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Full Length Research Paper

Profitability Analysis of Wine Grape Farms among irrigated and rain-fed farming systems in Dodoma Region, Tanzania

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The study compared profitability between irrigated and rain-fed farmers in Dodoma City and Chamwino District. Multi-stage and random sampling procedures were used to select the study area. A sample of 359 farmers was selected from two strata using a systematic sampling procedure. The data were collected using a structured questionnaire. Farm budgeting techniques and descriptive statistics were used to analyse profit levels. The findings showed that grape farming is a profitable venture in the study area. Farms under irrigation had significantly higher profit levels (return on investment TZS 1.79) compared to those under rain-fed wine grape farming (TZS 1.29). The economic implication is that the average returns for every shilling invested in wine grape production are higher than the prevailing weighted average rates on risk free investment such as treasury bills and bonds, which currently stands at 16.8 – 18.7% in the country. The study, therefore, recommends that any measure that promotes wine grape farming under irrigation is worthwhile to increase smallholder farmer`s income in the Dodoma region.

Keywords: Profitability, Wine Grape, Farm Budgeting technique, smallholder

INTRODUCTION

Grape is one of the world's largest economic fruits. Grape is a fruit of the grapevine from commonly known species *Vitis Vinifera L.* of the family Vitaceae (FAO, 2009; Khair *et al.,* 2009). Grape is the second most produced fruit after banana in terms of net edible quantity in the world (FAO and OIV, 2016). Being a fruit, grapes can be consumed both as fresh and processed products such as wine, juice, dried grapes, jam, and vinegar. Around 50% of global grape production is used for making wine and about one-third is used as fresh fruits while the rest are used for making juice and dried to make raisins (FAO and OIV, 2016). Apart from multiples usage of grapes, the grape also has numerous nutritional and health benefits to the human body. If grapes are eaten as fresh fruits, they provide the richest source of carbohydrates (15 to 18g per 100g serving) and one with a relatively high calorific content. The glycaemic index of grapes is very low (51g per 100g serving), falling at the low end of the range, it is therefore considered appropriate for inclusion in diets for diabetic individuals (FAO and OIV, 2016). According to the literature indicates the low glycaemic

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index varies from 1 to 55g, medium varies between 56 and 69g, while high glycaemic index starts at 70g and above[1]. Grapes also provide an important source of vitamins and minerals such as Vitamins B6, thiamine (Vitamin B1), vitamin C (citrus Acid), vitamin E, potassium and manganese. These minerals and vitamins are very important for strengthening body immunity and prevent the human body from infectious diseases. Moreover, grapes contain an antioxidant compound (*polyphenols, and other compounds like phenolic acids, anthocyanidins, anthocyans*), which help the body function, reduces the risk of heart diseases, and prevents the development of obesity and type 2 diabetes as well as processing *cardio-protective, neuro-protective*, antimicrobial and anti-aging properties (FAO-OIV, 2016; OIV, 2017b).

Besides, the grape subsector has a lot of economic benefits. Being a high-value economic fruit, the grape is one of the important sources of foreign export earnings and it has a different contribution to the national income of the producing countries (Punjabi and Mukherjee, 2015). Grapes and grape products are sold to provide cash income for individual farmers. It is also a significant source of foreign exchange for many countries. The global grapes trade stands at 1.5 billion USD, while the trade for grape products such as wine stand at 32.6 billion USD in 2016 (Punjabi and Mukherjee, 2015; OIV, 2017b). As such wine grapes play a significant role in the national income of producing countries in the world. Although the exact contribution of grape to the national income in Tanzania is not known, it is well-documented that grape cultivation contributes about 36% of household income among grape producing farmers particularly in Dodoma city (Lwelamira *et al.,* 2015a).

Likewise, grape cultivation provides direct employment to about 1700 households and the crop also benefits indirectly the livelihood of about 7800 beneficiaries at the farm level in the study area (UNCCD, 2013; Robbins, 2016). This figure does not include the number of service providers who are involved in the value chain such as trading, transporting, processing and packaging. Also, grape cultivation provides the raw material for many processing industries such as wine, juice, jam and vinegar, hence it is particularly poised to contribute to the contemporary national agenda of pushing the national economy from lower middle-income to higher middle income level. Despite these mentioned importance of grapes, the grape subsector has challenges of high input cost, low output prices, and limited access to the market (Lwelamira *et al.,* 2015a; Kulwijila *et al.,* 2018). For example, between 2010 and 2016, the cost of production rose from 290,000 to 730,000 TZS per tons of grapes, while farm gate prices remained relatively low, ranging from 500 to 1200 TZS per kilogram of grapes (Lwelamira *et al.,* 2015a; LWR, 2016). This affected farmer's income, which led to low-profit levels. The government and development partners took steps to address these problems such as establishing Makutupora research and training center, establishing irrigation scheme, processing firms and providing technical assistance to farmers in order to improve grape productivity and hence increase farmer's income and profit (URT, 2017; UNCCD, 2013). Unfortunately, these efforts have not improved grape productivity which is an important factor to ensure farmers` high profit and profitability (UNCCD, 2013).

Some research has been conducted sporadically on the profitability of grape farms elsewhere in the world (Khair *et al.*, 2009; Pappalardo *et al.*, 2012; Di Vita and D'Amico, 2013; Tomsik *et al.*, 2016; Appasmandri *et al.,* 2017), but none have been done to investigate profitability analysis of wine grape farms among irrigated and rain-fed farming systems in Tanzania. Some researchers also have studied on grape farming in Tanzania with a multidimensional focus such as grape value chain analysis (Hussein, 2010; Kulwijila *et al.,* 2018), measuring technical efficiency (Lwelamira *et al.,* 2015b; Kalimang`asi and Mwembezi, 2019), grapevine farming and its contribution to household income (Lwelamira *et al.,* 2015a). Njovu (2018) focused on crop water requirements as well as response in terms of grape yield and quality to different irrigation regimes. To the best knowledge of the researchers, there are no documented studies that assessed wine grape profitability comparing between irrigated and rain-fed farms. This study therefore aimed at analysing the profitability of wine grape farming compared between irrigated and rain-fed situations. The findings of the study will help the policymakers to make appropriate policies and suggestions for the further development of wine grape production in the Dodoma and country-wide. To achieve the above objective, the study developed the following hypotheses.

The null hypothesis (H_0) states that: there is no significant difference in profit levels achieved by farmers in irrigated and rain-fed grape farming $H_{01} : \beta_1 = \beta_2$

The alternative hypothesis (H_1) states that; there is a significant difference in profit levels between irrigated and rain-fed grape farming $H_{a1} : \beta_1 \neq \beta_2$

[1] The glycaemic index range was taken from various sources including the International Table of Glycaemic Index and Glycaemic index food guide available at www.glycemicindex.com and www.google.com respective on 22nd April, 2020

METHODOLOGY

Study area

The study was conducted in the Dodoma City and Chamwino District because they are leading in commercial grape production in the Dodoma region. Dodoma region is located between latitudes 4º and 8º South of the Equator and between longitudes 35º and 37º East of the prime meridian (Greenwich). Specifically, Dodoma City is located between latitude 5.50^0 and 6.30^0 South of the Equator and Longitude 35.30^0 and 36.02^0 East of Greenwich, while Chamwino district is located at 4.0^0 and 8.0^0 Latitude South of the Equator and between 35^0 and 37^0 Longitude East of the Greenwich (URT, 2015b; URT, 2015c).

Sampling Procedure and Sample Size

This study used a cross-sectional research design. A multi-stage sampling procedure was used. In the first stage, purposive sampling was used to select the Dodoma region, Chamwino district, and the Dodoma city based on their relatively high volume of commercial grape production. Moreover, Dodoma city and Chamwino districts have benefited from various interventions for grape expansion and productivity improvement since the 1960s. In the second stage, simple random sampling was used to select wards from each district. Simple random sampling was also used to select villages or *Mitaa* (in Dodoma City) from each ward. Then, the grape farmers were stratified into two strata based on their farming system; that is differentiating farmers cultivating under irrigation and those based on rain-fed production technology. Further, a sampling frame from each stratum was ordered in randomly to ensure that the sample frame was representative of the total population. Finally, farmers were selected using a systematic sampling procedure from each stratum because it is easy and cost-effective to implement compared to simple random sampling. Moreover, a systematic sampling procedure is more practical because it ensures a more even distribution of the sample over the entire population (Kothari, 2004). A total of 359 grape farmers were selected from the sampling frame consisting of 1700 smallholder grape farmers. The sampling frame was established in collaboration with the agricultural district officials before the actual data collection. A structured questionnaire was used to collect primary data from the respondents. The instrument included questions on farming operations such as land area cultivated, number of people in farming operations, days and hours used to perform farm operations, the quantity of manure, and agrochemicals as well as the cost of labour, manure, agrochemicals and output price. The questionnaire also contained information on socio-economic, demographic and institutional factors such as age, sex, years of schooling, farming experience, access to extension services and credit facilities.

Analytical techniques

Profitability Analysis

The profitability of grape farms was determined by the farm budgeting technique. The farm budgeting technique was used because the method is simple to use with the available data sets. Net farm income (NFI) was computed as the difference between gross returns and total cost (Mohammed *et al.,* 2013; Mlote *et al.,* 2013; Nwike and Ugwumba, 2015). Gross returns refer to the sum of returns from the sale of crop production. Actual returns from wine grape production are the sum of returns from sale of wine grapes and the market value of grapes that was eaten as fresh fruits during harvest. However, it was difficult to accurately establish the number of wine grapes that were eaten as fresh at the farm level (normally the amount consumed at the farm gate is very small), hence only the value generated from the sale of wine grapes was used to compute gross returns. The analytical model to determine NFI is given as follow;-

$$NFI_i = P_y Y_i - \sum (v_i x_i + TFC_i) \quad (1)$$

Where:

$P_i Y_i$ – Gross returns of an individual farmer; P_y – sale price, Y_i – Physical output for the i^th^ farmer; $i = 1,2,3..., = n$; TFC_i – Total fixed cost; $v_i x_i$ – Total variable cost (TVC); and $\sum$ – The summation sign.

Gross Returns

Gross returns (GR) from wine grape production were obtained by multiplying the number of wine grapes sold and the market price, as presented in equation 2.

$$GR_i = \sum_{i=1}^{n} P_i Y_i \quad (2)$$

Where

GR_i = Gross returns i^{th} farmer for $i = 1,2,3 \ldots n$

The GR is one component of net farm income. The second component is the total cost (TC). Total cost refers to outlays of money expenditure on the resource used to produce a given output. This includes total variable costs (TVC) and total fixed cost (TFC).

Total variable cost

TVC was computed as the sum of labour cost, agrochemical cost and manure. Labour cost was computed based on annual farm management activities such as weeding, spraying, repair and maintenance, irrigation and pruning. The agrochemical cost included the cost of herbicides, fungicide, and insecticides. Thus, TVC was computed using equation 3:-

$$TVC = v_1 x_1 + v_2 x_2 + v_3 x_3 \ldots\ldots\ldots\ldots \quad (3)$$

x_1 – Quantity of labour used by i[th] farmers (working days/ha); x_2 – Quantity of manure used by i[th] farmers (kg/ha); x_3 – Quantity of agrochemical used by i[th] farmers (kg/ha); and v_i – Price of variable inputs

Total Fixed Cost

Total Fixed cost (TFC) consists of two parts; depreciation cost of productive farm tools and annual capital recovery cost. Depreciation refers to a decrease in the market value of tangible or physical assets with use over the expected useful life and the annual capital recovery cost is equivalent to the annual payment on loans for the initial investment made to establish a vineyard with the down payment equal to the discounted salvage value (McGourty *et al.,* 2012; Ingels *et al.,* 2013).

Depreciation cost

The depreciation cost of farm tools was computed using the straight line method because the economic life span of farm productive tools such as hoes, pairs of scissors, machetes watering can/irrigation pumps and sprayers; which are usually used to perform various vineyards activities do not exceed 5 years. As such, a final value for such types of tools is equal to zero (Matus and Paloma, 2014). Hence, the formula for computing annual depreciation cost is presented in equation 4.

$$\sum_{i=1}^{n} d = \frac{p - s}{E} \ldots\ldots\ldots\ldots \quad (4)$$

Where;

d – Annual depreciation
p – Purchase price
E – Expected useful life span input
s – Scrap value

Annual capital recovery cost

The annual capital recovery cost was computed from the initial investment cost made on the establishment of a vineyard. This method is more accurate than straight-line depreciation and opportunity cost because it takes into account the time value of money. The capital recovery cost was computed at the market interest rate of 18% and the expected economic life of a vineyard is 20 years. The initial investment cost was established from activities such as land preparation, trenching, manure application, filling trenches, cutting/seedling and transporting trellis, erection of trellis, putting irrigation system and planting. The formula for computing annual capital recovery cost is expressed in equation 5.

$$A = [(p - s) * f + (s + r)] \ldots\ldots\ldots\ldots \quad (5)$$

Where;

A – Annual capital recovery cost
f – Capital recovery factor obtained from amortization table of value[2]
r – Market interest rate (annual interest rate 18%[3])
p – Purchase price (established initial investment cost), and
s – Scrap value

Hence, TFC was obtained by adding computed annual depreciation cost (equation 4) and annual capital recovery cost (equation 5), as presented in equation 6.

$$TFC_i = d_i + A_i \ldots\ldots\ldots\ldots \quad (6)$$

Where;

[2] Capital recovery factor was obtained from Amortization Table at the interest rate of 18% and 20 years

[3] Source: Commercial lending rate is 18% in 2016 available at www.bot.go.tz: Bank of Tanzania (BOT)

Table 1. Descriptive Statistics

Variable	Units	Average	SD	Minimum	Maximum
Age	Years	43	11	22	65
Education	Years of schooling	8	3	0	16
Farming experience	Years in farming	10	6	3	43
Household size	Head count	5	2	1	10
Vineyard size	Hectare	0.54	0.29	0.10	3.24
Quantity of Yield	Kg	5,688	3,832	206	27,993
Quantity of Manure	Kg	5,921	7,478	1,647	49,400
Quantity of Agrochemical	Kg	13	9	4	56
Quantity of Labour	Man-day	171	83	20.3	349
Wine grape price	TZS	964	253	500	1500

Source. Survey Data, 2016
Note. TZS - Tanzanian shilling; SD - Standard deviation

TFC_i = Total fixed cost for i^{th} farmer

d_i = Annual depreciation of small productive tools for i^{th} farmer

A_i = Annual capital recovery cost for i^{th} farmer;

This worked out TFC was added to TVC to obtain TC for the respective farmer, as presented in equation 7.

$$TC_i = TVC_i + TFC_i \quad (7)$$

Hence, the profitability analysis of wine grape farmers was computed using Return on Investment (ROI), as presented in profitability analysis.

Profitability Analysis

The ROI was computed as a ratio of NFI to (TC) per hectare, as expressed in equation 8.

$$ROI = NFI / TC \quad (8)$$

The economic implication is that if $NFI = TC$, implying that a farmer is operating on break-even point therefore there is no additional income for every shilling invested, while if the $NFI > TC$, implies that for every shilling invested there is extra additional income. Likewise, if $NFI < TC$, implies that a farmer is operating at loss.

Results and Discussion

Descriptive Statistics

The descriptive statistics of the sampled wine grape farmers are presented in Table 1. On average, a typical wine grape farmer in the study area was 43 years old, with 8 years of education, 10 years of farming experience and average household size of 5 persons. Moreover, on average smallholder wine grape farmers cultivated 0.54 ha, used about 5,921 kg/ha of manure and applied 13 kg/ha of agrochemicals as well as employed about 171 manday/ha to maintain a vineyard per year. The results (Table 1) also show that on average wine grape farmers recorded a mean yield of 5,688 kg/ha of fresh grapes with a standard deviation of 3,832 kg/ha. This high standard deviation indicating that there is high variability in actual yields obtained among farmers in the study area.

Also, on average a wine grape farmers recorded a price of 964 TZS/kg of fresh grapes with a standard deviation of 253 TZS/kg. This gives us a coefficient of variability (CV) of 26%, implying that majority of farmers recorded the average price of fresh grapes that varied greatly from the average price recorded in the sample area. These differences can be explained by the nature of the market for fresh grapes which is highly fragmented based on locality and external buyers. Nevertheless, some farmers are found far away from the market especially processing industries, which led them to fetch low prices compared to farmers who are close to the market. Next section presents the results of each input

Table 2: Input Cost Analysis

Cost Items	Description	Whole sample n=359	Irrigation n=176	Rain-fed n=183	Z-test of mean difference
Labour cost (TZS/ha)	Mean	1,073,502	1,145,002	999,157	2.6***
	SD	519,927	520,553	510,182	
	Minimum	134,801	134,801	242,240	
	Maximum	1,694,271	1,694,271	1,342,788	
Agrochemicals cost (TZS/ha)	Mean	367,500	377,113	323,004	2.2**
	SD	267,450	267,440	185,408	
	Minimum	58,593	65,577	58,593	
	Maximum	1,464,529	1,342,788	1,464,529	
Manure cost (TZS/ha)	Mean	65,541	78,583	50,761	3.6***
	SD	83,540	90,668	52,879	
	Minimum	14,114	14,114	21,051	
	Maximum	428,133	428,133	378,924	

Source. Survey Data, 2016; ***,** significant at 1% and 5 % respectively

costs used in wine grape farming.

Input cost Analysis

Table 2 presents input cost analysis. The results show that farmers under irrigated production technology used a significantly higher labour cost (1,145,002 TZS/ha) compared to 999,145 TZS/ha for farmers under rain-fed production system $(Z = 2.6; \alpha = 0.05)$. This difference can be explained by the additional activities, which are performed by farmers under irrigation, such as watering, they face an increased number of weeding, spraying, repair and maintenance of irrigation infrastructures. Labour cost per hectare had a higher standard deviation indicating that there was great variation in labour cost for most of the smallholder farmers.

The results (Table 2) also show that farmers under irrigation production technology had a higher mean cost of agrochemicals (377,113 TZS/ha) compared to farmers under rain-fed production technology (323,004 TZS/ha), being significantly different $(Z = 2.2; \alpha = 0.05)$, this is mainly because farmers under irrigation farming used significantly high quantity of agrochemicals. Frequent watering of grapes produced under irrigation also creates a conducive environment for insect reproduction, which increases the incidence of pests attack on grapes. Consequently, farmers under irrigated farming used significantly higher quantity of agrochemicals, hence incur higher agrochemical cost.

Annual Capital Recovery Cost

Table 3 presents annual capital recovery cost analysis. Results indicate that farmers under irrigation production technology had significantly higher annual capital expenditure (619,103 TZS/ha) compared to 509,826 TZS/ha for farmers under rain-fed production technology. This difference arises from the initial establishment cost of the vineyard, which was used to compute annual capital recovery costs. For example, the initial establishment cost of a vineyard under irrigated is higher (about 16.3 million TZS/ha) compared to 7.5 million TZS/ha under rain-fed grape (LWR, 2016). Likewise, manure cost is significantly higher (78,583 TZS/ha) under irrigation farming than 50,761 TZS/ha under rain-fed production $(Z = 3.6; \alpha = 0.001)$. This difference rises from the quantity of manure applied to the vineyard because farmers under irrigation applied a higher quantity of manure compared to farmers under rain-fed.

Apart from analysing input cost analysis and annual capital recovery costs, it is useful to know the cost structure for each production technology. Hence, the cost

Table 3. Annual Capital Recovery Cost

Cost Items	Description	Whole sample n=359	Irrigation n=176	Rain-fed n=183	Z-test of mean difference
Annual capital recovery cost (TZS/ha)	Mean	469,194	619,104	509,826	3.1***
	SD	310,663	329,495	335,480	
	Minimum	85,812	101,269	85,812	
	Maximum	914,822	914,822	673,924	

Source. Survey Data, 2016; *** significant at 1%

Table 4. Estimated cost structure of grape farming

		Irrigation n=176		Rain-fed n=183	
	Description	Amount	Percent	Amount	Percent
	Labour cost				
1	Pruning	159,973	10	142,202	10
2	Tying	123,444	8	136,589	10
3	Weeding	313,648	20	265,070	19
4	Trellis repair	61,722	4	77,962	6
5	Spraying	96,991	6	94,459	7
6	Irrigation	110,847	7	0	0
7	Manure application	94,472	6	82,502	6
8	Replacement/repair	42,198	3	60,810	4
9	Harvesting	141,708	9	139,552	10
10	**A. Total labour Cost**	**1,145,002**	**72**	**999,145**	**73**
11	B. Agrochemical (kg)	377,113	24	323,004	24
12	C. Manure (kg)	78,583	5	50,761	4
13	TVC (A+B+C)	**1,600,699**	**100**	**1,372,910**	**100**
	Fixed cost				
14	Depreciation	52,898	9	42,098	8
15	Annual recovery Cost	566,206	92	467,728	92
16	Total Fixed cost (14+15)	619,104	100	509,826	100
17	Total Cost (13+16)	**2,219,803**		**1,882,736**	

Source. Field survey (2016)

structure of grape farming is presented in the next section.

Cost structure of grape farming

The cost structure of grape production is shown in Table 4. Irrigating farmers generally incurred a higher cost of production compared to rain-fed farmers as can be seen by the cost of labour, agrochemical, manure and fixed cost. The total annual cost of production under irrigation farming was about 2,219,803 TZS/ha while under rain-fed was about 1,882,736 TZS/ha. The total variable cost is 1,600,699 TZS/ha under irrigation and 1,372,910 TZS/ha under rain-fed farming. Total variable cost represented

Table 5. Profitability Analysis

	Description	Irrigation n=176	Rain-fed n=183	Z-test for mean differences
1	Quantity of grape (kg/ha)	6,322	5,079	3.1***
2	Mean price (TZS/kg)	964	964	
3	Mean labour (Man-day/ha)	182	160	2.5***
4	Gross returns(sale of grapes) (1X2)	6,092,308	4,893,988	
5	Total Variable Costs	1,600,699	1,372,910	
6	Total fixed cost	619,104	509,826	
7	Total Production Cost (5+6)	2,219,803	1,882,554	
8	Gross Margin (4 - 5)	4,491,610	3,511,261	
9	Profit (4-7)	3,872,505	3,011,251	
10	Return on Investment (9/7)	1.74	1.29	2.0**

Source. Field survey (2016)
Note. *** implies significance at 0.01 probability level, and
** implies significance at 0.05 probability level.

72% of the total production cost under irrigation and 73% under rain-fed, while fixed cost stood at 619,104 TZS/ha under irrigation and 509,826 TZS/ha under rain-fed. Total fixed cost represented 28% of the total cost under irrigation and 27% under rain-fed.

The findings reveal that labour cost represented the highest percentage of the cost structure for all farmers varying from 69% to 73% (Table 4), followed by the cost of agrochemical which varied between 23% and 26%. The least-cost component for total variable cost was manure, varying between 4% and 5% for all farmers. This high labour cost was attributable to a low level of mechanization since every activity is done manually. Weeding was the most costly farm labour operation, which stood between 19% under rain-fed and 20% under irrigation. The least expensive labour cost component was repair and maintenance, ranging from 3 to 4%. Other cost items include annual capital recovery cost and depreciation. The annual capital recovery cost constitutes the highest (92%) share of fixed cost.

Profitability Analysis

The results presented in Table 5 show that gross returns from grape production were 6,092,309 TZS/ha under irrigation and 4,893,988 TZS/ha under rain-fed production technology. The gross margin was 4,491,610 TZS/ha under irrigation and 3,511,261 TZS/ha under rain-fed, while the net farm income was estimated at 3,872,505 TZS/ha under irrigation and 3,011,251.55 TZS/ha under rain-fed. The return on investment from wine grape farming was TZS 1.74 under irrigation and TZS 1.29 under rain-fed, implying for every one shilling invested in production there was an additional return of TZS 0.74 under irrigation and TZS 0.29 under rain-fed. The difference in return on investment between irrigated and rain-fed is significant $(Z = 2.08 : \alpha = 0.05)$, therefore null hypothesis of this study was rejected, implying that there is a significant difference in profit levels between irrigated and rain-fed grape farming.

The return on investment under irrigated farms is higher than findings by Khair *et al.* (2009) who reported a return of 38% in the grape orchard in Pishin – Pakistan and the findings by Appasmandri *et al.* (2017) who found a 39% return on grapevine production in Coimbatore in India. The higher return on investment for grape farming in Dodoma could be attributed to prevailing good weather conditions for grape farming in the Dodoma region as compared to hot climate in Pakistan and India, eventually leads higher farm productivity and profit levels. Also, a good output market led to a higher price during the 2015 growing seasons. All these factors ensure higher farm income and profit levels leading to higher return on investment among farmers. Moreover, the average returns for every shilling invested in wine grape production in the study area are higher than the prevailing weighted average rates on risk-free investment such as treasury bills and bonds, which currently stands

Table 6. Distribution of wine grape farmers by profit levels

Profit levels (TZS/ha)	Whole sample Distribution %	Rain-fed Distribution %	Irrigated Distribution %	Min/Max
0<	8	9	6	(2,147,639)
1-1,000,000	14	17	11	
1,001,000–5,000,000	52	48	57	
5,001,000-10,000,000	18	19	18	
> 10,000,000	8	7	9	
Total	**100**	**100**	**100**	24,180,640

Source. Field survey (2016)

at 16.8 – 18.7% in the country (Bank of Tanzania–BOT, 2017).

Distribution of grape farmers by profit levels

The distribution of grape farmers by profit levels is shown in Table 6. The results indicated that approximately half of the farmers (52%) received profit varying between 1,001,000 and 5 million TZS/ha. About 8% of farmers had a loss and 8% received profit above 10 million TZS/ha. The proportion of farmers who received a profit level between 1,001,000 and 5 million TZS/ha was higher under irrigation (57%) compared to farmers under rain-fed farming (48%). Also, the proportion of farmers who received a profit level above 10 million TZS/ha was higher under irrigation (9%) compared to farmers under rain-fed (7%). Meanwhile, the proportion of farmers who incurred a loss was higher under rain-fed (9%) compared to those under irrigation (6%). The maximum return was 24,180,640 TZS/ha, while the highest loss was 2,147,639 TZS/ha. None of the wine grape farmers operated at the break-even point that is $TR - TC = 0$.

CONCLUSION AND RECOMMENDATION

The analysis of wine grape profit level revealed that the majority of the farmers is realization positive net farm income, with only fewer farmers had incurred net losses. Based on the study findings it can be concluded that grape cultivation is a profitable venture in the study area. However, farms under irrigation had significantly higher profit levels compared to farms under rain-fed production. Hence, the study recommended that any measures directed at improving wine grape production under irrigation are worthwhile.

REFERENCES

Appasmandri S, Anjugam M, Sathaiah M, Muthuraja B (2017). Production and Profitability Analysis of Grapevine Orchard in Coimbatore, Tamil Nadu, India. Int. J. Curr. Microbiol. Appl. Sci., *6*(7): 2172-2180.

Bank of Tanzania (BOT) (2017). *Bank of Tanzania Annual Report 2015/2016, Bank of Tanzania,* Dar es Salaam, Tanzania. 244pp.

Di Vita, G, D'Amico, M. (2013). Origin Designation and Profitability for Small Wine Grap Growers: Evidence from a Comparative Study. Economics of Agriculture, 60(1), 7-24.

Food and Agriculture Organisation (FAO) (2009). *Agribusiness Handbook, Grape and Wines;* Food and Agriculture Organisation Investment Centre Division, Rome, Italy. 37pp.

Food and Agriculture Organisation (FAO) and Internation organisation for wine and Vine (OIV) (2016). Table and dried grapes: Non-alcoholic products of viticulture sector intended for human consumption, FAO and OIV, Rome, Italy. 62pp.

Hussein S (2010). Value Chain Analysis of Grapes in Tanzania. Unpublished dissertation for Award of MSc. Degree at Sokoine University of Agriculture, Morogoro.Tanzania. 1-72 pp.

Ingels CA, Klonsky KM, De Moura RL (2013). Wine grapes Costs and Returns Study, Sacramento Valley, University of California, USA. 21pp.

Kalimang`asi NN, Mwembezi GP (2019). Technical Efficiency among Smallholder Grape Farmers in Dodoma Region, Tanzania, Plan. Dev.Init. J., 4: 5-27

Khair S, Ahmad M, KHAN M (2009). profitability analysis of grapes orchards in pishin: an ex-post analysis. Sarhad J. Agric., 25(1): 103-111.

Kothari CR (2004). Research Methodology, Methods and Techniques (2nd Revised Edition)(Second Revised ed.). New Delhi, India: New age International (P) Limited, 401pp.

Kulwijila M, Makindara J, Laswai H (2018). Grape Value Chain Mapping In Dodoma Region, Tanzania. J. Econ. Sustain. Dev., 9(2): 171-182

Lwelamira J, Safari J, Wambura P (2015a). Grapevine

Farming and its Contribution to Household income and Welfare among Smallholder Farmers in Dodoma Urban District. Am. J. Agric. For., 3(3): 73-79.

Lwelamira J, Wambura P, Safari J(2015b). Technical efficiency in grape farming among smallholder farmers in Dodoma urban. Rural Plan. J., 17(1): 1-16.

Lutheran World Reliefs (LWR) (2016). Market study of grape juice industry in Dodoma, Tanzania. [htt://www.google.com] site visited on 16/01/2017.

Matus SL, Paloma S (2014). Farm viability of (semi)subsistence smallholders in Sierra Leone. Afri. J. Agric. Res. Econ., 9(3): 165-182.

McGourty G, Sumner DA, Gutierrez C, Stewart D (2012). Sample Costs to Produce Wine Grapes, using Biodynamic Farm Standard-Principles. University of California Agriculture and Natural Resources Cooperative Extension, Working paper 1.

Mlote SN, Mdoe NSY, Isinika AC, Mtenga LA (2013). Profitability analysis of small scale beef cattle fattening in the Lake Zone in Tanzania. J. Agric. Econ. Dev., 2(5): 203-216.

Mohammed AB, Ayanlere AF, Ekenta CM (2013). Profitability of coffee production in Kabba/Bunu local government area of Kogi state, Nigeria. *Afri. J. Agric. Res., 8*(23): 2897-2902.

Njovu A (2018). Effect of irrigation regimes on yield and quality of grapes (Vitis vinifera L. cv. ‘Makutupora red’) in Dodoma. Unpublished thesis for Award of Doctor of Philosophy at Sokoine University of Agriculture, Morogoro. Tanzania. 1-115 pp.

Nwike MC, Ugwumba CO (2015). Profitability of Rice Production in Aguata

Agricultural Zone of Anambra State Nigeria: A Profit Function Approach. Am. J. Agric. Sci., *2*(2), 24-28.

OIV (2017b). World Vitiviniculture Situation: OIV Statstical Reporton World Vitiviniculture. [htt://www.FAOorg/publications] site visited on 12/01/2018.

Pappalardo G, Scienza A, Vindigni G, D'Amico M (2013). Profitability of wine grape growing in the EU member states. J. Wine Res., 24(1): 59-76.

Punjabi M, Mukherjee A (2015). Grape exports under GLOBALGAP certification the Mahindra and Mahindra initiative in India. [http://www.FAO.org./publication] site visited on 22/4/2019.

Robbins G (2016). *Report for UNCTAD on the Potential for Quality Upgrading and Business Linkages Creation in the Tanzanian Wine Industry. FINAL DRAFT:* UNDAP, Dar es Salaam, Tanzania. 51pp.

Tomsik P, Stojanova H, Sedlo J, Vajcnerova I(2016). Factors of profitability of the grapes production. *Agricurual Economics – Czech, 62*(6), 292–297.

United Nations Convention to Combat Desertification (UNCCD) (2013). (2013). Grapes Value Chain Analysis Dodoma, Tanzania *, Final Draft Report.* UNCCD, Dar es Salaam, Tanzania. 57pp.

United Republic of Tanzania (URT) (2015b). *Chamwino District social economic profile report.* Chamwino District Council, Dodoma, Tanzania.22pp.

United Republic of Tanzania (URT) (2015c). City Council of Dodoma social economic profile report. City Council.of Dodoma, Dodoma, Tanzania. 60pp.

United Republic of Tanzania (URT) (2017). *Tanzania National Panel Survey Wave 4, 2014 – 2015.* National Bureau of Statistics,Ministry of Finance and Planning, Government priter, Dar es Salaam, Tanzania. 104pp.