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Access to Livelihood Capital and Food Security Status as Correlates to Empowerment Among Women on Irrigation Schemes in North-West Province, South Africa

Abstract. This paper examines the empowerment, access to livelihood capital, and food security status among women in irrigation Schemes in North-West Province, South Africa. A simple random sampling technique was used to select 84 women farmers. Data was obtained with a female empowerment agricultural index questionnaire and analyzed with frequency distribution, percentages, mean and standard deviation, and Chi-Square. The results on the indices of empowerment show that women are disempowered in the use of income and access to productive capital and credit, but are empowered in leadership and decision-making. The Chi-square analysis reveals that significant relationships exist between levels of empowerment, livelihood capital, and food security. The paper concludes that there is a need to modify intervention programs if empowerment is to be attained.

Keywords: livelihood, empowerment, food security, women, irrigation farming

JEL Classification: R2, Q160, Q12, Q15

Introduction

Livelihood analysis over the past three decades has been based on the pioneering classical work in the theory of entitlement which refers to the set of income and resource bundles over which households can establish control and secure livelihoods (Sen, 1981; Chamber and Conway, 1982). Natarajan et al. (2022) affirmed that a sustainable livelihood framework should include a dynamic, disaggregated structure that is ecologically coherent. The sustainable livelihood framework is depicted as an analytical tool (Sen 1981, Chambers and Conway 1982, Witheret et al, 2023). Closely related to the foundational theories are the evolution of terms such as "livelihood security" and "livelihood crisis." Livelihood security covers five broad dimensions; economic security, food security, health security, educational security, and empowerment (Adjimoti and Kwadzo, 2018; Kassegn and Abdinasir, 2023). Geremew (2017) used indicators such as economic, food, nutrition, health, education, empowerment, water, and sanitation to assess livelihood security. Saha and Shradha (2023) used the inverse of the Herfindahl-Hirschman Index in measuring livelihood diversification .

While much research attention has been placed on livelihood security and its analysis, there has been a paucity of literature on the analytical framework of livelihood crisis. In this paper livelihood crisis is shown as the inability of a household's capabilities and assets (physical, financial, natural, social, and human capital) to ensure the means of living during stresses such as; climate volatility, terms of trade, land values, scarce capital, and increasing debt. It thus implies that increasing climate volatility, droughts, land values, debts as well as

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declining terms of trade and capital availability will lead to a livelihood crisis, thus making sustainable livelihood outcomes unattainable. Badewa and Dinbabo (2022), in establishing a link between food security and livelihoods concluded that the intervention principles are food security assessments and surveillance, food aid and alternatives to food aid, cash-based interventions, income-generating activities, and agricultural rehabilitation. Sharaunga et al. (2015) concluded that "empowerment in agriculture alone is not a panacea to reduce household vulnerability to food insecurity" p.195. The severity scale of food and livelihood insecurity describes the cause and effect of the livelihood crisis. The severity of food insecurity and mortality risks using a combination of factors such as mortality rate, malnutrition rates, migration pattern and rates, income and livelihood assets, coping strategies, food availability, diversity, accessibility, public health, caring practices, water stress, and availability – are pointers to the presence of livelihood crises (ACF 2010, Badewa and Dinbabo, 2022).

Livelihood crisis results from the failure of livelihood strategies to achieve sustainable livelihood outcomes. Ajadi et al. (2015) noted that rural households obtain access to productive resources by negotiating their livelihood. Gender differences in access and use of selected productive resources exist (Okonya and Kroschel, 2014).

Women comprise the majority of the agricultural workforce, producing the bulk of food consumed (Krishna, 2023); lacking skills (Christiaensen, 2020), and with low agricultural productivity (Christiaensen and Brooks, 2018). Women combine economic roles in farming with physiological roles of raising children (Pierotti et al., 2022). Women as farmers are vulnerable to gender discrimination in the control of productive assets (Botreau and Cohen, 2020) and with low farming knowledge and skills (Lalani et al., 2017). Mukwedeya and Mudhara (2023) stated that due to gender, ethnicity, and marginalization, technological progress in agriculture has bypassed millions of poor people. This gap hinders optimum productivity, creates insecure livelihoods, and reduces yields by 20-30 percent (FAO, 2011).

Reducing the gender asset gap has shown that women's ownership of assets increases their bargaining power and household decision-making (Yobe et al., 2019), and improves empowerment (FAO, 2011). Ahmed et al. (2023) presented the Women's Empowerment in Agriculture Index (WEAI) tool to determine roles and extent of women's engagement in agriculture. The tool analyses decisions on production, resources, income, leadership and time. It also measures women's empowerment relative to men within their households. Women's empowerment is crucial for reducing household vulnerability to food insecurity (IFAD, 2011), improved economic agency and physical capital empowerment (Sharaunga et al., 2015).

In South Africa, about four million people in rural areas engage in smallholder agriculture with over fifty percent of rural households being headed by women in conjunction with a high incidence of poverty (Maziya et al., 2020). In South Africa, irrigation as a major intervention was introduced to supplement the water supply for farming activities. The provision of an irrigation scheme will enhance the physical capital base of farmers and provide higher yield than rain-fed agriculture (Jaramillo et al., 2020). Farmers with irrigation are able to intensify production and change cropping patterns (Mkuna and Wale, 2023), which improved health, education, employment, accessibility, and education. Most smallholder irrigation schemes in South Africa were located to reduce the incidence of poverty, develop livelihoods and increase accessibility to markets, (Christian, 2019). South Africa as a dry country experiences recurring water shortages and producers often explore avenues to sustain crop production (Meza, 2021). North-West Province has an annual rainfall

of 300-700mm per annum. Thus, the use of irrigation schemes is a reliable means to ensure adequate soil moisture for crops through watering at the right frequencies, and time slots, which consequently improves food security. In South Africa, the history of irrigation development has been classified into peasant, mission diversion schemes, the independent homeland, and the Water Act eras (Cochet, 2015).

The different periods defined individual rights, management systems, and access to water resources for agricultural and other economic activities. Mkuna and Wale (2023) report that female farmers in irrigation experience low food security, are poor, and are marginalized. The interplay between access and ownership of livelihood assets determines levels of empowerment, which thus leads to a livelihood crisis – food security is predominantly dependent on these interactions. The International Fund for Agriculture Development (2015) defined empowerment as the various processes through which people, individually and collectively, access productive resources, and participate meaningfully in decision-making that affects their livelihoods. It then implies that empowerment concerns both accessing assets and using opportunities to participate in shaping collective choices. Botai (2016) indicated that women's economic empowerment is a pre-condition for sustainable development. Sharaunga et al. (2015) found that empowering women reduces their vulnerability to food insecurity. Botai (2016) advocated that women must have more equitable access to assets and services.

This study is specific to the concept of empowerment, food security, and livelihoods among women in irrigation schemes, as the livelihood assets and activities in irrigation farming are different from general agriculture. The main objective of the study is to explore the incidence of empowerment through access to livelihood capital and food security status among women on irrigation schemes in North-West Province, South Africa. Specifically, the study and described demographic characteristics determined the level of empowerment and ascertained access to livelihood capital and food security status of women in irrigation farming.

Methods

The study was conducted in the North-West Province covering smallholder irrigation farming in Taung, Nyetse, Molatedi, and Mayaeyane areas. The region is situated at 1.200m above sea level, with a mean annual rainfall below 500mm and temperature of 16-38 degrees Celsius. All the main and subsidiary irrigation schemes under the Taung irrigation scheme were covered. The characteristics of the irrigation schemes include 1100m –1300 m altitude, 0-9% slope, 318mm average annual rainfall, and mean temperature of 38.5^{o}C temperature, with a pivot system. Other irrigation schemes covered outside the Taung irrigation area are Molatedi Irrigation, Nyetse Project, and the Mayaeyane Project, which is located in the Ngaka Modiri Molema District Municipality.

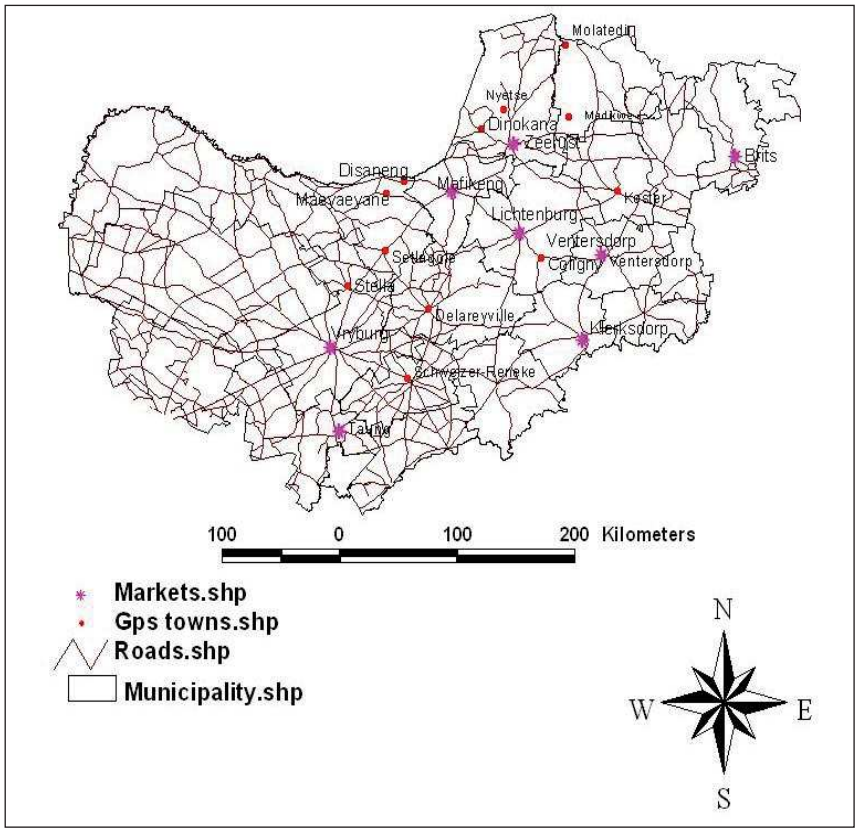

Fig. 1. Map of North-West Province showing irrigation schemes

Source: Palamuleni, et al. (2013).

The research design of the study was descriptive and quantitative with a total population of 120 women identified during the field observation. Raosoft sample size calculator, with a confidence interval of 95% and 5% error, was used to calculate a sample size of 84 women from which primary data was generated.

Empowerment was measured using a modified Women's Empowerment in Agriculture Index (WEAI), which measures the roles and extent of women's engagement in agriculture. The tool analyses decisions on production, resources, income, leadership, and time.

Access to livelihood capital was measured on a 2-point scale each for availability and non-availability, and adequate and not adequate, to facilitate the responses due to the literacy level of women farmers. A set of 35 indicators were developed for the scale comprising 8 for financial capital, 9 for human capital, 6 for physical capital, 5 for natural capital, and 7 for social capital. A composite score was calculated for each of the indicators and an access score was computed from the composite score. Food security status was determined by Household Food Insecurity Access Scale (HFIAS) due to differential responses inherent in cultural or social contexts (Coates et al., 2007). In this study, a modified Women Empowerment in Agricultural Index (WEAI) was used due to the non-inclusion of the time budgeting variable

and the adjustment of the pooled score from the index for interpretation of the outcome. The scores from each of the indices on the modified WEAI were pooled and the mean was used as the cut-off point. Women with scores below the mean depict disempowerment while those above the mean indicate empowerment. To ensure the reliability of the questionnaire, a split-half technique was used, and a reliability coefficient of 0.85 was obtained. Data was analyzed with the Statistical Packages for Social Science (SPSS) using frequency distribution, percentages, and Chi-Square analysis.

$$\chi^2 = \sum \frac{(O-E)^2}{E} \quad (1)$$

Where:
χ^2 is the chi-square test statistic
Σ is the summation operator
O is the observed frequency
E is the expected frequency

Results and discussion

Table 1 presents the results on the personal characteristics of women farmers and shows a mean age of 52.5 years, mean household size of 6 persons, mean farming experience of 8.4 years, and mean dependent per household of 4 persons. 60% are married, while 57% are predominantly with high school education level. In addition, 60% of women farmers have income from produce sales, and 55% have non-farm income from pensions . The trend of these characteristics implies that there is a high involvement of women in irrigation farming and exploring livelihoods associated with agriculture as pathways to empowerment. Setshedi and Modirwa (2020) reported similar findings on the personal characteristics of women farmers.

Table 1. Personal characteristics of women farmers

Variables	**Description**
Age	Mean = 52.5 years, SD 9.2
Household size	Mean 6 persons, SD 2
Marital status	Predominantly married 60 percent
Education level	Predominantly secondary school 57 percent
Farming experience	Mean 8.4 years, SD 7.9
Number of dependents	Mean 4 persons, SD 4.2
Farm income	Predominantly farm product sales are 60 percent
Non-farm income	Predominantly pensions are 55 percent

Source: Author's own calculation.

Figure 2 shows that 73.8% of women farmers participate in decision-making on crop farming, 83.4% of women do not participate in decision-making on non-farm economic activities, and 66.7% have less input in the use of income generated in wage and salary employment. Similarly, 57.2% of women do not participate in decision-making about which

food crop to grow, and more women (66.7%) have less input in decision-making in non-farm economic activities. Women participate in decision-making on which food crops to grow when it is primarily for household consumption, and make decisions of engaging in non-farming activities (Khed and Krishna, 2023; Christiaensen, 2020).

Fig. 2. Women's role in household decision-making on production and income generation

Source: Author's own calculation.

Figure 3 shows that a high proportion of women farmers had access to productive resources. Namely agricultural land, cell phone, small consumer durables, large consumer durables and housing. This may be attributed to the fact that ownership of basic necessities is a priority among women and that additional incomes, together with the purchase systems that spread payment over a period of time, have assisted the women farmers. This agrees with the findings of Saha and Shradha (2023) and Badewa and Dinbabo (2022).

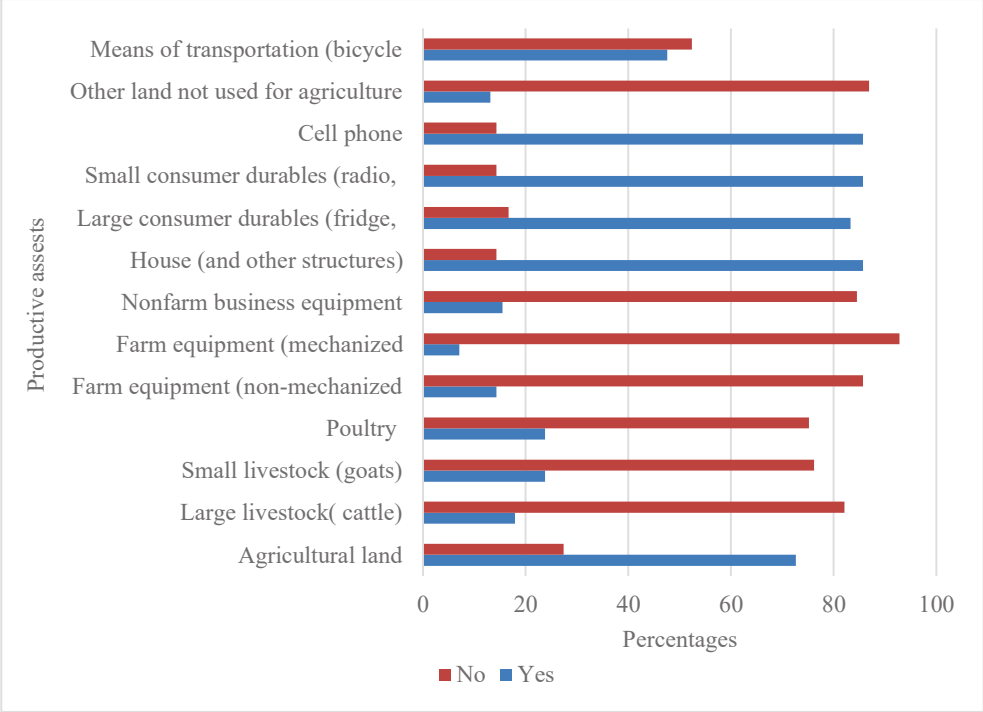

Fig. 3. Ownership of productive assets by women farmers

Source: Author's own calculation.

Figure 4 shows a large proportion of women had access to credit through non-governmental organizations, informal lenders, formal lenders, and friends or relatives – with the informal lender being the highest. Female farmers in irrigation schemes required credit for securing inputs – to ensure that such credit is not put to a different use, the credit is often in the form of direct inputs. Owusu and Yiridomoh (2021) noted that access to credit determines the use of improved crop varieties, timely field operations, and climate information services. Similarly, demand for formal credit is influenced by formal education, experience in farming, landholding size, and extension contacts (Chandio et al. 2021). Dwomoh et al. (2023) found that inequality was marginally higher among women than men in terms of access to agricultural productive resources and living in coastal areas rather than in the -coastal areas. Lindie et al. (2021) reported that lack of access to credit reduced the level of empowerment among female livestock farmers.

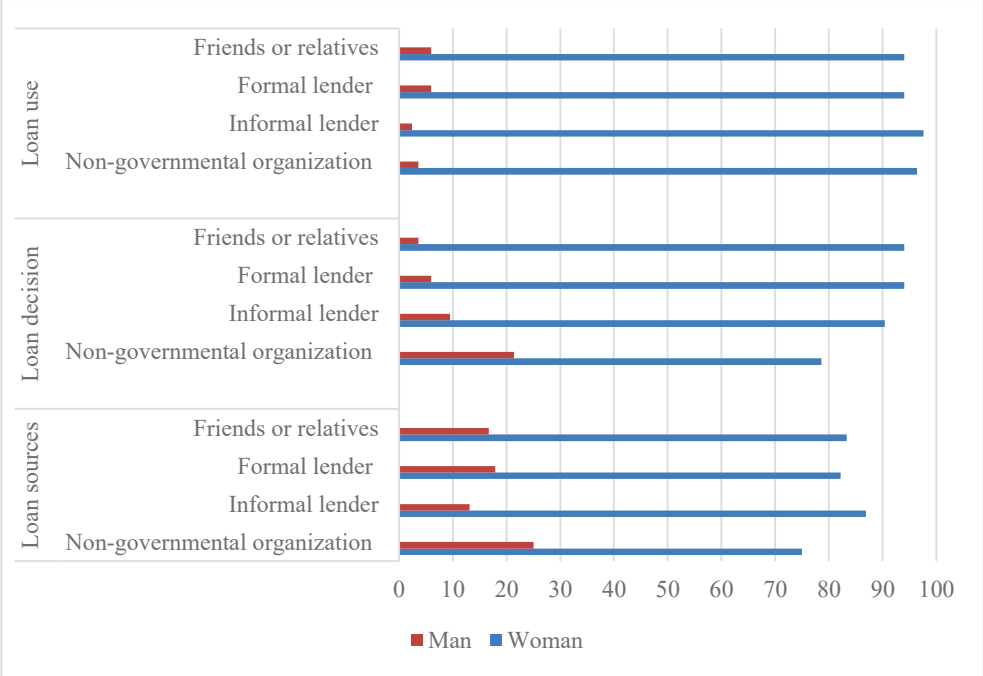

Fig. 4. Women's access and decision-making on credit

Source: Author's own calculation.

Table 2 presents the findings on group membership and leadership roles among women farmers and shows that women farmers are prominent members of civic groups and water user associations. Adbu et al. (2022) affirmed that women's membership and participation in farmer-based organisations were influenced by the likelihood of empowerment, household gender parity, and financial services. Miroro et al. (2023) stated that cooperative membership among goat farmers is influenced by education attainment and agro-veterinary services. Hansen and Asmild (2023) asserted that women's participation in farmer-owned cooperatives depended on female membership strength and the number of female external board members. The table further shows that women have confidence in speaking in public on decision-making processes and ensuring payment of services to confront misbehavior. Lecoutere et al. (2023) found that the use of women role models in training improves leadership roles among female farmers. Similarly, Okonya et al. (2021) stated that women's level of authority, autonomy, and confidence improved with years of farming experience, membership in farmers' groups, level of education, and high farm income.

Table 2. Group membership and leadership roles among women farmers

	Specification	Yes	No
Group Membership and social capital	Agricultural producer's group	3 (3.6)	81 (96.5)
	Water users' group	39 (46.4)	45 (53.6)
	Credit or microfinance group	8 (9.5)	76 (90.4)
	Mutual help or insurance group	18 (21.4)	66 (78.5)
	Trade/ business association	34 (40.5)	50 (59.5)
	Civic groups	63(75.0)	21 (25.0)
	Local government	16 (19.1)	68 (81.0)
	Religious group	24 (28.6)	60 (71.4)
Leadership roles	Confident public speaking on decision	74 (88.1)	10 (11.9)
	Confident speaking on proper services	37 (44.0)	47 (56.0)
	Confident public speaking on misbehavior	38 (45.2)	46 (54.8)

Source: Author's own calculation. Data in parentheses are percentages.

Table 3 shows the results of decision-making by women in smallholder irrigation farming to cover types of crops to grow, crops to market, livestock rearing, non-farm business activity, and ownership of wage or salary, and non-farm business activity having the highest proportion. This may be attributed to the fact that the majority of the respondents are single parents, divorced or separated. The adoption of irrigation technologies by women farmers has led to improved input in production decisions and control over income use (Bryan and Lefore, 2021). Kumar et al. (2021) found that the participation of women in self-help groups increases empowerment, control over income and decision-making over credit. The participation of women in alternative livelihood activities improved their empowerment and decision-making abilities (Bryan and Garner, 2022; Lawson et al., 2020).

Table 3. Decision-making of women in smallholder irrigation farming

Specification	Wife	Husband	Both
Agricultural production	24 (28.6)	20 (23.8)	40 (47.6)
Agricultural inputs to buy	32 (38.1)	20 (23.8)	32 (38.1)
Types of crops to grow	63 (74.0)	13 (15.5)	2 (2.4)
Crops marketing	72 (86.9)	3 (3.6)	8 (9.5)
Livestock production	76 (90.5)	0(0.0)	8 (9.6)
Non-farm business activity	79 (94.1)	3 (3.6)	2 (2.4)
Ownership of wage or salary	79 (94.1)	3 (3.6)	2 (2.4)
Major household expenditures	42 (50.0)	11 (13.1)	31 (36.9)
Minor household expenditures	37 (44.1)	14 (16.7)	33 (39.3)

Source: Author's calculation. Data in parentheses are percentages.

Figure 5 shows that 56% of women who have control over the use of income are disempowered, 78.99% are disempowered in terms of access to productive resources as an index of empowerment; 60.2% of women in terms of access to credit are disempowered; 51.8% of women are empowered in terms of leadership roles and 53% of women are empowered with respect to decision making on their production activities. Alem et al. (2023) reported that a differential exists in the spending pattern of men and women, with women spending a large proportion on children's and household goods, as well as the health status of children.

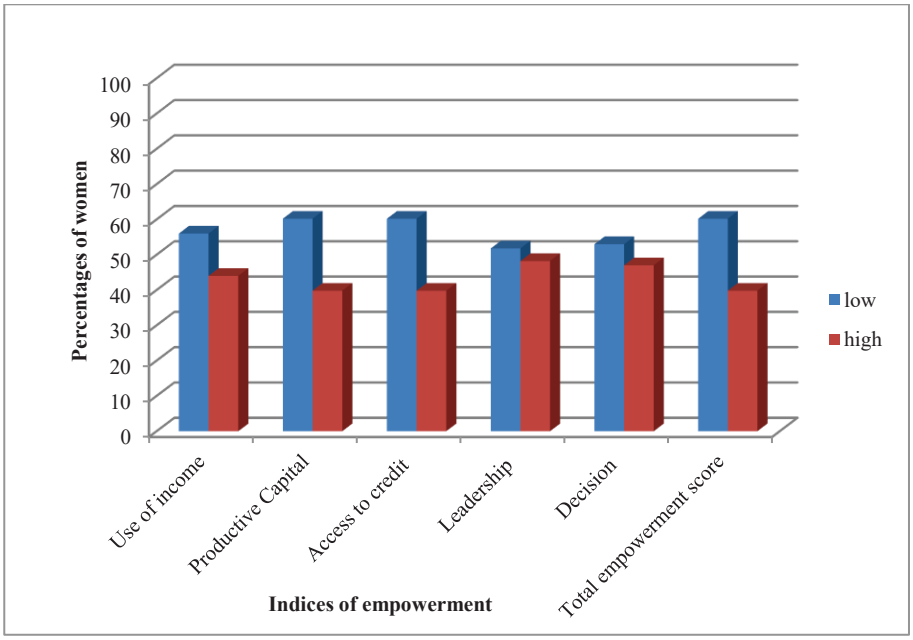

Fig. 5. Distribution based on empowerment indices.

Source: Author's own calculation.

Women have traditionally been limited in their access to credit due to low levels of education and properties acceptable as collateral. Women holding leadership roles influence other women's participation in group activities (Oxfam International, 2013). Basiglio et al. (2023) found that women are significantly less likely to ask for credit, and a high level of education enhances the disappearance of the gender gap. The social and leadership capital women acquire through women-only settings of social and economic self-help groups have not translated to meaningful influence in mixed-gender settings (FAO. 2023). Po and Hickey (2020) found that the expansion of women's rights through participation in irrigation and water management interventions have led to reduction in burden of labor and increased their leadership, thus eliminating shift discriminatory norms.

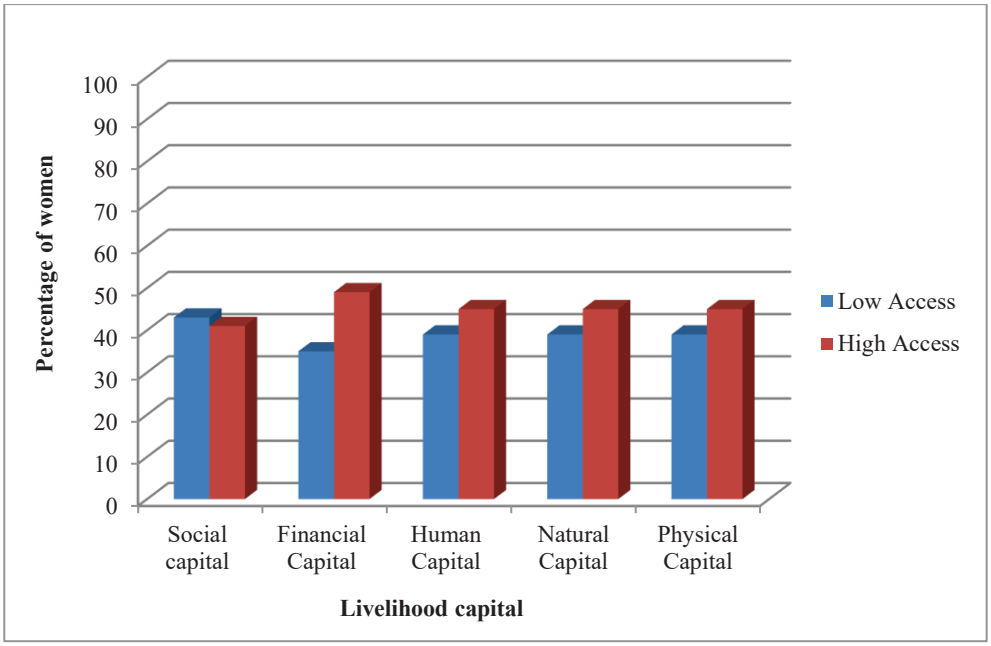

Fig. 6. Access to livelihood capital by women

Source: Author's own calculation.

Figure 6 shows access to livelihood capital by women in irrigation farming. The proportion was computed from a composite score calculated for each of the indicators and the access score was computed from the composite score, which was obtained from scores on access to livelihood capital, measured on a 2-point scale, each for availability and non-availability, and adequate and not adequate. A set of 35 indicators were developed for the scale comprising 8 for financial capital, 9 for human capital, 6 for physical capital, 5 for natural capital, and 7 for social capital.

Table 4. Cross-tabulation and Chi-square values showing relationships between levels of empowerment, livelihood capital, and food security.

Livelihood Capital and Food security		Low empowerment	High empowered		Chi-Square Value	df	p
Social capital	Low access	29	14	43	5.99	1	0.05
	High access	18	23	41			
	Total	47	37	84			
Financial capital	Low access	22	13	35	6.02	1	0.05
	High access	25	24	49			
	Total	47	37	84			
Human capital	Low access	26	13	39	3.85	1	0.05
	High access	21	24	45			
	Total	47	37	84			
Natural capital	Low access	28	11	39	3.85	1	0.05
	High access	19	26	45			
	Total	47	37	84			
Physical capital	Low access	23	16	39	3.85	1	0.05
	High access	24	21	45			
	Total	47	37	84			
Food security	Not secured	38	26	64	7.92	1	0.05
	Secured	9	11	20			
	Total	47	37	84			

Source: Author's calculation. Data in parentheses are percentages.

Table 4 presents the results on the cross-tabulation and Chi-square values showing the relationship between levels of empowerment, livelihood capital, and food security. All the livelihood capital and food security are significantly related to empowerment with social, financial, human, natural, physical, and food security factors. The Chi-square values are $\chi 2 = 5.99$, $p = 0.05$; $\chi 2 = 6.02$, $p = 0.05$; $\chi 2 = 3.85$, $p = 0.05$; $\chi 2 = 3.85$, $p = 0.05$; $\chi 2 = 3.85$, $p = 0.05$; $\chi 2 = 7.92$, $p = 0.05$ respectively. He and Ahmed (2022) noted that while physical and natural capital positively influenced agricultural livelihood strategy, human, social, and financial capital impacted positively on the non-agriculture livelihood strategy. Li et al. (2020) stated that physical and human capital affect each other and then jointly have significant impacts on the sustainable livelihood index. Sun et al. (2023) reported that the spatial and temporal distributions of farmers' sustainable livelihood through heterogeneous factors affect the overall development of farmers' sustainable livelihood. Jaka & Shava (2018) indicated that women's economic empowerment and livelihoods are enhanced by access to competitive markets, entrepreneurial education, and adequate funding.

Conclusions

The findings from this paper have added to the literature through large-scale evidence on access to livelihood capital, and food security status as correlates of women empowerment among women on irrigation schemes. The findings show varying degrees of

disempowerment among women in irrigation farming within the study area on indices of empowerment such as the use of income, access to productive capital, and access to credit, while women were empowered in indices of leadership and decision-making. Significant relationships were recorded between levels of empowerment, livelihood capital, and food security. The paper concludes that there is a need to modify the intervention programs if empowerment is to be attained.

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