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# ASSESSING THE EFFECTS OF THE SUPPORT PROGRAM FOR ARABLE AGRICULTURE DEVELOPMENT ON THE LIVELIHOODS OF SMALLHOLDER FARMERS IN BOTSWANA

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## ABSTRACT

Smallholder farming plays a significant role in ensuring the livelihoods of many rural populations. However, despite poor performance, farmers continually depend on governments to support agriculture. The literature provides inconclusive evidence about the impact of continued support governments provide to farmers despite these challenges. This study evaluated the effects of the Integrated Support Program for Arable Agriculture Development (ISPAAD), a production input subsidy, on the livelihoods of smallholder farmers in Botswana, specifically focusing on livelihood assets. ISPAAD, which operated from 2008 to 2023, provided financial assistance and agricultural inputs such as seeds and fertilizers to boost food security and improve farmer welfare. Despite its discontinuation due to monitoring issues, the program's replacement, Temo-Letlotlo, aims to address these shortcomings. Using the Sustainable Livelihood Approach (SLA) framework, the study examined various livelihood assets—natural, human, financial, social, and physical—of farmers who benefited from the production input subsidy. The study utilized a multistage sampling technique to collect primary data from 470 farmers in the Central District. The results revealed an overall Livelihood Assessment Index (LAI) score of 0.70, indicating a 70% improvement in livelihoods attributed to the input subsidy program. The results demonstrate that human capital improved the most, followed by financial and natural capitals, while physical capital improved the least. Notably, human assets showed the most improvement, particularly in farmers' ability to support their families and achieve self-reliance. However, challenges remain in creating employment opportunities and enhancing productivity, with farmers expressing concerns about the timing of input delivery affecting crop yields. The study emphasizes the need for targeted interventions to enhance farmers' livelihoods sustainably, recognizing that while subsidies may not be viable in the long term, they are necessary to keep farmers in production and reduce reliance on food handouts. Therefore, subsidies are critical for immediate support, but long-term strategies must be developed to ensure the resilience of smallholder farmers in Botswana's semi-arid conditions.

**Key words**: Livelihood assets, production input subsidy, smallholder farmers, Botswana

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## INTRODUCTION

The attainment of a stable and sustainable livelihood is the goal of every nation aligned with the Sustainable Development Goals 1 and 2 of ending hunger and poverty. Many governments employ different policies and programs for poverty alleviation. In Botswana, most of the policies of poverty alleviation are centered around agricultural programs. Agriculture is the primary source of food security and livelihood over 70 percent of the rural population in Botswana [1]. Most agricultural producers are smallholder farmers engaged in subsistence farming, primarily within the traditional sector, which is dominated by individuals with small holdings [2]. Over two-thirds of these subsistence farmers practice mixed farming, where they grow crops on their smallholdings and graze livestock communally [3, 4].

Due to a significant rural population depending on agricultural livelihoods and diminishing agricultural productivity, Botswana has invested in crop production input subsidies to boost food security and farmer welfare [4]. These programs have changed over time but with similar set goals [5, 6] and at times running concurrently. Some of the programs were developed to provide farmers with financial assistance and later developed to provide freely accessible capital inputs in the arable sector, such as seeds and fertilizers. The Integrated Support Program for Arable Agriculture Development (ISPAAD) (which ran from 2008 to 2023) has been succeeded by Temo-Letlotlo in the 2023-2024 cropping season. ISPAAD was an input subsidy program that provided agricultural inputs and farm mechanization services to enable small-scale farmers with modern ways of ploughing to enhance their production and create employment for the rural population, hence improving their livelihoods. Through ISPAAD, the government aimed to address the low yields in the agricultural sector by assisting farmers in managing extreme weather conditions. The program offered production inputs, including seeds, fertilizers, and tractor services, to smallholder farmers at no cost for up to five hectares, and covered 50% of the cost for additional land up to 16 hectares.

ISPAAD was discontinued due to lack of monitoring hence the birth of the new program Temo-Letlotlo set to improve on the areas where ISPAAD was lacking. Although research has reported positive impacts of various input subsidy programs on food security and poverty or its severity in different countries [7], little is known in Botswana about the effects of input subsidy programs on the livelihood of the smallholder farming households. According to Seleka and Mmopelwa [8], ISPAAD's success in reforming the agricultural sector to accomplish government goals has been dismal. The authors reported low productivity and decreasing yields. However, considering that the program was set to improve food security and improve smallholder arable farmers' livelihoods through household farming, the literature is

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silent on how the subsidy program has fared in improving the livelihoods and welfare of the farmers. The studies [5, 8] focused mainly on the crop acreage, production yields and productivity of the farmers. A few studies [9, 10] assessed the impacts of ISPAAD on the income and livelihoods of the farmers and concluded that the program had the potential but lacked monitoring, thus did not produce the intended results. Despite the findings from the previous studies, the available literature only utilized the yields as a basis to benchmark the performance of the program.

There is no empirical evidence of the capital benefits that have accrued to the farmers, hence the current study aimed to evaluate the household livelihood status of the smallholder arable crop farmers in Botswana following the adoption of the ISPAAD program. This evaluation used the Department for International Development sustainable livelihood analysis (DFID SLA) framework to evaluate the arable farmers' livelihood status. Furthermore, this study identified the different factors that influence the livelihood status of farmers, with the goal of providing policy recommendations. Therefore, this study aims to address the knowledge gap related to improved livelihoods resulting from participating in the crop production input subsidy.

## LITERATURE REVIEW

The Brundtland Commission introduced the concept of sustainability in 1987, focusing on human development. Later, Chambers and Conway [11] introduced the concept of sustainable livelihoods, defining livelihoods as how people can make a living based on assets, capacity, and activities. The United Nations Development Program (UNDP) followed suit, focusing on health, education, and well-being. The Department for International Development (DFID) adopted the definition from Chambers and Conway, which has since become the universal definition. DFID proposed a people-centered sustainable livelihoods analysis (SLA) framework to understand and analyze farming households' livelihoods [12]. The framework includes information on vulnerability, resources, policies, institutions, procedures, strategies, and outcomes. Livelihood assets are categorized into five categories: natural capital, human capital, physical capital, social capital, and financial capital. A broader base of assets results in better security of livelihoods, and more assets allow farm households to adjust their strategies more effectively [13]. These livelihood assets determine farming households' livelihood strategies, resulting in various livelihood outcomes. These five asset categories are interconnected; therefore, not one independent category can yield all the various and numerous livelihood outcomes that people need. Assets reflect the resource stock households can utilize to meet their basic needs, manage risk, make an income, and withstand stress and shocks.

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There is a substantial body of research available on the topics of livelihood capitals [14, 15]. Nyairo *et al.* [16] reported that, although there are several studies on livelihoods, one limitation in many of these studies is to focus on the vulnerability of interest groups such as farmers, to climate risks like drought. Other studies [17, 18] focus on sustainability adopting the same method of analysis. However, the current body of research on livelihood capitals lacks a comprehensive examination of the tangible impacts of technologies designed to support arable farming in the context of reducing poverty and promoting stability for farming households.

Based on the studies reviewed from different regions [13, 18, 19, 20, 21, 22], farmers employ various adaptation strategies to cope with ecological vulnerability and improve their livelihood outcomes. The studies [23, 24] also highlight the importance of access to different capitals such as natural, physical, human, social, and financial capital in enhancing livelihoods. Additionally, vulnerability to climate change and variability is a significant concern for smallholder farming households. Thus, literature shows that interventions such as strengthening communication networks, providing subsidies and training, and promoting income diversification are recommended to address this vulnerability. However, the studies did not show how providing subsidies and interventions improve the livelihood of the farmers. Therefore, the present study contributes to the available literature by utilizing the SLA framework to assess the success of the arable farming input subsidy in improving the sustainable livelihood of farmers.

## METHODOLOGY

### Study Area

The study selected the Central District of Botswana which has the highest number of smallholder farms than any other district [25]. The Central District is in the Eastern region of the country. It extends to the country's borders with Zimbabwe in the northeast and the Republic of South Africa in the south and east. The Central District is home to most mines (diamond, soda ash, copper, nickel, and coal). Although the mines play a significant economic role for the entire nation, they provide only small employment opportunities for people in the Central District. Therefore, most rural village households depend on agriculture for their livelihood. The Central District comprises nine sub-districts and these subdistricts comprise a total of 97 extension areas. Four sub-districts were randomly selected namely, Serowe, Tonota, Tutume and Machaneng. Figure 1 shows the Central District in the map of Botswana and the four (4) subdistricts selected for the study.

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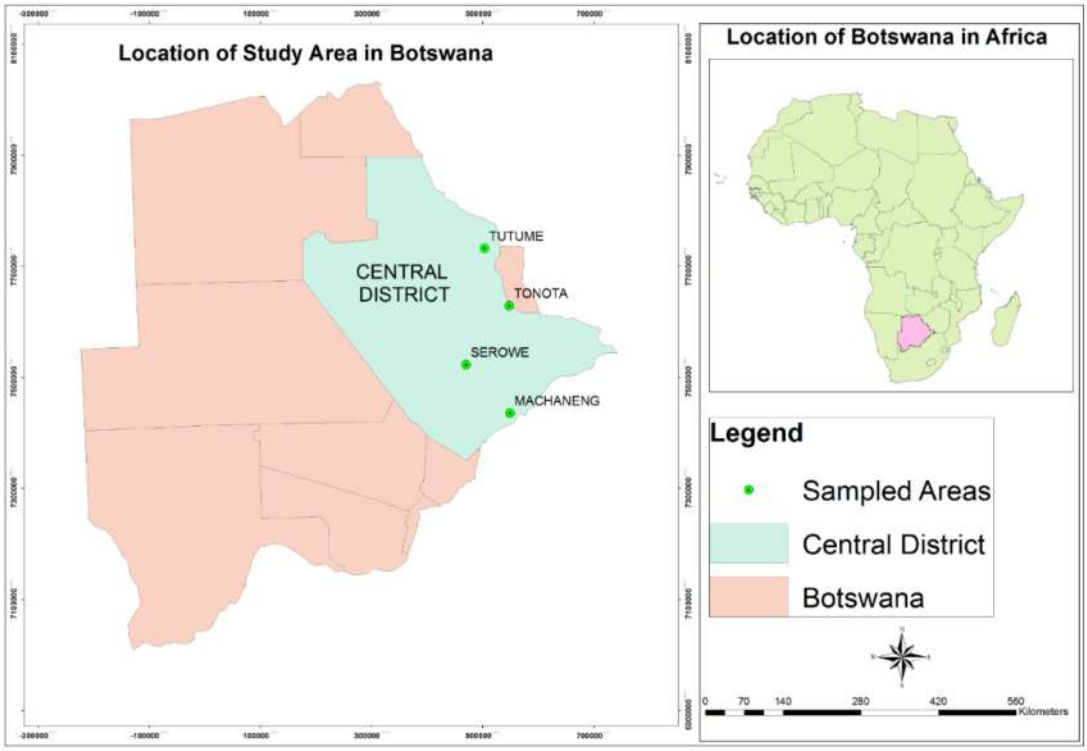


**Figure 1: Study area map**

Source: Author's construct (2021)

## Study design, sampling procedure and data collection

The study followed a cross-sectional survey design and evaluated the farming households' livelihood status of farmers who participated in the ISPAAD program. The study utilized data from 470 farm households, collected through structured interviews and field observations in the Central District of Botswana during the 2021 cropping season. Focus group discussions (FGDs) were conducted to triangulate data from the household survey. The farmers were selected based on their participation in the ISPAAD program for the previous years and accessed at least one of the subsidized inputs: seeds, fertilizers, agrochemicals, and/ or tractor services to plough in the 2021 cropping season.

The study selected the sample using a multistage sampling procedure. Starting with a purposive selection of the Central District for having the highest number of smallholder farmers and most arable production activities occurring in this district. The second stage randomly selected four subdistricts out of the nine in the Central District, hence the study's selection of Machaneng, Serowe, Tonota, and Tutume subdistricts. The third stage involved a census of the extension areas under the selected four (4) subdistricts. The four subdistricts comprised forty-four (44) extension areas. The final stage involved randomly selecting the farmers to make the determined sample size from the sampling list the extension area officers

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provided. Determining sample size was done by using the Yamane (1967) formula, which gave a sample size of 392 (Equation 3.1).

$$\boldsymbol{n} = \frac{\mathbf{N}}{\mathbf{1}+\boldsymbol{Ne}^{\mathbf{2}}} \quad (3.1)$$

Where n = the sample size needed, N = population size, and e = margin of error. A margin of error (e) of 5% for this study, and the sample frame was 18513. The sample size was then calculated as follows:

$n = 18513 / [1+18513(0.05)^2] = 392$

However, to cater for the incomplete entries and avoid missing data, sample size was increased by 20%, giving a total of 470 farmers. In selecting the respondents, study employed proportionate sampling method to determine the number per subdistrict to ensure equal representativeness in each subdistrict. The final stage was randomly selecting farmers from the sampling frame. Four focus group discussions (FDG) were conducted in two of the selected sub-districts to augment the quantitative data and provide further clarifications that the quantitative data could not clearly explain. Each FDG consisted of 15 to 20 participants of the same gender to ensure that members were free to express their views freely. Two FDGs were conducted in Serowe, one consisting of 20 females while the second one was made up of 15 male farmers. The other two FDGs were conducted in Tutume consisting of 15 females and 19 male farmers. FDGs could not be conducted in the other subdistricts as the farmers did not show up in satisfactory numbers to represent the gender groups.

## Ethical considerations

The Institutional Review Board (IRB) at the University of Cape Coast granted study approval for the research. Permission to conduct the research was also obtained from the Botswana Ministry of Agricultural Development and Food Security. Local leaders in the Central District of Botswana were also contacted and consulted prior to conducting the survey in the localities. Finally, informed verbal consent was granted by the primary respondent before the beginning of the interview.

## Empirical data analysis

This study assessed the livelihood status improvement attributed to the Integrated Support Program for Arable Agriculture Development (ISPAAD) subsidy. Various descriptive statistics, such as average and percentage, were used to evaluate the farmers' socioeconomic characteristics and livelihood assets. Furthermore, the study estimated the Livelihood assessment index (LAI).

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**Livelihood assessment index (LAI)**

DFID SLA served as the foundation for the development of the LAI. Farmer's livelihood was specified as follows:

Livelihood of farmers = $f$ (human, natural, financial, social, and physical assets)

Using the livelihood assets, the study determined the farmers' household livelihood status attributable to the improvement associated with accessing and using the ISPAAD inputs and services. Literature was reviewed to identify the indicators portraying farmers' livelihood. After the pre-test, the indicators were revised and modified where necessary. The livelihood indicators considered were asked in Likert scale questions to gather farmers' responses about improving their livelihood assets following benefiting from the ISPAAD program.

The indicators for the five assets were evaluated using equal weighting to represent the livelihood status of farmers accurately. Subsequently, a composite index was created. Although each asset included a varied number of indicators and used indicators with different scales and units, balance weighting was employed to ensure that each asset contributed equally to the overall index. Following the work of Ahmed *et al*. [15] and Hahn *et al.* [26], the conversion of sub-components to index was computed using each indicator's minimum and maximum values as shown in Equation (3.2).

$$\boldsymbol{I_i index} = \frac{\boldsymbol{I_u - I_{min}}}{\boldsymbol{I_{max} - I_{min}}} \quad (3.2)$$

Where $I_i$ was the original indicator or subcomponent in the asset used to construct the index, $I_u$ was the mean score from the responses for the particular indicator, and $I_{min}$ and $I_{max}$ were the minimum and maximum values, respectively. After standardizing each sub-component, the sub-components were averaged using Equation (3.3).

$$\boldsymbol{A_i} = \frac{\sum_{i=1}^{n} \boldsymbol{I_i index}}{\boldsymbol{n}} \quad (3.3)$$

Where $A_i$ was one of the five major components, i.e. the livelihood assets for the district [Natural Assets (NA), Physical Assets (PA), Financial Assets (FA), Human Assets (HA), and Social Assets (SA)]. *Ii* represented the sub-components that make up each major component, and *n* was the number of sub-components in each major component. After computing the mean scores for each asset, the composite overall livelihood assessment index for the households was then constructed using Equation (3.4).

$$\boldsymbol{LAI_i} = \frac{\sum_{i=1}^{n} \boldsymbol{w_i M_i}}{\sum_{i=1}^{n} \boldsymbol{w_i}} \quad (3.4)$$

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Which can also be expressed as:

$$LAI_i = \frac{(w_{NA}NA + w_{PA}PA + w_{FA}FA + w_{HA}HA + w_{SA}SA)}{(w_{NA} + w_{PA} + w_{FA} + w_{HA} + w_{SA})}$$

Where $LAI_i$ was the calculated livelihood assessment index, $w_i$ were the weights of the components determined by the number of indicators used to construct each major component and were included to ensure that all sub-components contributed equally to the overall $LAI_i$ [26]. Individual farmer LAI*i* scores were determined as a continuous measure of the degree of farmers' livelihood improvement. The scores were computed by taking an average of each farmer's livelihood asset indicator. For this study, the LAI*i* was scaled from 0 (low improvement) to 1.00 (high improvement) as an improvement attributed to the ISPAAD program. Livelihood assets pentagon was also constructed to evaluate the livelihoods status differences between the different subdistricts of the study area

## RESULTS AND DISCUSSION

### Assessment of farmers' livelihood status

The study results revealed that the farmers in Botswana have a high livelihood status score with an overall livelihood assessment index (LAI) of 0.70 (Table 1). This implies that ISPAAD has brought a 70% improvement in their overall livelihoods as measured using the LAI. The LAI results are discussed in order of the subcomponents scores. These results are similar to the findings of Senthamizh *et al.,* [23] who also found that the farmers in Nadu exhibited a medium level of livelihood, however, their study focused on farmers who were not receiving any production subsidies like in the current study. The results, according to the different livelihood assets revealed varying levels of improvement as discussed below.

### Human Assets

The study results showed that human assets improvement scored the highest index of 0.77. This implies that the human capital improved by 77% owing to the beneficiation of ISPAAD. The human capital improved specifically under the ability to support other family members and the ability to feed household members. These indicators scored 0.91 and 0.90 (Table 1), respectively, suggesting that, from the farmers' production, ISPAAD has improved the farmers' abilities to support family members and feed their households by 91% and 90%, respectively. Self-reliance also scored 0.89, suggesting an 89% improvement in the farmers' self-reliance. Interaction with the farmers during the focus group discussion revealed that they could not have formal employment since they were mainly aged above 65 years. They would either rely on younger family members for sustenance or, in extreme cases, be put under safety net programs that Mosha [27] and Moseley [28] purported that the government must have for people with low or no incomes. According to a

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participant in the female FGD, with the ISPAAD program, farmers[1] can "*fend for themselves*" and not "*bother*" other people with their needs. Solesbury [29] noted that one of the concerns that led to the coining of sustainable livelihoods was citizen participation, emphasizing self-reliance. This is also supported by Darmawan et *al.* [30] who emphasized the importance of farmer independence. Therefore, for a program like ISPAAD set to improve the farmers' livelihoods, achieving an improvement in the self-reliance indicator of the farmers is a desirable outcome.

Increased access to labour and creating employment opportunities for household members scored low at 55 and 62 per cent respectively, for each component. Farmers reckon the youth and some elderly members of the society refuse to work in the fields and opt to work for some "*Ipelegeng"* program. Ipelegeng is a short-term unemployment relief serving as a poverty alleviation instrument in the country's urban and rural areas. Ipelegeng pays the same as farm labour but with fewer hours of engagement; hence the employment indicators scored low.

**Natural Assets**

Natural asset indicators all scored above 0.74 (Table 1) except for the increase in productivity. Although farmers reported an 83% improvement in the adoption of new technologies such as row planting, the productivity improvement was lowest at 67%. Farmers reported that given the activities involved in row planting, farmers worry about soil moisture loss while waiting for the tractor services to complete the three activities, that is, ploughing, harrowing, and planting/sowing. Therefore, some preferred the broadcasting method as they would plough once and not lose time and soil moisture. By the time the dry spells hit, their crops would have reached some heat tolerance level, allowing them to have some harvest from their fields. Nevertheless, with broadcasting, some farm management activities, such as weeding and harvesting, may be challenging for farmers to perform, leading to poor management and low yields especially considering the average land cultivated and the age of farmers.

The increase in the number of livestock holdings indicator also scored higher at 79%. Most farmers practiced mixed farming. Therefore, production from the crop fields also helps them supplement their livestock, especially fowl and goats hence the increase in the number of livestock holdings. The results also showed an improvement in production area size of 73%. This may be because the government sets the standard number of hectares for which farmers receive tractor service. Therefore, because the government bears the cost, farmers feel they need to plough

[1]The program allows us to at least be able to provide food for ourselves especially those of us without livestock and late husbands. One can plough and harvest the little that rain affords them, without fear of bothering and asking other people which takes away one's dignity and being made to feel like a destitute

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the maximum number of hectares that the government pays for which was set at four hectares in the year of study.

Through the ISPAAD subsidy program, the government of Botswana aimed at increasing production and improving the food security and the livelihoods of the farmers. Since majority of the people in Botswana depend primarily on agriculture, for their livelihood, the production subsidy enables the arable farmers access to mechanized farming and improved seeds, hence improving their livelihoods. Productivity is expected to increase with the increased adoption rate of improved technologies [31, 32]. However, the results revealed that productivity improvement was lower than the adoption rate of appropriate technologies. Farmers purported that productivity does not improve because of the lack of monitoring[2] of the subsidy implementation, as farmers receive inputs and services late[3] after the onset of the rainy season hence losing out on the soil moisture content needed for the seedlings to grow.

**Financial Assets**

All indicators except one in the financial subcomponent scored above 70%. The results suggest that ISPAAD helped farmers realize an improvement in their financial assets. This implies that ISPAAD removed the burden of farmers' financial struggles in accessing the necessary inputs and tractor services for their farms, translating into some financial benefit. Only access to financial facilities scored 59%. This result is not surprising because most farmers were 65 years and above. Thus, they were not eligible for formal financial lending and did not seek to borrow finances for their production.

**Social Assets**

Social asset indicators included the ability to interact with other members of society at the farm level and in the general community set-up. It is alarming that indicators relating to farm event interactions scored lower than the general community interaction indicators. The indicators scored below 50%, suggesting that farmers are disinclined to work together on farm interactions. These low scores could result from the subsidy program effects reducing the interaction with the extension officers since most of the motivation to participate is derived from extension fieldwork days

[2]Factors affecting our time as farmers to plough mainly are the seeds and time of receiving the tractor services rainfall. When the ministry authorizes the distribution of seeds, they know it is the time for farmers to plough. We rely solely on rainfed agriculture as the main determinant of our ploughing but now the major problem hindering us from good harvests, is the tractor issues. Tractor owners really make it hard by coming to plough very late

[3] the program relies on private tractor owners to register and render services to farmers. However, we do not know who is to monitor if the private tractor owners are doing the job as expected or not. This is my major concern that the government is paying but who is supervising them to see if they are keeping their side of the agreement

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organized by the extension area officers. However, with the ISPAAD program, extension officers are responsible for registering farmers, issuing inputs, and recording the outputs. These officers are housed in central areas. They are more office-based, limiting their work to issuing inputs and delivering ISPAAD service requirements and less on the other extension service roles in the ploughing fields/farms. However, the other indicators showed some improvement in general. This result differs with Immanuel *et al.* [24] who found that farmers in Nadu had a higher social capital.

**Physical Assets**

Physical assets scored the lowest, with all the indicators scoring below 60% except the ability to access vehicles, trucks, and tractors, which scored 70%. These results suggest that farmers can mechanize their farms due to the improvement brought about by the ISPAAD program. However, there is less improvement in their physical assets, which scored an overall 57%. This could mean that most of the benefits accrued due to the ISPAAD program are mainly towards providing food security for the household and physical assets improvement becomes a secondary benefit. Generally, the study results suggest that the livelihood status of arable crop farmers in the study area is high comparable to the other studies [23, 24]. This can be attributed to the implementation of the input subsidy by the country, which aims to support farmers in sustaining their agricultural livelihoods despite the difficulties posed by semi-arid conditions for arable crop production.

**Comparing LAI between the Sub-Districts**

The livelihood asset scores were compared between the sub-districts (Figure 2). There is a slight disparity in the improvement scores according to the sub-districts. Machaneng sub-district recorded the lowest scores in all the livelihood improvement except for the physical assets. During the survey, the observation made was that this sub-district farmers had the poorest yields among the four. Therefore, it could be possible that farmers were scoring the livelihood improvement based on their current farm performances. Tutume has the lowest score of 0.50 in physical assets, the lowest for all the assets among districts. However, all the areas scored above 0.50 in all the assets, suggesting that at least fifty per cent of the livelihood asset improvement for the farmers is attributable to the ISPAAD program benefits.

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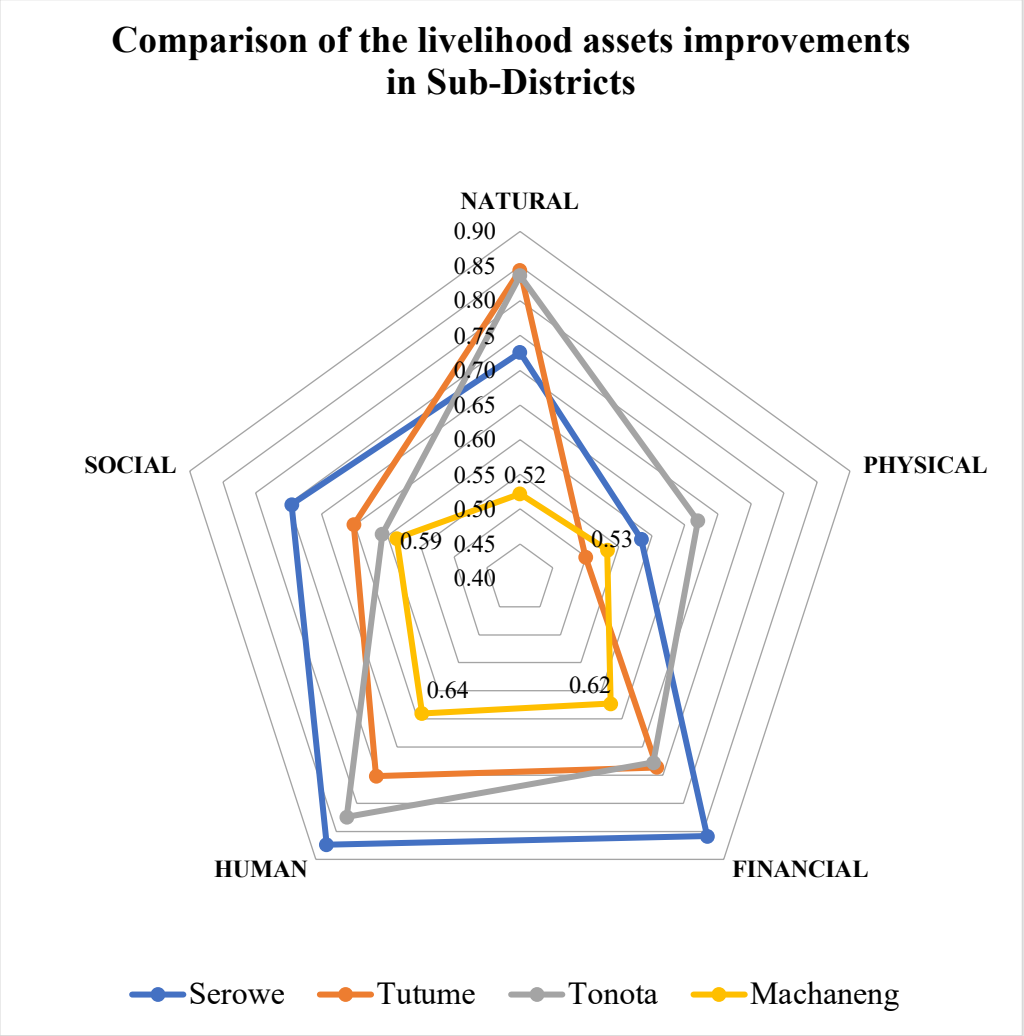


**Figure 2: Livelihood assets pentagon comparing the Sub-Districts**

*Test of significance for the livelihood assets improvement per Sub-Districts*

The results showed that there was no significant difference between sub-districts LAI which means the program is yielding similar benefits across the district (Table 2).

## CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

This study established that arable farming households in Botswana generally have a high livelihood status score which showed overall livelihood assessment index (LAI) of 0.70. The study has established that ISPAAD has brought a 70% improvement in the overall livelihood capacity of the farmers in the Central District, while improving the human, natural, financial, social and physical livelihood assets by 77%, 74%, 74%, 65% and 57% respectively. These results suggest that farmers who participated in the input subsidy program benefited from improvements in their livelihood capitals, especially with self-sustenance showing that food security may

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be achieved at individual and household levels through beneficiation of the input subsidy programs.

In conclusion, the ISPAAD program in Botswana has had a positive impact on the livelihoods of smallholder arable crop farmers. The program has particularly improved human assets, such as the farmers' ability to support family members and feed their households. However, there are areas where the program has not been as successful, such as creating employment opportunities for household members and increasing productivity. Overall, the ISPAAD program has had a positive impact on farmers' livelihoods. However, this study has limitations; we couldn't find literature on farmers' livelihoods before the subsidy program, hindering our ability to assess the extent of improvement. Therefore, the study was limited to farmers' perceptions. Although farmers may become dependent on the agricultural input subsidies making the subsidies permanent, adding a recurring cost to national budgets and not sustainable in the long-run, with no government support for small-holders especially in semi-arid areas where farmers continually obtain poor yields, the production subsidy is necessary to keep farmers in production. Without the subsidy, farmers may be pushed out of production which may lead to a need for food handouts.

**Policy Recommendations**

The government of Botswana, through the Ministry of Agriculture, should consider the continuation of the provision of input subsidies to smallholder arable farming households to protect and improve the livelihood status of the rural population. However, there is a need to address areas where the program has not been successful, such as creating employment opportunities and increasing productivity. While the subsidies may not be sustainable in the long run, they are necessary to keep farmers in production and prevent the need for food handouts.

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**Table 1: Livelihood Assessment Index (LAI) scores for farmers in Botswana**

| Sub-Component | Mean | Index | Major index |
|---|---|---|---|
| NATURAL ASSETS | | | 0.74 |
| Increase in size of production land | 2.94 | 0.73 | |
| Increase in yield | 2.79 | 0.70 | |
| Increase in Productivity (yield per unit area) | 2.70 | 0.67 | |
| Increase adoption rate to appropriate technologies | 3.33 | 0.83 | |
| Increase in number of livestock holdings | 3.14 | 0.79 | |
| PHYSICAL ASSETS | | | 0.57 |
| Able to buy (bicycles, cars, trucks, and tractors) | 1.71 | 0.43 | |
| Able to buy farm inputs (water tank, wire fence the farm) | 2.07 | 0.52 | |
| Able to get access to vehicles (trucks, tractors) | 2.82 | 0.70 | |
| Able to build a house(s) | 2.23 | 0.56 | |
| Able to connect water to your yard | 2.41 | 0.60 | |
| Able to connect electricity to your house | 2.37 | 0.59 | |
| FINANCIAL ASSETS | | | 0.74 |
| Increase in income levels | 2.95 | 0.74 | |
| Increase in saving levels | 3.18 | 0.79 | |
| Decrease in debt levels | 3.34 | 0.83 | |
| Increase in access to financial facilities | 2.34 | 0.59 | |
| HUMAN ASSETS | | | 0.77 |
| Ability to feed household members | 3.62 | 0.90 | |
| Ability to support other family members | 3.64 | 0.91 | |
| Increase in employment opportunities for household members | 2.20 | 0.55 | |
| Increase in access to labour | 2.47 | 0.62 | |
| Self-reliance | 3.54 | 0.89 | |
| SOCIAL ASSETS | | | 0.65 |
| Membership in association farmer group | 1.50 | 0.38 | |
| Support from association/farmer group | 1.97 | 0.49 | |
| Participation in social activities | 2.89 | 0.72 | |
| Support to family and friends | 3.41 | 0.85 | |
| Ability to pay for societal contributions, e.g., burial cover | 3.01 | 0.75 | |
| Access to services from extension officers | 2.88 | 0.72 | |
| OVERALL LAI | | | 0.70 |

Source: Computation from field data (2021)

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**Table 2: Determining the significance of the difference between the subdistrict LAIs using ANOVA**

| Source of Variation | Sum of squares | Df | Mean Square | F | P-value |
|---|---|---|---|---|---|
| Between Groups | 0.0920 | 3 | 0.0307 | 2.8536 | 0.0701 |
| Within Groups | 0.1719 | 16 | 0.0107 | | |
| Total | 0.2639 | 19 | | | |

p>0.05
Source: Computation from field dat, (2021)

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