Determinants of Onion Profitability among Smallholder Farmers at Mlembule ward in Mpwapwa District

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Ikisiri

Andiko hili lililenga kuchunguza viambuzi vya faida ya kulima vitunguu kwa wakulima wadogowadogo kata ya Mlembule wilaya ya Mpwapwa. Malengo mahususi ni kuchanganua faida halisi ya vitunguu, kubaini viambuzi vya faida kwa vitunguu na kuchunguza mikakati inayotumika kuongeza faida yake. Takwimu za awali na zile za upili (Primary and secondary data) zilikusanywa kwa kutumia usaili uliopangiliwa (structured interview), usaili usiopangiliwa wote (semi structured interview), majadiliano kwenye vikundi (Focus Group Discussion) na mapitio ya machapisho ya vitunguu (Documentary review). Kumbukumbu za awali na zile za uwili zilikusanywa kwa kutumia madodoso ya kuwasaili walioteuliwa (respondents and key informants). Mbinu za kuwachagua washiriki wa utafiti ni sampuli rahisi ya nasibu (simple random sampling). Sampuli isiyo ya uwezekano aina ya upendeleo (purposive sampling) ilitumika kuwapata wataalam na watawala wenye nyadhifa malimbali (key informants) zinazoshabihiana na utafiti huu. Mbinu zauchambuzi zilizotumika ni takwimu maelezo (descriptive statistics) na uchambuzi wa kurudi nyuma katika hali ya ukosefu wa uhakika na habari kamilifu (Binary Logistic Regression analysis). Uchambuzi wa takwimu unaonyesha kuwa kiwango cha faida ghafi na faida halisi kwa mkulima wa vitunguu huwa ni kubwa kipindi cha kiangazi kulikokipindi cha mvua. Kwa kutumia uchambuzi wa kurudi nyuma katika hali ya ukosefu wa uhakika na habari kamilifu (Binary logistic regression analysis) ilibainika kuwa vifuatavyo ni viambuzi chanya vya faida; jinsia (0.047), elimu (0.029), mtaji (0.049), mbegu (0.011), masoko (0.05), masoko na bei (0.034), uwepo wa mikopo (0.034), umwagiliaji (0.05), mbolea (0.032) na ukubwa wa shamba (0.016). Mikakati iliyokwisha kutumika kuongeza upatikanaji wa faida ni pamoja na; kuuzia mazao shambani, kuongeza kiasi na ubora, kuunda vikundi vya umwagiliaji, masoko na mitaji. Kutokana na matokeo ya utafiti huu, imedhihirika kuwa uboreshaji wa huduma za ugani, kupatikana vyanzo vya fedha vya kuwakopesha mitaji, kuongeza bajeti, uboreshaji wa miundominu ya umwagiliaji, uchukuzi na mawasiliano kutawawezesha wakulima wa vitunguu kuongeza upatikanaji wa faida.

Abstract

This paper evaluates the determinants of onion profitability among smallholder farmers at Mlembule Ward. Specifically, the paper determines onion profitability status, examines determinants of onion profitability and assesses strategies for improving profitability. The paper employed a cross-sectional research design whereby structured and semi-structured interviews, focus group discussions and documentary review methods werere used for data collection. Probability and non-probability sampling techniques were employed to select a sample of respondents and key informants respectively. Data analysis employed in this study included both inferential and descriptive statistics. The findings depicted that, average gross profit, average net

profit and profit margins were higher in the dry season compared to the rainy season. Binary logistic regression analysis indicated that, sex (0.047), education (0.029), capital (0.049), seeds variety (0.011), market access (0.05), market prices (0.034), credits access (0.034), irrigation technology (0.05), fertilizer (0.032) and farm size (0.016) significantly affected the profitability of onion at p<0.05. The main strategies employed for profitability were wholesale selling, improving yield quantity and quality and formingWater Users Association (WUA). Therefore, community efforts, credit availability, research and financial support from the Ministry of Water and Irrigation and interested development partners have to improve profitability. Empowering marketing associations, improving market and irrigation infrastructures and extension services provision through the ditrict council have to improve onion profitability.

Keywords: Onion profitability, determinant factors, small holder famer, yield quantity

1.0 Introduction

1.1. Background Information

Globally, over 4,955,432 ha are estimated to grow onion annually, producing 93,168,548 tons, making it the second most important horticulture crop after tomatoes (HANCI, 2018). Worldwide, onion is grown in 170 countries. China, India, and USA led the world production by 20,507,759; 13,372,100; and 3,320,870 tons, respectively. Egypt the leading African country produced 2,208,080 tons followed by Nigeria (1,346,218), Morocco (1,001,304), Algeria (821,072) and South Africa (518,284) all in tons (FAO, 2021). Tanzania ranked sixth amongst African countries (URT, 2017). The crop is produced almost all over the country, from the Southern Highlands through the Central Plateau to the Northern Highlands where most of the producers are small scale farmers cultivating between 0.5 and 1 ha. The main producing regions in tons per hectare are Morogoro (6.9), Dodoma (6.74), Arusha (6.3), Iringa (5.8), Tabora (5.2), Manyara (4.9), Kilimanjaro (4.5), Mara (4.0), Mbeya (2.4) and Lindi (2.5) (URT, 2017).

Dodoma region has 2,173.64 ha with a production of 17,531.04 tons. The targeted production for the region is 10.2 tons per hectare annually while the actual is 6.74 tons per hectare. Mpwapwa district is one of the main producers of onion in the region (URT,2017; Mlay, *et al.*, 2015). Farmers sell onion in wholesale and retail. In wholesale, the farmers sell at market centres in Mpwapwa town at agreed market prices. In retail selling, farmers sell in small lots in their local markets at prices fixed at the market depending on onion demand and supply on the day. Also, farmers sell at farmgate prices where buyers purchase directly from the farmers at negotiable prices. Due to a lack of marketing information on prices, farmers sell at low prices.

Mlembule ward in Mpwapwa district is the main producer of onion in the district. The annual average rainfall is 600 mm Hg, and the climatic condition is favourable for onion production in dry and rainy seasons. The ward has 462 ha producing an average productivity of 6 tons per hectare. Despite the high ward productivity which is 89% of the region its profitability is low (URT, 2017; Mlay, et al., 2017; Mzalendo Associates Co. Ltd, 2015).

Literature concentrated on determinants of onion productivity (Mlay, *et al.*, 2017; Martin, 2017; Musyoka*et al.*, 2016; Salus, 2020), to mention a few. However, there is limited information about the determinants of onion profitability. Therefore, there is an information gap about determinants of onion profitability in the study area. To fill the existing gap the following questions need to be answered. What is the current profitability of onion?What are the determinants of onion profitability? What strategies have been employed to improve the profitability of onion? The ward was selected because it was a major area of onion production in the district experiencing low profitability. The findings are expected to provide the basis for policy makers and planners at different levels who set pro-poor policy programmes on crop profitability.

2.0 Methodology

The study was conducted in the Mpwapwa district at Mlembule ward. The study was done at this ward because is the main producer of onion and its profitability is documented to be low.
The study employed a crossectional research design in which data was collected from a representative sample of the population at a single point in time (Schwab and Donald, 2013). Primary data was collected directly from sampled onion farmers and secondary data from documents, including official reports and articles related to the study. Also, key informants who were Agricultural Extension Officer (AEO), Village Executive Officer (VEO) and Ward Executive Officer (Weo) provided secondary data.

Both probability and non-probability sampling techniques were employed to select 132 from 298 smallholder farmers. A simple random sampling method was used to select individual smallholder onion farmers, while purposive sampling was applied to select the key informants and the two villages involved in the study (Mlembule and Nduga villages).Structured interviews using questionnaires were administered to selected onion farmers. A semi-structured interview was used to obtain primary data by administering a checklist to key informants. Focus group discussions were conducted with ten selected people based on gender, knowledge, experience and duration of stay in the study area.

Descriptive analysis such as frequencies, percentages and ratios, and inferential statistics (binary logistic) were employed for data analysis. Profitability analysis involved the computation of average gross profit, average net profit, average gross profit margin and average net profit margin as per the formula shown hereunder:

$$Average\ Gross\ Profit = Average\ Net\ Sales - Averg.\ Farming\ costs \quad (1)$$

$$Average\ Net\ Profit = Average\ Gross\ Profit - Averg.\boldsymbol{Marketing}\ costs \quad 2)$$

$$Average\ Net\ profit\ margin = \left(Average\ \frac{Net\ profit}{Net\ sales}\right) \times 100\% \quad (3)$$

$$average\ Gross\ profit\ margin = \left(average\ \frac{Gross\ profit}{Net\ sales}\right) \times 100\% \quad (4)$$

Binary logistic regression was used to examine the relationship between profitability and its determinants. This model was adopted since the dependent variable (Profitability) was a dummy

variable (1 if onion production is profitable and 0 if otherwise). The explanatory variables were: age, sex, education, farming costs, seed variety, farm size, fertiliser, pesticides, irrigation technology, extension services, capital, market access, market infrastructure, market price and credit access (Equation 5).

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14} + \beta_{15} X_{15} + \varepsilon_i \quad (5)$$

Where, Y_i is the profitability of onion production, β_0 = constant, β_i are estimated coefficients of the explanatory variables, X_i are explanatory variables and ε_i = disturbance term (Table 1).

Table 1: Description of the explanatory variables

X_1= Age	1 if youth (18 years - 32 years), 0 if above 32 years
X_2=Sex	1 if male, 0 if female
X_3=Education and training	1 if received education and training, 0 if otherwise
X_4 = farm size	1 if > acre, 0 if < acre
X_5= farming costs/acre	1 if exceeds 61.2% of revenue , 0 if below
X_6 = seed variety	1 if certified seeds, 0 if non certified
X_7=Fertilizer application	1 if inorganic, 0 if organic
X_8 = Pesticides use	1 if applied, 0 if not applied
X_9=Irrigation technology	1 if applied, 0 if not applied
X_{10} = Extension services	1 if access, 0 if otherwise
X_{11} = Capital access	1 if sufficient capital, 0 if otherwise
X_{12}=Market access	1 if tariffs and charges access, 0 if otherwise
$\boldsymbol{X_{13}}$=transport infrastructure	1 if there is defined transport network access. 0 if otherwise (remote).
X_{14}=Market Price	1 if high (above 2,000 Tsh. per kg), 0 if below.
X_{15}=Credit access	1 if access, 0 if otherwise

3.0 Results and Discussions

3.1 Status of Onion Profitability

3.1.1 Average Profit Analysis

Information obtained from Ward Executive Officer (WEO) explained that onion farming was done in dry and rainy seasons. The study identified respondents who were involved in production for both seasons. The findings showed that 100% of respondents produce onion in both seasons. In the rainy season, the average harvest per acre was 1ton (20 bags/50 kg)and the average market price was 2,070/= Tsh. per kg. The average farm costs amounted to 1,400,000/= Tsh. per acre. The average gross profit (AGP) was 670,000=Tsh. per acre, and the Average Gross Profit Margin (AGPM) of 32.4%. The Average Net Profit (ANP) was 610,000/= Tsh.with an Average Net Profit Margin (ANPM) of 29.5% (Table 2).

Table 2: Average Profit statement in the rainy season (per acre) (n=132)

Activity Description	Units	Quantity	Unit price Tsh	Tsh
Sales income				
Harvest	Kg.	1,000	2,070	2,070,000
Total Average sales income				2,070,000
Average farming Cost farming				
Transplanting	Acre	1	100,000	100,000
Weeding	Acre	1	100,000	100,000
Irrigation	Month	3	10,000	30,000
Spraying	Month	3	30,000	90,000
Harvesting	Acre	1	50,000	50,000
Ploughing	Acre	1	30,000	30,000
Land clearing	Acre	1	40,000	40,000
Bud preparation	Acre	1	20,000	20,000
Harrowing	Acre	1	50,000	50,000
Nursery	Acre	0.25	160,000	40,000
Seeds	Kg	5	36,000	180,000
Fertiliser	Kg	100	4,000	400,000
Pesticides	Lt	6	45,000	270,000
Total farming cost (67.6% of sales)				1,400,000
Average Gross profit (AGP)				670,000
Less: Marketing fees				60,000
Average Net Profit (ANP)				610,000
Average Gross Profit Margin (AGPM)				32.4%
Average Net Profit Margin (ANPM)				29.5%

In dry season (Table 3) average onion harvest per acre was 1.4 tons (28 bags/50 kg) and the average market price was 1,500/= Tsh.per kilogramme. The average farm costs amounted to 1,300,000/= Tsh. per acre. The AGP was determined to be 800,000/= Tsh. per acre with an AGPM of 38.1%.The average marketing costs were 90,020/= Tsh. and the ANP was 800,000/= Tsh. with ANPM of 33.1%.(Table 3).

Table 3: Average Profit Statement in Dry Season (per acre) (n=132)

Activity Description	Units	Quantity	Unit price Tsh	Tsh
Sales income				
Harvest	Kg.	1,400	1,500	2,100,000
Total Income				2,100,000
Farming costs				
Transplanting	Acre	1	100,000	100,000
Weeding	Acre	1	60,000	60,000
Irrigation	Month	3	30,000	90,000
Spraying	Month	3	20,000	60,000
Harvesting	Acre	1	50,000	50,000
Ploughing	Acre	1	30,000	30,000
Land cleaning	Acre	1	40,000	40,000
Buds preparation	Acre	1	20,000	20,000
Harrowing	Acre	1	50,000	50,000
Nursery	Acre	0.25	160,000	40,000
Seeds	kg	5	36,000	180,000
Fertilizer	kg	100	4,000	400,000
Pesticides	Lt	4	45,000	180,000
Total farming costs (61.9% of sales)				1,300,000
Average Gross Profit (AGP)				800,000
Less: Marketing costs				90,020
Average Net Profit (ANP)				710,080
Average Gross Profit Margin (AGPM)				38.1%
Average Net Profit Margin (ANPM)				33.8%

The annual average harvest was reported to be 2.4 tons per acre. The average harvest sales were 4,176,000 Tsh.(rainy and dry seasons sales) while annual average farming costs were 2,700,000= Tsh.per acre (rainy and dry season costs), and average marketing expenses of 150,020/= Tsh. per acre. The profit analysis done showed an annual average gross profit of 1,476,000/= Tsh. with an average annual gross profit margin of 35.3% and an average annual net profit of 1,325,980/= Tsh. with average annual net profit margin of 31.8% (Table 4).

Table 4: Annual Average Profit Statement (per acre) (n=132)

Activity Description	Units	Quantity	Unit price Tsh	Tsh
Sales income				
Harvest	Kg	2,400	1,740	4,176,000
Total Income				**4,176,000**
Farming costs				
Transplanting	Acre	1	100,000	200,000
Weeding	Acre	1	60,000	160,000
Irrigation	Month	3	30,000	120,000
Spraying	Month	3	20,000	150,000
Harvesting	Acre	1	50,000	100,000
Ploughing	Acre	1	30,000	60,000
Land cleaning	Acre	1	40,000	80,000
Buds preparation	Acre	1	20,000	40,000
Harrowing	Acre	1	50,000	100,000
Nursery	Acre	0.25	160,000	80,000
Seeds	kg	5	36,000	360,000
Fertilizer	kg	100	4,000	800,000
Pesticides	Lt	4	45,000	450,000
Total farming costs (64.7% of sales)				2,700,000
Average Gross Profit (AGP)				1,476,000
Less: Marketing costs				150,020
Average Net Profit (ANP)				1,325,980
Average Gross Profit Margin (AGPM)				35.3
Average Net Profit Margin (ANPM)				31.8

These results implied that onion farming is more profitable in the dry season than in the rainy season (Table 2 and Table 3). The differences in the APs and APMs were due to an increase in production costs in rainy season specifically, weeding, spraying, pesticides which were 100,000/= Tsh. , 90,000/=Tsh. and 270,000/=Tsh. respectively in the rainy season and 60,000/= Tsh, 60,000/=Tsh .and 180,000/=Tsh. respectively in the dry season. Also, average selling price during rainy season was higher than dry season due to higher market demand. These results are supported by Sugiartini *et al.* (2021) and Rao (2016) who documented that onion cultivation at the rainy season affects the productivity due to excessive moisture and impacted the price value fluctuation.

3.2 Determinants of Onion Profitability

By using data obtained from respondents, a binary logistic analysis was carried out to examine the most determinants of onion profitability. The model defined the profitability of onion production as a function of age, sex, education, farm size, farming cost, capital, seeds variety, fertiliser, pesticides, irrigation technology, extension services, access to market, market infrastructure, market price and credits (Table 5).

Table 5: Binary logistic regression analysis (n=132)

Category	Description	β	S.E.	Wald	df	Sig.	Exp(β)
Constant		3.972	0.711	10.55	1	0.618	13.091
Demographic factor	Age	-1.124	0.278	8.373	1	0.053	8.364
	Sex	0.413	0.423	12.457	1	0.047	1.511
	Education	1.318	0.619	4.539	1	0.029	3.736
Production factors	Farm size	1.284	0.719	11.936	1	0.016	3.611
	Farming cost	-2.517	0.845	8.873	1	0.137	0.081
	Seeds variety	0.618	0.667	9.154	1	0.011	1.855
	Inorganic fertilizer	1.726	0.506	11.635	1	0.032	0.178
	Pesticides use	0.335	0.921	2.101	1	0.395	1.398
	Irrigation technology	1.148	0.433	11.654	1	0.050	1.865
	Extension service	0.749	0.949	1.732	1	0.422	2.115
	Capital	1.028	0.642	9.365	1	0.049	2.795
Marketing factors	Market access	0.623	0.955	2.888	1	0.050	1.865
	Market infrastructure	0.514	0.497	1.069	1	0.973	1.672
Financial factors	Market price	1.589	1.015	1.787	1	0.034	4.899
	Credit access	1.106	0.673	2.701	1	0.021	3.022

Note: Log Likelihood=2.773; Cox&Snell R^2=0.813; Negelkerke R^2=0.971; Chi-Square=110.464, p -value = 0.05

The Nagelkerke correlation coefficient (R^2) value of 0.971 means that about 97.1% of the variation in profitability is explained by the mentioned factors above while the cox&snell R-square of 0.813 shows that 81.3% of variations in onion profitability is explained by the explanatory variables.

3.2.1 Demographic factors

3.2.1.1 Sex

Table 5 shows that sex of respondents had a significant effect on onion profitability with p-value = 0.047 (which is less than 0.05), such that the male farmers have more likelihood to be profitable than female farmers by the odds ratio of 1.511. This is supported by the Wald chi squared test of 12.457 which is greater than zero. This explains that males had a more positive effect on onion profitability than females because males have access to resources than their counterparts (Habtu and Getnet, 2020).

3.2.1.2 Smallholder Farmers' Education

Education adds to the profitability of onion with a positive regression coefficient of 1.318, Wald chi squared test greater than zero (4.534) and the p-value of 0.029 which is less than 0.05 (Table 5). The variable is significant and explains that educated farmers have more likelihood to be profitable by the odd ratio of 3.736 than illiterates. This implies that an increase in education for onion farmers will increase onion profitability. The study results concurred with those of Salusi

(2020), who reported that there was a positive relationship between education and agricultural profitability.

3.2.2 Production factors

3.2.2.1 Seeds variety

Table 5 shows that seed varieties positively influence the onion profitability with a positive regression coefficient of 0.618 and a Wald chi-squared test of 9.154 which is greater than zero. The effect of this variable on onion profitability is significant with a p-value of 0.011 such that farmers who use certified seeds have more likelihood of being profitable than those who use non certified seeds by the odd ratio of 1.855. This study concurs with those of Chijioke and Akaninyene (2019) who suggested that users of improved maize seed varieties earned higher profitability and were more technically efficient than non-users.

3.2.2.2 Capital

Capital has positive onion profitability effect with a positive regression coefficient of 1.028 and a Wald chi-squared test of 9.365 which is greater than zero. The results are significant with a p-value = 0.049 at 0.05 (5%) (Table 5). The results show that smallholder farmers who are able to secure capital have more likelihood to be more profitable than those who cannot access capital by the odd ratio of 2.795.These results are supported by Maembe1 and Hamza (2021) that onion production is capital-intensive crop using significant amounts of money.

3.2.2.3 Farm size

Farm size has a positive effect on onion profitability with a regression coefficient of 1.284 and a Wald chi- squared test statistic of 11.936 which is greater than zero (Table 5). The variable is significant with a p-value = 0.016 which is less than the level of significance of 5% (0.05). The results conclude that farmers with farm size greater than 1 acre have more likelihood to be profitable than those who have less than an acre by an odds ratio of 3.611. Thus, the profitability of onions is more likely to increase as farm size increases. These findings concurred with Chenchen *et al.* (2019), who documented that farm size positively impacted farmers' profitability.

3.2.2.4 Inorganic fertilizers

Inorganic fertilizers application has a positive effect on the profitability of onions with a negative regression coefficient of 1.726 and a Wald chi-square test statistic of 11.635 which is greater than zero (Table 5). The result shows that farmers who applied inorganic fertilizers have more likelihood to be more profitable in production than those who do not apply by the odd ratio of 0.178 and a p-value of 0.032. These results concurred with Dabessa (2021), who explained that farmers applying the recommended rates of inorganic fertilizer in maize production were more profitable than those who do not apply the recommended rates.

3.2.2.5 Irrigation technology

Irrigation technology exhibits the profitability of onion positively with a positive regression coefficient of 1.148 and a Wald chi-squared test of 11.654 which is greater than zero. The effect of this variable on Onion profitability is significant with a p-value = 0.050 such that farmers who

use irrigation systems have more likelihood of being profitable in onion production than those who do not use irrigation schemes by the odd ratio of 1.865 (Table 5). Anna (2011) supported these results by concluding that an increase in agricultural profitability depends largely on the availability of irrigation facilities.

3.2.3 Market Access

Market access exposed positive profitability of onion with an estimated odd of 1.865 which is greater than 1 and a Wald chi-squared test of 2.8881 which is greater than zero. The effect of this variable on Onion profitability is significant with a p-value = 0.050 (Table 5). This explains that improved market accessibility to onion farmers increases onion profitability. These results correspond to those of Emmanuel (2021), who noted that lack of market affects the profitability of onion and vice versa is also true.

3.2.4. Financial factors

3.2.4.1 Market price

Market price disclose positive relationship with onion profitability with a positive regression coefficient of 1.589 and a Wald chi-square test statistic of 1.787 which is greater than zero. The result shows that when the price is greater than 3,500 Tsh Farmers have more likelihood to be profitable in onion production than when the market price is less than 3500 Tsh by the odd ratio of 4.899. The results are significant with p-value = 0.034 which is less than 0.05. and explained that they have a positive effect on onion profitability.

3.2.4.2 Credit Access

Credit access has a positive regression coefficient of 1.106 and a Wald chi-squared test of 2.701 which is greater than zero. The results are significant with a p-value = 0.021 at $p< 0.05$(Table 5). This shows that onion farmers who are able to access credit services have more likelihood to make a profit than those who cannot access credit services. The study results concurred with Ekunwe *et al.* (2015), who explained that credit beneficiaries were more profitable in crop production than non-credit beneficiaries.

Therefore, from the findings, sex (0.047), education (0.029), capital (0.049), seeds variety (0.011), market access (0.05), market prices (0.034), credit (0.034), irrigation (0.05), use of inorganic fertilizer (0.032) and farm size (0.016) were significantly affected the profitability of onion production. Also, the Nagelkerke correlation coefficient (R2) value of 0.988 means that about 98.8% of the variation in profitability of onion production is explained by the mentioned factors above. Age of respondents (0.053), pesticides use (0.395), extension services (0.422), market infrastructure (0.973) and farming costs (0.137) had an insignificant effect on onion profitability since their p-value is greater than 0.05 and the odds ratio is above 1.

3.3 Strategies for improving onion profitability

Respondents were required to select the strategies employed to improve profitability from the list provided (Figure 1). Wholesale selling scored 75%, followed by improving yield and quality (62.8%), access to market information (59.1%) and forming of water users associations (50.9%). Those who scored below 50% were microfinance institutions (42.4%), market associations (36.4%) and research support (24.2%) (Figure 1).

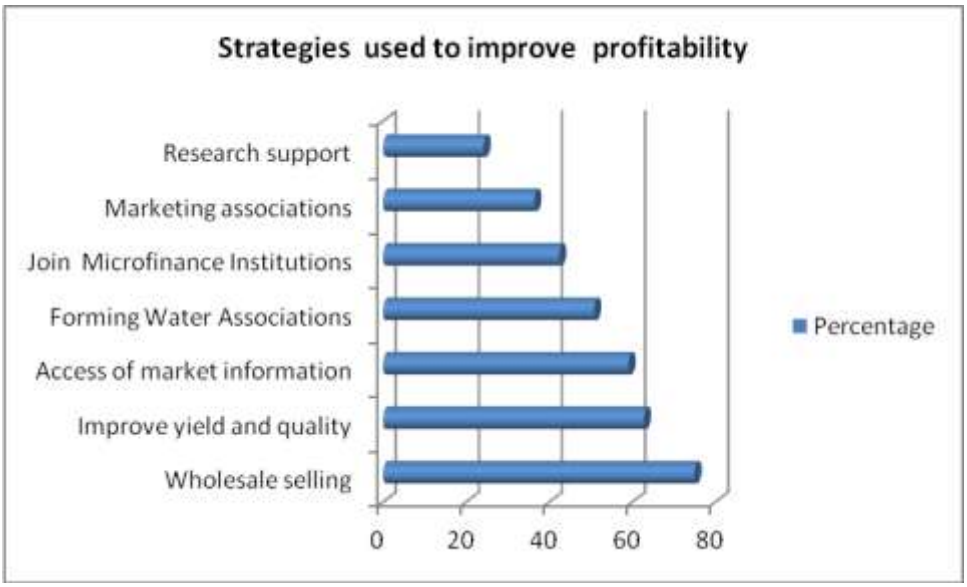

Figure 1: Strategies used to improve onion profitability

*Multiple response

3.3.1 Wholesale selling

The results in Figure 1 found that farmers preferred to sell in wholesale than retail. In wholesale the farmers carry their produce to local markets in Mpwapwa town where they sell at competitive market prices. However, farmers lack strong organized marketing groups to solicit marketing information. The results are supported by Canale and Alba, (2021) who reported that awareness of the market prices, knowledge of publicly available market prices and purchasing contract terms improve producers' incomes.

3.3.2 Improve onion quantity and quality

Ways of improving yield and quality ofonion werereported by the respondent as follows; *"improved seeds, pests and insects control and proper storage strategies are used to increase profitability. However, we are limited with fund to buy some inputs*". The results are similar to those of Zenbaba (2021) who noted that improved seed varieties, fertilizers, quality seeds, irrigation services, crop protection methods and storing houses improve the profitability of onions.

3.3.3 Formation of water users association

Water Users Association (WUA) was one of the strategies used by farmers to solve irrigation challenges (Figure 1). Information obtained from the Ward Executive Officer (WEO) reported that WUA helps farmers to monitor, manage, distribute and conserve water, resolving water conflicts and fees collection. However, the association is constrained by poor management of water fees collection. Aarnoudse (2018) supported this studyand observed that many farmers have not proved effective at cost recovery or become financially self-sufficient.

3.3.4 Access of Market Information

The results in Fig.1, farmers seek information in order to improve onion productivity. The information required is aboutcurrent crop prices, transport costs, quantity and quality of onion

required. Information from farm the extension officer explained that many farmers get market information from friends within Mpwapwa town and in the radio broadcastings. The results concurred with those of Abebe (2018) who realized that information from different sources like radio, television and friends help farmers to facilitate the use of production technology.

4.0 Conclusion and Recommendations

4.1 Conclusion

This paper evaluates determinants of onion profitability among smallholder farmers in the Mpwapwa district, Dodoma region. The profitability of onion is determined through average gross profit, average gross profit margin, average net profit and average net profit margin. It was noted that production was profitable since the annual average margins were 35.3% and 31.7% respectively. However, these margins were lower in rainy seasons(34.4% and 31.3%) compared to dry seasons (38.1% and 33.8%) due to an increase of production costs in rainy seasons specifically, weeding, spraying and pesticides.

Additionally, factorswhich significantly affected the profitability of onions with a value of $p < 0.05$ were sex, education, capital, seeds variety, access to market, market prices, access to credit services, irrigation technology, use of inorganic fertilizer and farm size. Age of respondents, pesticides, extension services, market infrastructure and farming costs insignificantly affected the profitability of onions since their p-value was greater than 0.05.

Moreover, the main strategies employed by farmers to improve onion profitability included wholesale selling, improving onion quantity and quality of production, formingWUA and access to market information. However, the WUA is constrained by poor management of fees collection. Additionally, farmers were limited with the strongly organized group which deals with market information and sharing production costs. Also, few respondents reported for joining microfinance institutions, market associations and the use of research findings to support onion farming.

4.2 Recommendations

Based on the findings, the following are the recommendations. Irrigation technology on the 462 ha available for onion production should be improved through community efforts together with the support of the Ministry of Water and Irrigation and interested development partners. Farmers have to be encouraged to join or form their microfinance institutions such as Savings and Credit Cooperative Societies (SACCOS) where through their savings they can access cheap credits to improve capital. The capacity building to the Water Users Association management have to be done to enable it to discharge irrigation obligations diligently.

Also, due to the increase of production costs in the rainy season, specifically, weeding, sprayingandpesticides the farmers have been encouraged to form marketing associations like Agricultural Marketing Cooperative Society (AMCOS) which will give them a joint bargaining power in the market when purchasing farm inputs. Also through their associations they can share inputs and marketing costs.

In addition, extension services, and research activities haveto be improved to assist farmers to increase profitability through farming technology improvement, use of improved seed varieties and proper use of inorganic fertilizer. The district council have to allocate a budget for the improvement of market infrastructures to enable farmers to access onion markets. The farmers through their organized associations as cooperative societies have to improve access to production and marketing information to enable them to get markets and agricultural inputs.

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