultural sector, representing more than 21,700 female members [56]. National programs like the National Initiative for Human Development NIHD or The Moroccan green plan underscore the government's commitment to supporting female cooperatives, particularly in rural areas, as drivers of economic empowerment [27, 39].

Women's cooperatives create pathways to economic empowerment and community development by providing access to leadership roles, training, and financial resources. These cooperatives enhance financial independence and skills, enabling women to overcome societal barriers and economic inequalities, thereby gaining control over their lives and making meaningful decisions [37]. Empowerment involves both individual agency, which allows women to manage resources and make autonomous choices, and transformative agency, which challenges restrictive societal norms and inequitable systems [2, 38, 46]. In Rwanda, the mandatory inclusion of women in cooperative leadership has strengthened trust and social capital, fostering loyalty and sustainable development. By connecting women to new technologies, markets, and leadership opportunities, these cooperatives significantly enhance women's agency and engagement [46].

Cooperatives also strengthen women's roles within households and communities, while fostering solidarity through collective action [62]. They create spaces where women can collaborate, challenge restrictive norms, and advocate for systemic change [21]. This collective power enables women to address inequalities, influence governance, and advocate for improved opportunities, promoting a more inclusive and equitable society [14]. Despite these advances, Moroccan women from disadvantaged backgrounds still face significant obstacles in establishing and sustaining cooperatives.

2.2 Challenges facing women's cooperatives

The development of women's agricultural cooperatives in Morocco faces numerous challenges that hinder their growth and effectiveness.

One significant obstacle is the financial and institutional barriers, which restrict access to essential resources. Women often struggle to secure bank loans due to a lack of collateral and systemic discrimination within the financial sector [13, 52]. Additionally, the absence of sufficient initial capital prevents many cooperatives from reaching their full potential. This issue is compounded by inadequate training in critical areas such as management, marketing, accounting, and modern agricultural techniques, which limit cooperative productivity [43].

Another pressing issue lies in the challenges of value addition. Many women's agricultural cooperatives are unable to add significant value to their products, which reduces their profitability. For instance, cooperatives producing high-quality honey often sell their products in bulk at low prices instead of creating premium, marketable goods. Similarly, cooperatives involved in arboriculture, such as almond and fig production, frequently lack access to modern processing technologies and infrastructure, forcing them to sell raw goods at lower prices [22].

Sector-specific hurdles are also prevalent in industries such as livestock farming and meat production. High operational costs, limited access to quality feed, and insufficient veterinary services constrain profitability and productivity [44]. Environmental challenges like prolonged drought further exacerbate these issues by reducing pasture availability and increasing feed costs, ultimately threatening the sustainability of cooperatives [36].

In addition, market access and logistical issues significantly limit the success of women's cooperatives. They often face challenges accessing profitable markets due to logistical inefficiencies, lack of market knowledge, and unfair competition). Basic infrastructure deficiencies, such as inadequate roads, storage facilities, and processing centers, hinder their ability to produce, store, and distribute goods effectively. Internal governance problems, such as ineffective decision-making and internal conflicts, further stifle cooperative activities.

Technological and environmental constraints also impede cooperative progress. Limited access to modern production and management technologies reduces competitiveness and operational efficiency [16, 68]. Climate change and environmental challenges, including droughts, exacerbate these difficulties, further threatening productivity and the long-term sustainability of cooperatives [39].

Moreover, socio-cultural barriers pose significant challenges to women's participation in cooperatives. Deeply ingrained cultural and social norms, including poverty, illiteracy, religious conservatism, and patriarchal attitudes, often limit women's autonomy and engagement in leadership roles [69]. Rural women are particularly affected, as they face resistance from family and community members. Men often oppose their participation in mixed-gender cooperatives or activities outside the home, restricting women to unpaid domestic responsibilities [11].

Finally, a lack of recognition and institutional support further hinders the effectiveness of women's cooperatives. Many lack formal recognition, restricting their access to grants, resources, and technical assistance [66]. Inequitable commercialization practices also reduce women's compensation for their labor, which undermines motivation and long-term commitment [27].

These challenges highlight the urgent need for targeted interventions to address financial, technological, environmental, and socio-cultural barriers. Overcoming these obstacles requires a comprehensive approach, including financial support, training programs, improved infrastructure, and initiatives aimed at shifting societal attitudes toward women's participation in economic activities [20]. Addressing these issues is essential for ensuring the long-term success and sustainability of women's cooperatives, ultimately unlocking their potential as catalysts for empowerment and development.

2.3 The capability approach and gender: A framework for women's empowerment in cooperatives

The Capability Approach, developed by Sen [63, 64] and Nussbaum [54], provides a robust framework for understanding women's empowerment, emphasizing the expansion of freedoms to lead lives they value. By integrating a gender perspective, this approach highlights structural inequalities and traditional norms that constrain women's opportunities, paving the way for strategies to address educational, economic, and social barriers. This perspective is particularly relevant in the context of cooperatives, which hold significant potential to address these gaps.

Cooperatives empower women by enhancing both individual and collective agency, aligning with key dimensions of the Capability Approach while fostering trust in leadership and strengthening their roles within communities [8,

46]. Membership in cooperatives not only fosters financial independence through access to economic resources but also strengthens social and political agency, enabling women to challenge restrictive norms [36, 52]. However, critical gaps remain in understanding how cooperatives can maximize these impacts, especially in contexts like Morocco, where entrenched cultural and social barriers such as high illiteracy rates and limited access to education continue to hinder women's socio-economic opportunities [26, 39].

Previous studies employing the Capability Approach to assess women's empowerment have provided meaningful perspective but suffer from significant limitations [6]. Lecoutere [42] examined cooperatives in Uganda and found that participation enhanced women's decision-making power within households and communities. However, the study primarily focused on household-level decision-making, leaving critical dimensions like mobility and economic agency underexplored. Furthermore, Lecoutere's reliance on cross-sectional data limits the ability to capture long-term empowerment dynamics, particularly the transformative effects of sustained cooperative engagement.

Similarly, Zereyesus et al. [70] applied the Women's Empowerment in Agriculture Index (WEAI) to examine the relationship between empowerment and household health outcomes in Northern Ghana. While the findings revealed a strong link between women's empowerment and improved child nutrition, the study narrowly focused on health-related outcomes and overlooked broader empowerment dimensions, such as community participation and leadership development. Additionally, the study relied on aggregated household-level data, which risks masking individual variations in empowerment experiences, particularly for marginalized women within households.

Di Tommaso [18] and Pigg [60]further illustrate the challenges of applying the Capability Approach to empowerment research. Both studies focused on well-being at the individual level, neglecting the relational and collective dynamics that are critical for understanding empowerment in cooperative settings. While these studies offer valuable methodological contributions, their frameworks fail to account for the interplay between individual capabilities and systemic constraints, such as cultural norms and power imbalances within communities.

Women's empowerment is a multifaceted concept encompassing various dimensions. Mayoux [48] and Mosedale [47] describe it as the process through which women gain strength, confidence, and the ability to make strategic choices and control resources. Narayan (2002) emphasizes increased control and ownership of assets, while Batliwala [10] underscores the interplay of material resources, intellectual growth, and systemic gender ideologies in shaping empowerment.

Researchers Laszlo and Grantham conclude in their analysis that there is no universal approach to measuring women's economic empowerment [41]. The process of empowerment manifests differently across contexts and various areas of a woman's life. Therefore, it is important to choose appropriate measures of the economic empowerment concept that fit the research framework. Measures cannot be meaningful unless closely aligned with a specific context. As pointed out by Laszlo and Grantham, the effectiveness of measures essentially depends on the "degree of alignment between researchers' conceptualization of empowerment, the measures they employ, and the data available to them" [41].

This study applies the Capability Approach proposed by Sen [63] to assess empowerment, integrating Nussbaum's [53] universal human capabilities. Key dimensions of empowerment include:

- Personal decision-making
- Community participation
- Freedom of mobility
- Household decision-making
- Economic decision-making.

These dimensions provide a structured framework for exploring empowerment within cooperative contexts.

While significant strides have been made in conceptualizing and measuring empowerment, gaps persist, particularly in applying theoretical constructs to cooperative settings. Agarwala [3] highlights the need to recognize women's roles in informal economies and reframe cooperative participation as a transformative opportunity to challenge gender norms and enhance agency [10]. For cooperatives to truly empower women, it is essential to incorporate their voices into decision-making at all levels, ensuring access to leadership roles and skill development opportunities.

3 Methodology

3.1 Description of study area

Demographically (Fig. 1), the Marrakech-Safi region holds substantial importance in Morocco's agricultural cooperative landscape, accounting for 20% of the national total. The region is home to an impressive 3,363 operational agricultural cooperatives, with 93% actively functioning. Among these, 810 cooperatives are exclusively managed by women, underscoring the significant presence and role of female leadership in this sector (ODCO 2022).

This research aims to evaluate the contribution of cooperatives to women's empowerment in Morocco. The study focuses on n = 52 cooperatives located across six provinces of the Marrakech-Safi region.

Geographically, these cooperatives are strategically distributed, predominantly in provinces characterized by mountainous terrain and rich local produce. Al Haouz province leads with 21% of the cooperatives, followed by Essaouira and Chichaoua, which host 18% and 15%, respectively. This distribution reflects the region's agricultural diversity and its reliance on cooperative structures for economic and social development.

The Marrakech-Safi region's agricultural potential is vast, encompassing 285,000 holdings spread across a total area of 3.92 million hectares, of which 350,000 hectares benefit from irrigation. With a population of 4.52 million, 57% of whom reside in rural areas, the region represents a significant agricultural labor force. This rural demographic highlights the critical role of cooperatives in supporting livelihoods, enhancing economic resilience, and fostering women's participation in agriculture.

Focusing on this region enables a comprehensive assessment of cooperatives' effectiveness in empowering women under challenging socio-economic conditions. By analyzing cooperative structures and their impact, this study investigates how cooperatives influence women's autonomy. Special attention is given to female-only cooperatives, which serve as models for fostering economic independence and social empowerment.

Fig. 1 Study Area. Source: author's, DB from [Ministry of the Interior, General Directorate of Territorial Collectivities. (2015). General Monograph of the Marrakech-Safi Region. Rabat, Morocco: Ministry of the Interior [49]

3.2 Data type and source

The study is based on primary data collected from members of female agricultural cooperatives in the Marrakech-Safi region. These cooperatives were identified from the National Office of Development and Cooperation (ODCO) database, which served as a reliable source for selecting operational and active cooperatives. The data collection targeted members of 52 cooperatives strategically chosen across six provinces in the region, ensuring representation of diverse agricultural activities and geographical contexts.

3.3 Sampling size and sampling technique

The selection of respondents relied on a combination of convenience sampling and purposive sampling. Convenience sampling was used to address logistical constraints,[7] such as geographic dispersion and resource limitations, as well as cultural challenges, including the reluctance of some women to participate due to personal or community norms. Purposive sampling ensured the inclusion of active and operational cooperatives, as identified in the ODCO database. This mixed approach was essential for managing logistical constraints, such as rural dispersion and cultural sensitivities, while ensuring the study's objective of capturing relevant and reliable data.

The study initially surveyed 300 women, representing a significant portion of the 2695 members of female agricultural cooperatives in the Marrakech-Safi region. However, during the data validation process, it became evident that a portion of the responses was unreliable. Specifically, many participants did not answer key questions related to the economic dimension of empowerment and household decision-making, which were crucial to the study's objectives.

To ensure the validity and reliability of the data, the study retained 225 responses that met the required criteria for completeness and accuracy. This final sample size was determined using Cochran's formula for finite populations, ensuring a 95% confidence level and a 5% margin of error.

The formula is as follows:

$$n = \frac{z^2 \cdot p \cdot (1-p)}{e^2} \cdot \frac{N}{N + \left(\frac{z^2 \cdot p(1-p)}{e^2} - 1\right)}$$

where:

$Z = 1.96$: Confidence level of 95%

$P = 0.5$: Maximum variability,

$e = 0.05$: Margin of error,

$N = 2695$: Total population size.

Using Cochran's formula, the required sample size for a 5% margin of error was calculated as 336 members. However, the final sample of 225 respondents, while smaller, includes only reliable and complete responses, ensuring the robustness of the data for analysis. Incomplete responses, particularly on critical aspects such as economic empowerment and household decision-making, were excluded to maintain the validity of the results [40]. This final sample, despite being slightly smaller than the ideal size, is sufficient to draw solid conclusions due to its geographic diversity, covering six provinces, and the inclusion of cooperatives engaged in diverse agricultural activities. By retaining only reliable responses, the study enhanced the quality of its findings and mitigated sampling bias, ensuring robust and credible results.

3.4 Method of data collection

This study relied on primary data collected between September and December 2022, during the post-COVID-19 period, from members of operational and active female agricultural cooperatives in the Marrakech-Safi region. Data was gathered

[7] In rural settings, where logistical challenges and cultural norms can limit access and participation, convenience sampling proves advantageous. This method allows researchers to collect data from easily accessible respondents, helping overcome geographical barriers and resource limitations. Combined with purposive sampling, which targets specific cooperative members to ensure relevance to the study, this approach ensures that the data represents the key population of interest. The use of these sampling techniques in rural areas has been widely documented, with studies highlighting their ability to balance the need for reliable data with the practical constraints posed by remote locations [58], Hossain et al. [28]). Such methods are particularly effective when studying women's empowerment in rural cooperatives, where participation is often influenced by socio-cultural factors and logistical barriers.

through a structured questionnaire administered face-to-face, designed to explore key dimensions of women's empowerment within cooperatives. The data collection process spanned four months, including one month dedicated to preparation such as training enumerators and pilot testing the questionnaire and three months of fieldwork.

The cooperatives were identified using a comprehensive database provided by the National Office of Development and Cooperation (ODCO), which lists 241 operational and active female agricultural cooperatives in the region. From this population, 52 cooperatives were strategically selected across six provinces Al Haouz, Marrakech, Chichaoua, Kelaat Seraghna, Essaouira, and Rehamna to ensure geographic and activity-based diversity. Within each selected cooperative, between 5 and 15 members participated in the survey. The face-to-face administration of the questionnaire was crucial for overcoming logistical challenges, such as geographic dispersion, resource limitations, and cultural sensitivity, and ensuring high-quality data collection.

3.5 Construction of the global empowerment index (GEI)

The Global Empowerment Index (GEI), as utilized in this study, aligns closely with the Capability Approach developed by Sen [63, 64] and expanded by Nussbaum [53], which emphasizes the expansion of individuals' freedoms and capabilities to lead lives they value. This approach provides a multidimensional lens to evaluate empowerment, considering not just resources and outcomes but also the processes and contexts that shape agency and well-being. By capturing five critical dimensions personal decision-making, economic decision-making, household autonomy, freedom of mobility, and participation in community activities, the GEI reflects the interconnected and relational nature of empowerment within agricultural cooperatives.

The GEI's design incorporates Kabeer's [37] framework for empowerment, which identifies three interrelated dimensions: resources, agency, and achievements. Resources, in the context of this study, include women's access to economic tools, cooperative memberships, and financial services, enabling them to exercise choice. Agency is reflected in the decision-making dimensions of the GEI, such as economic and household decision-making, which capture women's ability to influence key aspects of their lives. Achievements, or well-being outcomes, are represented through dimensions like freedom of mobility and community participation, highlighting how empowered women navigate societal constraints and actively engage in public life.

Each dimension in the GEI is measured using a 5-point ordinal scale, allowing nuanced evaluation of empowerment levels across different contexts. For instance:

- Personal decision-making evaluates women's autonomy in choices about health, education, and personal matters.
- Economic decision-making measures control over income, financial resources, and economic activities.
- Household decision-making assesses participation in decisions about family budgeting, children's education, and household expenditure.
- Freedom of mobility captures the ability to access social, economic, and educational opportunities without restrictions.
- Community participation gauges women's engagement in cooperatives, collective decision-making, and local organizations.

This composite approach offers a significant advantage over single-dimension measures by integrating multiple facets of empowerment, ensuring a comprehensive understanding of women's roles within cooperatives.

3.6 Comparison with the women's empowerment in agriculture index (WEAI)

The Women's Empowerment in Agriculture Index (WEAI), introduced by USAID (United States Agency for International Development) in collaboration with the Oxford Poverty and Human Development Initiative (OPHI) and the International Food Policy Research Institute (IFPRI), serves as a comprehensive framework for assessing women's empowerment in agricultural contexts [5].

The WEAI measures empowerment through five key domains: decision-making in agricultural production, access to and control over productive resources, control of income use, leadership in the community, and time allocation. This multidimensional structure allows for a holistic evaluation of empowerment, with particular emphasis on agency as a central dimension. The concept of agency, as articulated in the WEAI, aligns with Kabeer's [37] definition of empowerment,

which emphasizes the capacity to make strategic life choices in contexts where such opportunities had historically been restricted.

Despite its wide applicability and rigorous methodology, the WEAI has notable limitations. As highlighted by Bageant et al. [9], aggregating indicators at the household or national level often obscures the unique experiences of marginalized women, particularly in specific regions or age groups. Furthermore, while the WEAI is well-suited for capturing decision-making in agricultural contexts, it overlooks broader dimensions of empowerment that are critical in rural cooperative settings, such as freedom of mobility and active participation in community initiatives. These gaps underscore the need for complementary frameworks or localized adaptations to capture more effectively the complexities of empowerment in diverse socio-economic contexts.

Our study addresses these limitations by introducing the Global Empowerment Index (GEI), a multidimensional framework tailored to the Moroccan context. Unlike the WEAI, the GEI expands the scope of empowerment measurement to include dimensions beyond agriculture, incorporating freedom of mobility and community participation as critical factors in cooperative settings. Additionally, the GEI is designed to capture empowerment at the individual level, thereby avoiding the potential masking of inequalities within households or cooperatives. This localized and inclusive approach ensures that the nuances of women's empowerment, particularly in rural Morocco, are fully captured.

3.7 Advancing empowerment measurement

The construction of the GEI builds on the strengths of previous frameworks like the WEAI while addressing their limitations. By adopting a multidimensional approach that incorporates both individual capabilities and relational dynamics, the GEI provides a nuanced understanding of empowerment within cooperatives. This study highlights the importance of capturing the interplay between agency, resources, and achievements, ensuring that empowerment is not merely measured by outcomes but also by the processes and opportunities that enable women to exercise choice and agency.

GEI's adaptability and multidimensionality make it a valuable tool for evaluating the impact of cooperatives on women's empowerment. It not only aligns with theoretical advancements in the Capability Approach but also provides actionable insights for policymakers and practitioners seeking to foster sustainable gender equity and development.

To quantify empowerment sub-indices were created for each indicator category, with ratings of c1, c2, c3, c4, and c5, respectively, to construct the GEI. Kc represents the number of elements in each category.

The overall quality index is then calculated as the average of the sub-indices, thus providing a synthetic measure of women's empowerment within agricultural cooperatives.

The method used is as follows:

sub-indices ….. were constructed for indicator category:

c {c1 (dimension1) c2 (dimension2)c3 (dimension3) c4(dimension4) c5(dimension5)}.

$$X_{c_j} = \frac{1}{K_c} \sum_{1}^{K_c} \Phi(x_k|c)$$

where Kc is the number of items in category c.

The Global Empowerment index is constructed as the average of the sub-indices:

$$\text{Global Empowerment index} = 1/5(X_{c_1} + X_{c_2} + X_{c_3\ldots\ldots\ldots\ldots})$$

The survey's hierarchical data structure required a multilevel analysis to understand how variables at different levels interact and affect women's empowerment. This approach allows for the identification of variance sources, including individual and cooperative-level effects, and is well-established in fields such as education (Goldstein 1995); [29, 30]).

The analysis begins with an unconditional model to determine whether a hierarchical structure is suitable for the data. This initial model does not include explanatory variables; instead, it partitions the total variance of the dependent variable, the Global Empowerment Index (GEI), into two components:

a. Intra-Cooperative Variance: Variance attributable to differences among members within the same cooperative.
b. Inter-Cooperative Variance: Variance attributable to differences between cooperatives.

The two-level empty model is represented by equations at both levels:

3.8 First level (Individual members within cooperatives)

The specification of the first level (member and cooperative) is as follows:

$$Y_{ij} = \beta_{0j} + e_{ij} \tag{1}$$

where:y_{ij}: Score of members i of cooperative jβ_{0j}: Mean score of cooperative je$_{ij}$: Error terms measuring the difference between the final average score of cooperative j and that of its member i. It is assumed to follow a normal distribution with a mean of zero and a constant variance σ_1^2

3.9 Second level (Cooperative level)

The specification of the second level (cooperative level) is as follows:

$$\beta 0j = \gamma 00 + u0j \tag{2}$$

The second-level model uses the level 1 intercept parameter as an explanatory variable. This simply means that the mean score of the cooperative varies randomly around a general average of all members (final mean score).With:γ_{00}: Mean final score of all members.u_{0j}: Error term measuring the difference between this final mean score and that of cooperative j. It is assumed to follow a normal distribution with a mean of zero and a constant variance.σ_2^2

If we replace the mean score of the cooperative with its new expression:

From (1) and (2) we have:

$$Y_{ij} = \gamma_{00} + u_{0j} + e_{ij} \tag{3}$$

Evaluating the need for multilevel analysis:

Estimating this model enables us to assess whether cooperative-level effects significantly influence the dependent variable (GEI). The intra-cooperative correlation coefficient (ρ) quantifies the proportion of total variance attributable to differences between cooperatives:

$$\rho = \frac{\sigma_2^2}{\sigma_1^2 + \sigma_2^2}$$

This coefficient helps determine the extent to which the hierarchical structure of the data affects the GEI scores.

3.10 Partitioning variance

The total variance ($V_{Y_{ij}}$) is the sum of the variances at both levels:

$$V_{Y_{ij}} = V_{\gamma_{00}+u_{0j}+e_{ij}} = V_{u_{0j}} + V_{e_{ij}} = \sigma_1^2 + \sigma_2^2$$

By calculating the intra-cooperative correlation coefficient, we confirm the necessity of employing a multilevel model to account for the hierarchical nature of the data and to properly analyze the empowerment dynamics.

3.11 Global empowerment index calculation

The Global Empowerment Index (GEI) is computed by averaging the scores across five dimensions of empowerment: personal decision-making, economic decision-making, household decision-making, freedom of mobility, and participation in community activities (Fig. 2). Each dimension is measured on a 5-point ordinal scale, allowing for a nuanced evaluation of women's empowerment based on established theoretical frameworks.

This methodological approach ensures the reliability of the findings and provides valuable insights into the roles of individual and cooperative-level factors in shaping women's empowerment within agricultural cooperatives.

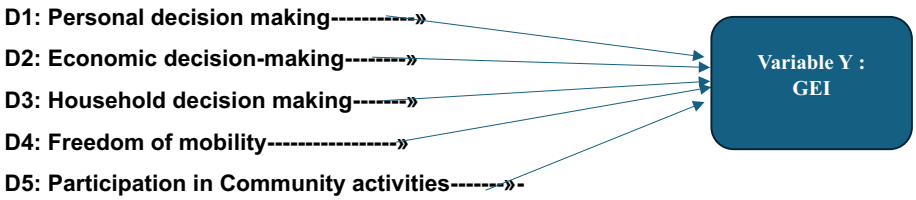

Fig. 2 Diagram of the construction of the global empowerment index

4 Results

To provide a comprehensive understanding of empowerment levels among female members of agricultural cooperatives, we analyzed the Global Empowerment Index (GEI) across its five dimensions.

4.1 Distribution of GEI scores

The distribution of GEI scores provides important insights into the overall empowerment levels of the surveyed women. A histogram (Fig. 3) illustrating the frequency of different empowerment scores highlights the patterns and variability among the members.

The analysis shows that most women have empowerment scores concentrated around the average of 3.75, indicating a moderate overall level of empowerment. The calculated standard deviation of 0.463 reflects relatively low dispersion around the mean, suggesting that empowerment levels are consistent across members.

This homogeneity implies that while empowerment levels are not highly variable, many members experience a similar degree of empowerment. Such findings underscore the effectiveness of cooperatives in providing a stable platform for empowerment but also highlight potential opportunities for targeted interventions to elevate empowerment levels for those scoring below the mean.

4.2 Descriptive analysis of cooperatives and socio-economic profiles

The study focuses on agricultural cooperatives, which constitute approximately 30% of all female-led cooperatives in the region, according to the National Office of Development and Cooperation (ODCO). The sample comprises 52 female agricultural cooperatives, predominantly located in rural areas, with 89.8% of the cooperatives in non-urban regions and only 10.2% in urban settings.

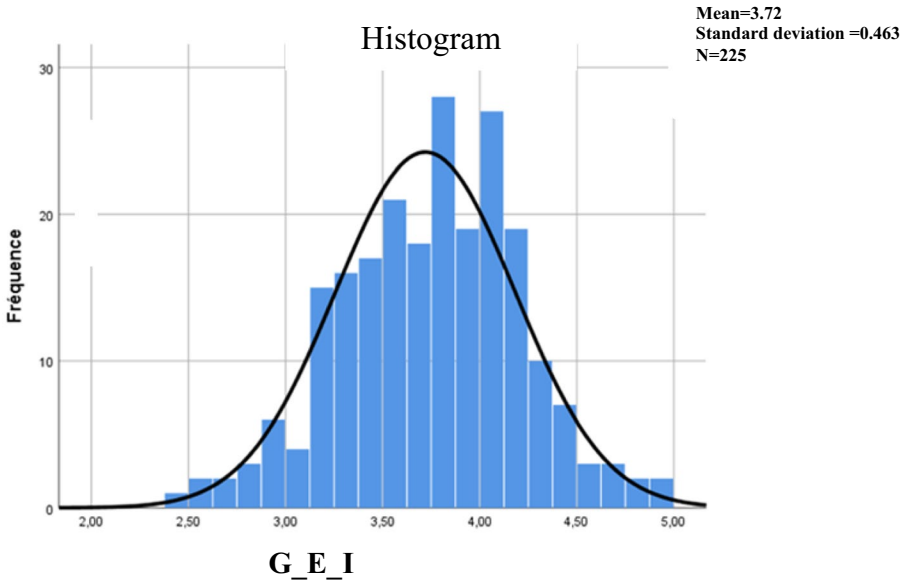

Fig. 3 Histogram of the Overall Empowerment Index. Source: Field Survey

The demographic characteristics of cooperative members reveal that most participants are married, with an average household size of 4.31. In terms of education, a considerable number of members have limited formal education, with many having completed only primary or secondary schooling. This limitation underscores the importance of targeted capacity-building initiatives to enhance members' skills and knowledge.

The analysis highlights both opportunities and challenges. Cooperatives have the potential to serve as platforms for financial independence, skill enhancement, and economic inclusion for rural women, particularly in contexts where alternative opportunities are limited. However, low education levels and the lack of access to infrastructure and markets remain significant obstacles to maximizing the impact of these cooperatives. Addressing these issues is crucial to ensuring the long-term success and sustainability of the cooperatives.

The surveyed female agricultural cooperatives (Table 1) are geographically dispersed across various provinces, including the rural area of Al Haouz (53.8%, marked with an asterisk in Table 1 to indicate the highest proportion of surveyed cooperatives) and the more urbanized or semi-urban regions of Essaouira (20%), Rehamna (10.2%), El Kelâa des Sraghna (9.8%), Chichaoua (4%), and Marrakech (2.2%). Al Haouz plays a central role in this analysis due to its historical emphasis on livestock rearing and its rich agricultural potential. By accounting for the largest proportion of surveyed women's agricultural cooperatives, it reflects both a long-standing tradition of pastoral and semi-pastoral livelihoods and a capacity for sustaining diverse agricultural activities.

Livestock farming emerges as the primary activity, involving 32.4% of cooperatives in Al Haouz. This practice is deeply rooted in the cultural and traditional heritage of the region, which has been historically shaped by pastoral and semi-pastoral lifestyles. It serves not only as a key economic driver but also as an integral part of local identity. Studies such as highlight similar reliance on pastoral systems in other rural contexts, often under environmental challenges like droughts and overgrazing. Eeswaran et al. (2022) further emphasizes the critical role of livestock farming in food and nutritional security, despite challenges like feed scarcity and climate variability.

Following livestock farming, olive cultivation (13.3%) and beekeeping (14.7%) hold significant importance, contributing to economic growth through both domestic consumption and export markets. Multifunctional cooperatives, representing 21.3% of the total, demonstrate remarkable adaptability by diversifying into high-value activities, such as goat farming, poultry farming, tree cultivation, and milk marketing. These efforts ensure resilience in the face of changing

Table 1 Descriptive breakdown of the characteristics of the women's agricultural cooperatives surveyed

	Number	Percentage Valid	Percentage	Cumulative percentage
Sector	225	100.0	100.0	
AGRICULTURE (H.R.A.)	225	100.0	100.0	
Environment	225	100.0	100.0	
Rural	202	89.8*	89.8	89.8
Urban	23	10.2	10.2	10.2
Province	225	100,0	100,0	
Al Haouz	121	53.8*	53.8	53.8
Rehamna	23	10.2	10.2	64.0
Chichaoua	9	4.0	4.0	68.0
Essaouira	45	20.0	20.0	88.0
El Kelâa des Sraghna	22	9.8	9.8	97.8
Marrakech	5	2.2	2.2	100.0
Branch of activity	225	100.0	100.0	
LIVESTOCK	73	32.4*	32.4	32.4
MULTIFUNCTIONAL	48	21.3	21.3	53.8
OLEICULTURE (OLIVE TREES)	30	13.3	13.3	67.1
APICOLE	33	14.7	14.7	81.8
GOAT FARMING	18	8.0	8.0	89.8
TREE CULTIVATION	9	4.0	4.0	93.8
POULTRY	10	4.4	4.4	98.2
MILK COLLECTION & MARKETING	4	1.8	1.8	100.0

Source: Field survey * : Highest percentage observed within the respective category

market demands and economic conditions. As suggest, diversification strategies, such as introducing more productive breeds and integrating crop-livestock systems, enhance rural economies. Similarly, Eeswaran et al. (2022) underlines the importance of mixed farming systems, which increase resilience by combining crops and livestock.

Together, these activities create a dynamic agricultural network that strengthens the socio-economic fabric of rural communities. While livestock farming remains central, the diversification into multifunctional and high-value products reflects evolving strategies to meet market demands. Women's participation, a critical yet underexplored factor in other studies, plays a pivotal role in fostering resilience, innovation, and sustainability within Al Haouz cooperatives. This integration of tradition and adaptability underscores their role as essential drivers of rural economic development.

The socio-economic characteristics of female cooperative members and their households, as summarized in Table 2, reveal several important trends. Most members are in their prime working years, with an average age of 42.36 years. Married women constitute the largest group (46.7%), followed by single women (23.6%). Their participation, often tied to task-based or productivity-based compensation systems, plays a vital role in cooperative activities. As observed by Lecoutere [42], cooperatives provide an essential platform for married women to exercise agency in economic decision-making while managing familial responsibilities.

Despite low levels of formal education, these women demonstrate a strong commitment to improving their economic circumstances. Limited access to higher education has not prevented them from leveraging cooperative membership to enhance financial independence and skill development. This reflects the transformative potential of cooperatives in empowering women, even in the face of educational barriers.

Household characteristics reveal a significant reliance on agricultural incomes, with cooperative earnings playing a pivotal role in supporting rural livelihoods. Cooperatives foster economic resilience and provide women with pathways

Table 2 Socio-economic characteristics of women cooperative members

	N	Percentage	Valid percentage	Average
Marital status		99.6	100.0	2.17
Single	53	23.6	23.7	
Married	105	46.7	46.9	
Divorced	42	18.7	18.8	
Widowed	24	10.7	10.7	
Sponsor's mission	225	100.0	100.0	3.24
President	45	20.0	20.0	
Treasurer	7	3.1	3.1	
Vice-president	23	10.2	10.2	
Member	150	66.7	66.7	
Education level	225	100.0	100.0	1.94
No	30	13.3	13.3	
Primary	63	28.0	28.0	
Qualifying secondary	57	25.3	25.3	
Secondary college	43	19.1	19.1	
University	29	12.9	12.9	
Vocational training	3	1.3	1.3	
Spouse's activity	95	42,2	100,0	4.01
Farmer	26	11,6	27.4	
Retailer	2	0.9	2.1	
Civil servant	6	2.7	6.3	
Retired	8	3.6	8.4	
Employee/Worker	30	13.3	31.6	
No	10	4.4	10.5	
Informal work	13	5.8	13.7	
Number of members at inception				11.42
Household size				4.31
Age				42.36

Source: Field survey

to financial inclusion and decision-making power, as highlighted by Bageant et al. [9]. However, limited income diversification poses sustainability challenges. Expanding market access and promoting value-added production are critical, as shown by Jones et al. (2023), who emphasize the importance of modern value chains in rural development. Such strategies are essential to reducing reliance on single income sources and enhancing long-term rural resilience.

The dual role of married women in managing both domestic responsibilities and cooperative participation is integral to fostering economic autonomy. Their ability to balance these roles reflects their resilience and adaptability. However, the limited formal education of many members underscores the need for targeted training and capacity-building programs to fully realize the benefits of cooperative membership.

4.3 Analysis of the global empowerment index (GEI)

4.3.1 Branch of activity and empowerment

The findings in Table 3 reveal significant differences in empowerment levels across cooperative activities within the context of rural Morocco, particularly in the Marrakech-Safi region. Women involved in tree cultivation, such as olive and fruit trees, exhibit the highest empowerment index (4.3403). This reflects the economic and social significance of these high-value crops in the region, where advanced agricultural practices and sustained dedication are required. These activities foster economic decision-making by providing stable financial returns and opportunities to reinvest in household needs. Additionally, they enhance household autonomy as women play active roles in managing resources

Table 3 Summary of global empowerment index (GEI) analysis results

	Index	F
Branch of activity		
LIVESTOCK	3.5077	8.74***
MULTIFUNCTIONAL	3.6042	
OLIVE (OLIVE TREES)	3.8256	
BEEKEEPING	3.8807	
GOAT FARMING	4.0412	
TREE CULTIVATION	4.3403	
POULTRY	3.7788	
MILK COLLECTION & MARKETING	3.8750	
Province		
El Haouz	3.6388	4.39***
Rehamna	3.9100	
Chichaoua	3.8750	
Essaouira	3.6835	
El Kelâa des Sraghna	3.8267	
Marrakech	4.3875	
Total	3.7199	
Area		
Rural	3.6958	5.48***
Urban	3.9321	
Total	3.7199	
Educational level		
None	3.1792	30.42***
Primary	3.4950	
Qualifying secondary	3.9090	
College secondary	3.9375	
University	4.0671	
Vocational training	3.7833	
Total	3.7199	

Source: Field survey *** : indicates statistical significance

and budgets. The communal nature of tree cultivation further strengthens community participation, with women often assuming leadership roles in coordinating collective efforts and accessing regional markets. These contributions align with the region's agricultural strategy, which prioritize value-added products for both local and export markets.

In contrast, women engaged in livestock farming report the lowest empowerment index (3.5077). This activity, while deeply rooted in the cultural heritage of areas like Al Haouz, presents significant challenges. Its labor-intensive and physically demanding nature, coupled with low financial returns, limits progress in economic decision-making and personal autonomy. Furthermore, restricted access to veterinary support, markets, and productivity-enhancing technologies hinders freedom of mobility, as women are often confined to managing daily farm tasks. These barriers highlight the vulnerability of livestock-based cooperatives in a context where economic diversification and market-oriented approaches are increasingly critical.

4.3.2 Province and empowerment

Table 3 also highlights variations in empowerment levels across the Marrakech-Safi region demonstrating a profound urban–rural divide, shaped by disparities in infrastructure, cultural norms, and access to opportunities. In Marrakech, with an empowerment index of 4.38, urban women benefit from structured environments that integrate them into educational, economic, and social systems. These settings amplify their decision-making autonomy and position them as active contributors to community development, while also fostering economic independence through greater access to resources and markets.

In rural areas like Al Haouz, where the empowerment index stands at 3.63, women face more complex and systemic challenges. Limited infrastructure and deeply ingrained cultural norms restrict their mobility and opportunities for economic agency, confining their potential within traditional roles. Yet, these barriers are not immutable. The growing penetration of digital tools offers rural women alternative paths to empowerment, enabling access to virtual markets, financial education, and peer networks. These opportunities can disrupt existing constraints, gradually shifting rural women's roles and aspirations.

To reduce these disparities, policymakers should adopt an integrated approach. Beyond expanding digital infrastructure, efforts should focus on creating localized hubs for cooperative activities, where women can learn, collaborate, and innovate. Strengthening inter-regional connections can also bridge the urban–rural divide, allowing the exchange of knowledge and resources that empower women across diverse contexts. By fostering these synergies, the region can create a more inclusive and transformative empowerment framework.

4.3.3 Rural vs. urban settings

The analysis in Table 3 reveals that women in urban areas achieve higher empowerment levels (3.93) compared to their rural counterparts (3.69). This disparity highlights the significant impact of the environment on women's empowerment. Urban settings provide better access to resources, formal employment, and social networks, which collectively enhance women's financial independence and confidence.

In contrast, rural areas face systemic challenges, including poor infrastructure, limited educational opportunities, and restrictive cultural norms that constrain women's empowerment. For instance, in regions like Al Haouz, societal expectations may limit women's ability to work in mixed-gender environments or travel independently. However, the growing availability of smartphones and internet access is gradually reshaping these norms, offering rural women new pathways to explore economic opportunities and strengthen their financial and social standing.

4.3.4 Education level and empowerment

Education emerges as a fundamental driver of women's empowerment, as evidenced in Table 3, where women with university degrees achieve the highest empowerment index (4.06). This highlights education's transformative potential, equipping women to navigate socio-economic challenges, advocate for their rights, and participate actively in decision-making processes. The significant gap between educated and uneducated women underscores the need for policies prioritizing quality education for girls and women in underserved areas. Such policies should ensure that education is not only accessible but also empowering, with gender-sensitive curricula emphasizing leadership, entrepreneurship, and critical thinking to expand women's opportunities.

Mentorship programs connecting young women with role models can further inspire and prepare them for leadership roles, fostering a generation of empowered women ready to drive societal change. The analysis in Table 3 also reveals that women's empowerment is influenced by cooperative activities, geographic context, and educational background. To maximize empowerment outcomes, targeted interventions should integrate technology in rural cooperatives, enhance access to education, and create inclusive environments that enable women to thrive as leaders in their communities.

4.4 Representation of the multilevel model

4.4.1 Empty model

The analysis in Table 4 of intergroup and intragroup variances in empowerment aligns with findings in Goldman et al. (1977), which emphasize the interplay between these dynamics in shaping group outcomes. The significant variance between cooperatives (23.17) suggests that inter-cooperative factors, such as organizational governance, resource allocation, and external market access, heavily influence empowerment. Goldman et al. highlighted that intergroup cooperation fosters higher performance by prioritizing collective goals, a dynamic that seems applicable here, where cooperatives that collaborate effectively outperform those functioning in isolation.

The variance between cooperatives, measured at 23.17, indicates substantial differences in empowerment levels across different cooperatives. This suggests that structural and contextual factors, such as governance practices, resource availability, policies, and organizational culture, play a critical role. Cooperatives that foster inclusive decision-making, implement innovative strategies, and establish effective marketing channels exhibit higher levels of empowerment. These findings highlight that not all cooperatives are equally effective in providing opportunities and support for their members.

Within individual cooperatives, the variance in empowerment levels is measured at 39.90, highlighting the importance of personal factors such as education, experience, and active engagement in cooperative activities. While the cooperative environment sets the stage, these individual attributes significantly shape the extent to which women feel empowered. This underscores the need to address not only institutional factors but also the personal and situational needs of members to ensure more equitable empowerment outcomes.

The variance breakdown reveals that 37% of the total variance in empowerment stems from differences between cooperatives. And 63% of the variance is attributed to differences within cooperatives.

This indicates that individual-level factors have a more pronounced influence on empowerment than cooperative-wide factors. While structural improvements at the cooperative level are important, the findings emphasize the need for tailored interventions addressing the personal circumstances and characteristics of the members themselves.

The analysis (Table 4) highlights the multifaceted nature of empowerment within cooperatives, shaped by both organizational and individual factors. A comprehensive approach that balances structural improvements with personalized interventions is essential to foster meaningful empowerment. By addressing these dual dimensions, cooperatives can better support women in achieving greater autonomy and socio-economic inclusion.

4.4.2 The complete multi-level model

Table 5 shows the estimation results for the full model *.

Table 4 Empty model (no exogenous variables)

Fixed effects	
Constant	3.72*** (0.041)
Random effects	
Level 2: intercooperative variance	23.17 (0.039)
Level 1: intra-cooperative variance	39.90 (0.021)
Percentage variance intercooperatives	37%
Percentage of intra-cooperative variance	63%

***: significant at 1% level. Source: Field survey

Table 5 Complete multi-level model

	Empty_model	Model 1	Model 2
VARIABLES			
Age of members		– 0.00963***	– 0.00869***
		(0.00253)	(0.00245)
maried		– 0.21756***	– 0.22139***
		(0.04361)	(0.04309)
Secondary		0.32383***	0.34931***
		(0.05459)	(0.05224)
membre		– 0.07008	– 0.07059
		(0.04816)	(0.04721)
particip_expos		– 0.03929	– 0.10034
		(0.07874)	(0.07385)
particip_training		– 0.04233	– 0.08647
		(0.07265)	(0.06303)
particip_assembly		0.25447***	0.20163**
		(0.09789)	(0.09132)
Nb_adh			0.00189
			(0.00377)
rural			– 0.05992
			(0.09718)
Livestock			– 0.50731***
			(0.09618)
Valorisation			– 0.39603***
			(0.10796)
Olive trees			– 0.19145*
			(0.11277)
apicultural			– 0.10390
			(0.09691)
Haouz			– 0.10020
			(0.07430)
Essaouira			– 0.04737
			(0.09632)
Constant	3.71976***	4.00879***	4.47437***
	(0.04198)	(0.16721)	(0.19138)
Observations	225	223	223
Number of groups	52	51	51

Standard errors in parentheses Source: Field survey

***p < 0.01, **p < 0.05, *p < 0.

5 Discussion and key findings

The analysis in Table 5 provides a deeper understanding of the factors that influence women's empowerment in cooperative settings. This discussion highlights four key areas for action: promoting inclusive governance, strengthening local training and infrastructure, challenging socio-cultural norms and bridging rural–urban disparities.

5.1 Promoting inclusive governance

One of the most important findings from the analysis is the positive impact of women's participation in general assemblies on empowerment, with coefficients of 0.25447*** in Model 1 and 0.20163** in Model 2. This highlights

the critical role of inclusive governance in enhancing women's confidence and agency, as supported by Anderson et al. [7] and Jemaneh and Shibeshi [33]. Assemblies promote ownership and accountability, reinforcing individual empowerment and cooperative cohesion. Unlike Bageant et al. [9], who emphasizes formal leadership training, this study underscores the unique value of assemblies as informal platforms for developing decision-making skills through active engagement.

The results further suggest that assemblies contribute to cultural transformation by normalizing women's participation in governance, complementing Jemaneh and Shibeshi's [33] observations on their role in overcoming socio-cultural barriers. Similarly, Lecoutere [42] demonstrated how participatory governance strengthens women's influence in collective decisions, reinforcing the importance of inclusive structures in fostering empowerment.

Despite these benefits, structural barriers such as limited education, restricted mobility, and entrenched societal norms continue to hinder women's participation, particularly in rural areas like Al Haouz. As noted by Agarwala [3], addressing these challenges through targeted interventions is crucial to enabling marginalized women to fully benefit from governance opportunities and maximize the empowering potential of assemblies.

5.2 Strengthening local training and infrastructure

Capacity building and infrastructure development are critical for enhancing the productivity and market competitiveness of cooperatives. Tailored training programs and investments in infrastructure, such as processing facilities, storage units, and digital tools, significantly contribute to cooperative performance. However, the analysis reveals the limitations of current training initiatives, evidenced by negative coefficients for participation in exhibitions and training programs (− 0.03929 and − 0.04233 in Model 1). These findings point to a misalignment between the content of these programs and the practical needs of cooperative members, particularly rural women.

This misalignment echoes Jemaneh and Shibeshi's [33] findings that generic training fails to address real-world challenges faced by women in agriculture. Similarly, Anderson et al. [7] highlight the necessity of integrating digital tools to enhance connectivity and market access, supporting this study's emphasis on technology as a driver of productivity. Additionally, the role of storage infrastructure in reducing post-harvest losses and stabilizing incomes aligns with observations by Bageant et al. [9] on the importance of targeted investments for cooperative sustainability.

5.3 Challenging socio-cultural norms

The analysis (Table 5) reveals the detrimental effects of socio-cultural norms on women's empowerment, particularly for older women and those with household responsibilities. Age and marital status significantly hinder empowerment, with coefficients of − 0.00963*** and − 0.00869*** for age, and − 0.21756*** and − 0.22139*** for marital status in Models 1 and 2, respectively. These findings reflect generational gaps in education, skills, and adaptability, alongside the burden of household duties, which align with Jemaneh and Shibeshi [33] and Bageant et al. [9]. Such constraints limit women's ability to actively participate in cooperative activities and decision-making.

Societal expectations linked to age and marital status exacerbate these challenges, restricting women's agency and participation in community roles, as also noted by Ibourk and Raoui [31]. Sectoral differences in empowerment further underscore these disparities. Women engaged in tree cultivation exhibit higher empowerment levels due to the financial stability and leadership roles these activities provide, as highlighted by Majurin [43]. Conversely, livestock farming reinforces traditional roles and limits empowerment, reflecting challenges documented by Meinzen-Dick et al. [45] in labor-intensive sectors.

5.4 Bridging rural–urban disparities

The findings reveal significant disparities in empowerment between rural and urban women. Although the coefficient for rural living (− 0.05992) is not statistically significant, rural contexts indirectly constrain empowerment by limiting access to education, training, and markets. Urban women, in contrast, benefit from better infrastructure and progressive norms that enhance mobility and decision-making autonomy.

These disparities align with Jemaneh and Shibeshi [33], who highlighted the structural advantages of urban settings in fostering women's agency. Our study further connects these differences to cooperative engagement, illustrating how rural women's limited access to markets and financial tools hampers their economic contributions. Bekkar et al. [12]

similarly emphasize the transformative role of digital tools in urban areas, while their limited availability in rural contexts exacerbates economic inequalities.

Additionally, rural women face compounded challenges from traditional roles that constrain their decision-making capacities within cooperatives, echoing the findings of Fajardo-Gonzalez (2021). our study highlights how cooperatives can contribute to reducing rural–urban disparities through localized, resource-oriented solutions.

6 Conclusion and recommendation

This study highlights the potential role of female agricultural cooperatives in Morocco, particularly within the Marrakech-Safi region, to advance women's empowerment across five dimensions: personal decision-making, economic decision-making, household decision-making, freedom of mobility, and community participation. These cooperatives have shown their capacity to enhance women's autonomy, leadership, and access to resources. However, systemic barriers such as socio-cultural norms, inadequate agricultural infrastructure, unequal rural–urban opportunities, and pervasive social and infrastructural disparities continue to limit their impact and broader inclusivity.

Reducing these disparities requires a multi-faceted approach centered on empowering women and addressing both structural and social inequalities. Empowerment must begin with comprehensive training programs focusing on personal development. Building women's confidence, leadership skills, and financial literacy provides a strong foundation for their participation in cooperative activities. This should be followed by targeted agricultural training programs that enhance technical expertise in areas such as irrigation management, crop diversification, pest control, and post-harvest technologies. Locally delivered and practical, these programs address the specific challenges faced by women in remote areas. Mentorship programs can further support this empowerment by pairing women with experienced mentors who provide guidance, share expertise, and foster leadership confidence.

Addressing infrastructural disparities is equally vital. Many rural regions lack adequate storage facilities, cold chains, and processing units, resulting in significant post-harvest losses and limited product quality. Investments in these infrastructures can improve cooperative productivity and market competitiveness. Similarly, transportation networks in rural areas are often underdeveloped, isolating cooperatives from larger markets. Efficient and accessible transportation systems are essential for connecting rural cooperatives to competitive markets and reducing logistical challenges. Policymakers must prioritize bridging these infrastructural gaps to enable equitable access to resources and opportunities.

Digital integration has the potential to help address infrastructural disparities. Expanding digital infrastructure in rural areas provides women with online training opportunities in modern agricultural practices, financial management, and governance. Digital tools and e-commerce platforms enable direct market access, reducing reliance on intermediaries and allowing women to capture higher profits. This integration also fosters connectivity, helping to bridge the urban–rural divide and ensuring that women in rural cooperatives benefit from broader economic networks.

Creating localized hubs for cooperative activities can further address infrastructural and regional disparities. These hubs would provide spaces where women collaborate, innovate, and access shared resources, fostering community building and reducing isolation. Strengthening inter-regional connections through these hubs can facilitate the exchange of knowledge, resources, and best practices, promoting inclusivity and shared growth.

Eco-friendly agricultural models offer additional opportunities to empower women while addressing both social and infrastructural inequalities. Activities such as organic farming, permaculture, and cultivating high-value crops like olive trees and medicinal herbs align with Morocco's environmental and cultural heritage. These sustainable practices diversify income streams and provide cooperatives with a competitive edge while fostering long-term resilience.

Access to microcredit tailored to agricultural needs remains another key strategy for addressing infrastructural disparities. Financing can help women establish or expand cooperatives, invest in modern farming equipment, and develop value-added activities such as food processing and artisanal production. Policymakers should support these efforts by fostering market linkages, organizing regional and national exhibitions, and creating solidarity-based markets to improve cooperative visibility and reduce economic and social exclusions.

Addressing socio-cultural barriers is important for advancing equitable empowerment. Advocacy campaigns targeting rural communities can challenge traditional norms that limit women's participation in agriculture and decision-making processes. Establishing community-based childcare facilities can alleviate domestic responsibilities, enabling women to engage more fully in cooperative activities and professional development. Inclusive governance structures within cooperatives can further ensure that all members, regardless of their socio-economic or infrastructural contexts, have an equal voice in decision-making processes.

While this study focuses on the Marrakech-Safi region, it acknowledges certain limitations. Cultural norms played a significant role in the reluctance of some respondents to answer sensitive questions, particularly those related to household decision-making and financial autonomy. This reflects entrenched societal barriers that hinder women's openness and empowerment, potentially underestimating the challenges they face. Furthermore, the use of convenience and purposive sampling was essential to navigate logistical constraints and cultural sensitivities. However, future studies could benefit from alternative sampling methods, such as stratified or systematic sampling, to enhance data collection strategies and minimize potential biases associated with non-random selection.

Moreover, the study's geographic scope limits the generalizability of its findings to other Moroccan regions and global contexts. However, the methodological framework, particularly the use of the Global Empowerment Index (GEI), provides a robust tool adaptable to diverse socio-cultural and economic settings. Future research should extend to other Moroccan regions and internationally, capturing varied agricultural systems and cultural dynamics. Longitudinal studies are also essential to evaluate the sustained impacts of cooperative participation and to address the structural and cultural barriers identified here.

By addressing these challenges through targeted policies and localized interventions, this study underscores the transformative potential of female agricultural cooperatives to drive sustainable rural development.

These cooperatives can contribute to women's empowerment and strengthen the socio-economic fabric of their communities, offering insights that may be relevant to other contexts.

Author contributions S.H. conceptualized the study, collected the data, and drafted the manuscript. A.I. performed the statistical analysis, supervised the research, and revised the manuscript. All authors reviewed and approved the final version of the manuscript.

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Data availability The data supporting the findings of this study were collected through structured surveys with members of female agricultural cooperatives in Morocco's Marrakech-Safi region. These data are not publicly available due to confidentiality agreements but can be obtained from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate This study was performed in accordance with the ethical standards of the Department of Economics, Laboratory of Social and Solidarity Economy, Governance and Development, Cadi Ayyad University. The study, its questionnaire, and methodology were approved by the Ethics Committee of the Department of Economics at Cadi Ayyad University on January 20, 2023. Informed consent was obtained from all individual participants included in the study. Each participant was fully informed about the purpose, procedures, and potential impacts of the research, and their participation was voluntary.

Consent for publication Anonymized findings derived from the study was also obtained from all participants. No personally identifiable information was included in the manuscript.

Competing interests The authors declare no competing interests.

Transparency The author states that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

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References

1. Ahrouch S. Les coopératives au Maroc : Enjeux et évolutions. Revue internationale de l'économie sociale : Recma, n° 322, pp. 23–26. [Online]. 2011. https://www.erudit.org/en/journals/recma/2011-n322-recma01019/1020728ar/
2. Agarwal B. "Bargaining" and gender relations: within and beyond the household. Fem Econ. 1997;3(1):1–51.
3. Agarwala R. Informal labor, formal politics, and dignified discontent in India. Cambridge University Press; 2013.
4. Ibourk A, ElAynaoui K. Agricultural cooperatives' sustainability and the relevance of start-up support programs: evidence from cooperatives' level in Morocco. Sustainability. 2023. https://doi.org/10.3390/su15043460.
5. Alkire S, Meinzen-Dick R, Peterman A, Quisumbing A, Seymour G, Vaz A. Women's empowerment in agriculture index. World Dev. 2013;52:71–91. https://doi.org/10.1016/j.worlddev.2013.06.007.
6. Anand P, Hunter G, Carter I, Dowding K, Guala F, Van Hees M. The development of capability indicators. J Hum Dev Capabilities. 2009. https://doi.org/10.1080/14649880802675366.
7. Anderson CL, Reynolds TW, Biscaye P, Patwardhan V, Schmidt C. Economic benefits of empowering women in agriculture: assumptions and evidence. J Dev Stud. 2021;57(2):193–208. https://doi.org/10.1080/00220388.2020.1769071.
8. Assaad RA, Nazier H, Ramadan R. Individual and households' determinants of women empowerment: Application to the case of Egypt. Social Science Research Network. [Online]. 2014. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3058289
9. Bageant E, Lentz E, Narayanan S, Jensen N, Lepariyo W. How do women's empowerment metrics measure up? A comparative analysis. Food Policy. 2024;129: 102764. https://doi.org/10.1016/j.foodpol.2024.102764.
10. Batliwala S. Defining women's empowerment framework, education for women's empowerment, prise de position de l'ASPBAE lors de la quatrième conférence mondiale sur les femmes de Beijing, septembre 1995. Asia-South Pacific Bureau of Adult Education, New Delhi. [Online]. 1995. https://www.unwomen.org/fr/how-we-work/intergovernmental-support/world-conferences-on-women
11. de Beauvoir S. Le Deuxième Sexe. Paris: Gallimard; 1949.
12. Bekkar Y, Lahrech T, Makhlouki B, Bounadi I, Harbouze R, Maatala N, Burte J. Overcoming barriers to youth economic inclusion in rural Morocco: A case study of Daït Aoua. Sustainability. [Online]. 2024. https://www.researchgate.net/publication/387468007_Overcoming_Barriers_to_Youth_Economic_Inclusion_in_Rural_Morocco_A_Case_Study_of_Dait_Aoua
13. Birchall J. Resilience of the cooperative business model in times of crisis. Geneva: International Labour Organization, Sustainable Enterprise Programme; 2009.
14. Bolin A. (Ed.). Women's empowerment through collective action: How Forest and farm producer organizations can make a difference. International Institute for Environment and Development & Food and Agriculture Organization of the United Nations. 2020.
15. Dohmwirth C, Liu Z. Does cooperative membership matter for women's empowerment? Evidence from South Indian dairy producers. J Dev Effect. 2020;12(2):133–50. https://doi.org/10.1080/19439342.2020.1758749.
16. Dohrn S, Pandolfelli L, Meinzen-Dick R. Gender and collective action: motivations, effectiveness, and impact. J Int Dev. 2008;20(1):1–11. https://doi.org/10.1002/jid.1424.
17. Didi K, Attouch H. Dynamique coopérative au Maroc et nouveau modèle de développement. 2022. IJFAEMA. https://doi.org/10.5281/zenodo.6841208.
18. Di Tommaso , M.L. (2007) Children capailities : a structural equation model or india . The Journal Socio-Economics ,36. pp. 436-450.
19. Eeswaran R, Nejadhashemi AP, Ciampitti IA. Current and future challenges and opportunities for livestock farming in West Africa: Perspectives from the Case of Senegal. Agronomy 2022, 12,1818
20. Erguibi H, Sadik A. L'implication organisationnelle et la participation active comme facteurs déterminants de l'autonomisation des femmes : Le cas du secteur coopératif de la région Guelmim Oued-Noun. 2022. https://www.revuefreg.fr/index.php/home/article/view/700
21. Arthur-Holmes F, Mengba JD. Conceptualizing collective action and informal women cooperatives in Africa's artisanal and small-scale mining sector: The case of Northern Ghana, The Extractive Industries and Society. 2024. [Online]. www.elsevier.com/locate/exis
22. Ferguson H, Kepe T. Agricultural cooperatives and social empowerment of women: a Ugandan case study. Dev Pract. 2011;21(3):421–9. https://doi.org/10.2307/23048605.
23. Gillot G. Les coopératives, une bonne mauvaise solution à la vulnérabilité des femmes au Maroc ? Espace populations sociétés. [Online]. 2016. https://journals.openedition.org/eps/6619
24. Goldman M, Stockbauer JW, McAuliffe TG. Intergroup competition and cooperation. J. Exp. Soc. Psychol. 1977;13(1):81–8.
25. Goldstein S. Understanding and managing children's classroom behavior. John Wiley & Sons. 1995.
26. Haut-Commissariat au Plan. Recensement général de la population et de l'habitat. Direction de la statistique, Rabat, Maroc. [Online]. 2014. https://rgph2014.hcp.ma/downloads/Resultats-RGPH-2014_t18649.html
27. Haut-Commissariat au Plan. Activité, emploi et chômage : Résultats annuels 2021. Direction de la statistique, Rabat, Maroc. 2021. [Online]. https://www.hcp.ma/file/233290/
28. Hossain M, Sultana A, Mazumder MAJ. Mechanisms and drivers of rural household income diversification in developing countries. J Rural Stud. 2016;43:112–22. https://doi.org/10.1016/j.jrurstud.2015.11.004.
29. Ibourk A, Taha SE. Les déterminants de la qualité dans l'éducation de la petite enfance. Critique économique, n° 36, été automne. [Online]. 2017. https://www.revuefreg.fr/index.php/home/article/download/1190/987/3840
30. Ibourk A, Taha SE. Key factors of cognitive performance in Moroccan preschool: Evidence from random slope model. Int Bus Res. 2018. https://doi.org/10.5539/ibr.v11n11p92.
31. Ibourk A, Raoui S. Impact of cooperative entrepreneurship on territorial human development in Morocco—spatial analysis. Int J Soc Econ. 2022;49(6):914–29. https://doi.org/10.1108/IJSE-03-2021-0145.
32. International Co-operative Alliance. Guidance notes to the co-operative principles. Brussels: International Co-operative Alliance; 2015. p. 2.
33. Jemaneh G, Shibeshi D. Women empowerment in agriculture and its effect on household food security: evidence from Gamo Zone of Southern Ethiopia. Agric Food Secur. 2023. https://doi.org/10.1186/s40066-023-00437.
34. Jones D, Kalmi P. Membership and Performance in Finnsh Financial Cooperatives. Rev. Soc. Econ. 2015;73(3):283–309

35. Jones, Derek C. Institutional design and cooperative success: the case of producer cooperatives (May 7,2023). Available at SSRN
36. Kabeer N, Cornwall A, Eyben R. Conceptualising empowerment and the implications for pro-poor growth: a paper for the DAC poverty network. 2024. [Posted on 2024–08–05].
37. Kabeer N. Resources, agency, achievements: reflections on the measurement of women's empowerment. Dev Chang. 1999;30(3):435–64.
38. Kabeer N. Gender equality and women's empowerment: a critical analysis of the third Millennium Development Goal. Gend Dev. 2005;13(1):13–24.
39. Kolovich L, Ndoye A. Morocco's Quest for Stronger and Inclusive Growth. Policy Center for the New South. 2023.
40. Krejcie RV, Morgan DW. Determining sample size for research activities. Edu. Psychol. Measurement 1970;30(3):607–610.
41. Laszlo S, Grantham K, Oskay E, Zhang T. Grappling with the challenges of measuring women's economic empowerment in intrahousehold settings. World Dev. 2020;132:104959.
42. Lecoutere E. The impact of agricultural co-operatives on women's empowerment: Evidence from Uganda. J Co-operative Org Manag. 2017;5(1):14–27. https://doi.org/10.1016/j.jcom.2017.03.001.
43. Majurin E. How women fare in east African co-operatives: the case of Kenya, Tanzania, and Uganda. Dar es Salaam: International Labour Office, ILO; 2012.
44. Masabo CMV. Women's empowerment through cooperatives: a study from women's perspectives (master's thesis, MSc Business Language and Culture - Business and Development Studies). Supervisor: Peter Wad. [Number of pages: 74]. [Number of STU: 167855]. 29.05.2015. 2015.
45. Meinzen-Dick R, Johnson N, Quisumbing A, Njuki J, Behrman J, Rubin D. Women's empowerment in agriculture: Lessons from qualitative research. IFPRI Discussion Paper (No. 1797), 2019, 1–64.
46. Meador JE, O'Brien D. Placing Rwanda's agriculture boom: trust, women empowerment and policy impact in maize agricultural cooperatives. Food Security. 2019;11(4):428. https://doi.org/10.1007/s12571-019-00944-9.
47. Mosedale S. Assessing women's empowerment: towards a conceptual framework. J Int Dev. 2005;17(2):243–57. https://doi.org/10.1002/jid.1212.
48. Mayoux L. Women's empowerment through sustainable micro-finance: Rethinking 'best practice'. Discussion Paper, Aga Khan Foundation Canada. 2005.
49. Ministry of the Interior, General Directorate of Territorial Collectivities, General Monograph of the Marrakech-Safi Region. Rabat, Morocco: Ministry of the Interior, 2015.
50. Miriti P, Otieno DJ, Chimoita E, Bikketi E, Njuguna E, Ojiewo CO. Gender gaps in sorghum productivity: evidence from male- and female-managed plots in Uganda. Dev Pract. 2022;33(4):375–86. https://doi.org/10.1080/09614524.2022.2069228.
51. Narayan D. Empowerment and Poverty Reduction: A Sourcebook. Washington DC: World Bank. 2002.
52. Nippierd A-B. Gender issues in cooperatives. International Labour Organization, Cooperatives Unit. Geneva: ILO. 2012.
53. Nussbaum M. Human rights and human capabilities. Harv Hum. 2007.
54. Nussbaum Approach to Welfare. Social Indicators Res, 74(1), 9 55. 2000
55. Office du Développement et de Coopération (2018), Annuaire Statistique. Rafiq. M, (2021), Income generating activities: what impact on women's poverty in morocco?
56. Office du Développement et de Coopération. Annuaire Statistique. 2021.
57. Onditi, F., & Odera, J. (2016). Gender equality as a means to women empowerment? Consensus, challenges and prospects for post-2015 development agenda in Africa. Afr Geogr Rev.
58. Patton MQ. qualitative research and evaluation methods. Thousand Oaks, CA: Sage Publications; 2002.
59. Pereira LD, Santos N, Henrÿ H, Benmokhtar A, Azenfar A. Morocco: investing in collective action: opportunities in agrifood cooperatives. Rome: Food and Agriculture Organization of the United Nations (FAO); 2018.
60. Pigg KE. Three Faces of Empowerment: expanding the theory of empowerment in community development. J. Commun. Develop. Soc. 2002;33(1):107–123.
61. Sacchetti S, Tortia EC. The Internal and external gouvernance of cooperatives: Membership and consistency of values. Euricse Working (2013) (Paper N°61/31)
62. Selhausen FM. What determines women's participation in collective action? Evidence from a Western Ugandan Coffee Cooperative. 2016.
63. Sen A. Well-being, agency and freedom: The Dewey lectures 1984. J Philosop. 1985
64. Sen A. Development as freedom. Oxford: Oxford University Press; 1999.
65. Silberschmidt M. Disempowerment of men in rural and urban East Africa: implications for male identity and sexual behavior. World Dev. 2001;29(4):657–71.
66. United Nations General Assembly. Cooperatives in social development: report of the secretary-general. United Nations. A/64/132. 2009.
67. Tribak W, Rguig S. Women's rural cooperatives in morocco: challenges and collapses. IJIGS. 2021;2(1):85.
68. Wu Y, Tham J. The impact of environmental regulation, Environment, Social and Government Performance, and technological innovation on enterprise resilience under a green recovery. Heliyon. 2023;9(10): e20278. https://doi.org/10.1016/j.heliyon.2023.e20278.
69. Zeidan D, Benhaddou A. Cooperative approaches to rural women's economic empowerment in Morocco. Women's Stud Int Forum. 2013;40:22–30. https://doi.org/10.1016/j.wsif.2013.04.005.
70. Zereyesus YA. The effect of women's empowerment in agriculture on household nutrition and food poverty in Northern Ghana. Soc Indic Res. 2018;138(1):89–108. https://doi.org/10.1007/s11205-017-1656-3.

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