

Impact Assessment of CREATE Fund Program on Agricultural Productivity, Income and Food Security in Zimbabwe

Report submitted to:
Zimbabwe Agricultural Development Trust
44 The Chase, Mt Pleasant
Harare

*Conrad Murendo, Machiweyi Kunzekweguta, Muchaneta Pondiwa, Kamurai
Mhovha, Gamuchirai Murenje and Kizito Mazvimavi*

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
*Matopos Research Station,
P.O. Box 776,
Bulawayo,
Zimbabwe*

Table of Contents

<i>Table of Contents</i>	<i>ii</i>
<i>List of Tables</i>	<i>iv</i>
<i>Executive Summary</i>	<i>v</i>
1 INTRODUCTION	1
2 OBJECTIVES	1
3 MATERIALS AND METHODS	2
3.1 Data Collection and Analysis.....	2
3.2 Sentinel sites	2
3.3 Sampling frame	3
3.4 Analytical methods	3
4 RESULTS AND DISCUSSIONS	4
4.1 Socio-economic characteristics of farmers	4
4.2 Smallholder farmers' access to credit and relationship with the borrower	6
4.2.1 Nature of operation and challenges faced by smallholder farmers	6
4.2.2 Conditions required to obtain the credit?	12
4.2.3 Percentage of farmers who borrowed disaggregated by gender	13
4.2.4 Form of credit accessed by smallholder farmers.....	14
4.2.5 Type of inputs received/purchased using cash from the borrower.....	15
4.2.6 Challenges faced in accessing credit from the borrower.....	15
4.2.7 Suggested solutions to the challenges encountered by farmers in accessing credit	16
4.2.8 Other services received from borrower (%).....	16
4.3 Crop production	18
4.3.1 Major crops cultivated by farmers in 2016/17 season	18
4.3.2 Effect of credit that was accessed by farmers on cereal production and productivity	19
4.3.3 Effect of credit on Michigan Pea bean and Mung bean production and productivity	20
4.4 Crop sales and access to market.....	22
4.5 Distance from the output market.....	22
4.6 Level of market participation	23
4.7 Economic value of crops grown, and contribution of CREATE Fund to total sales	24
4.8 Effect of the CREATE facility on crop and agricultural (farm) income.....	26
4.9 Reasons for selling crops	31
4.10 Challenges encountered by smallholder farmers during crop sales	32
4.11 Livestock Production	33
4.11.1 Types of animals owned	33
4.11.2 Output market of the livestock and livestock products	35
4.12 Off-farm income and other livelihoods strategies.....	36
4.13 Annual income generated by smallholder farmers (all sources).....	37

4.14	Using annual income as a measure of wellbeing	39
4.15	Asset accumulation	41
4.15.1	Type of assets usable and repairable owned	41
4.16	Food availability and access at household level	42
4.16.1	Food security measurements	42
4.16.2	Effect of credit on food security	43
5	<i>CONCLUSION AND RECOMMENDATIONS</i>	45
5.1.	Summary of findings.....	45
5.2.	Factors undermining the impact of CREATE facility.....	47
5.3.	Recommendations.....	47
5.4.	Conclusion	50

List of Tables

Table 1. Households interviewed in each district with respective value chains	3
Table 2. Socio economic characteristics of farmers and crops grown	6
Table 3. Collateral required to obtain credit by type of collateral and value chain (%).	13
Table 4. Form of credit accessed by smallholder farmers (%)	14
Table 5. Type of inputs received or purchased (multiple responses).....	15
Table 6. Challenges faced by farmers in accessing credit from the borrower (%)	15
Table 7. Solutions suggested by farmers to the challenges encountered in accessing credit (%).....	16
Table 8. Services received from the borrower (%)	16
Table 9. Other sources of credit accessed by smallholder farmers	17
Table 10. Crops grown by farmers in 2016/17 season (n=513).....	19
Table 11. Effect of past year credit on cereal production and productivity	20
Table 12. Effect of credit volume on Michigan peas and mung beans production and productivity	21
Table 13. Output market for the bulk of crops sold (includes all crops).....	22
Table 14. Distances travelled to the market and borrower (km).	23
Table 15. Crop sales by district for 2016/17 season	24
Table 16. Contribution of crop sales under CREATE Fund to total household sales	26
Table 17. Effect of credit access on crop and agricultural income (Binga and Murehwa)	27
Table 18. Effect of credit volume on crop and agricultural income (Binga and Murehwa)	28
Table 19. Effect of credit access and volume on perennial crop and agricultural income	29
Table 20. Effect of initial credit borrowed and duration on perennial crop income and farm income	31
Table 21. What were the reasons for selling your produce? (%)	32
Table 22. Challenges faced by farmers in selling their produce (%)	33
Table 23. Types of animals owned by farmers (%) (n=513)	34
Table 24. How many livestock animals do you currently own?	35
Table 25. Where did you sell your livestock?.....	35
Table 26. Off-farm income sources in the past 12months, % (n=513).	37
Table 27. Level of annual income generated by smallholder farmers	39
Table 28. Percentage of farmers leaving at above USD2 per day.	41
Table 29. Asset accumulation over 5 years ago.....	42
Table 30. Effect of credit borrowed last 12 months on household food security.....	43
Table 31. Effect of volume of credit initial borrowed on household food security	45

List of figures

Figure 1. Percentage of female farmers who borrowed by borrower (%).....	14
Figure 2. Livestock products produced in the last 12 months, % (n=513)	36

Executive Summary

The Zimbabwe Agricultural Development Trust (“ZADT”) provides soft loans through the Credit for Agricultural Trade and Expansion (“CREATE”) Fund for supporting smallholder agriculture in Zimbabwe. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) was commissioned by ZADT to conduct an impact assessment of the CREATE Fund in order to quantify the effect of the Fund on farmer’s agricultural production, asset accumulation, income, food and nutritional security. The study employed quantitative data collection techniques where the household questionnaire was used to collect information from 513 households. The study was carried out in targeted sentinel sites where different value chains were being supported by borrowers. The borrowers accessed funds from selected financial institutions to support farmers in various agricultural activities. The sentinel sites selected for the survey included Binga, Buhera, Chiredzi, Chipinge, Mt Darwin, Murehwa and Mutasa. Borrowers with active and matured facilities as well as long relationship with farmers were sampled to assess the sustainability of the intervention beyond the project life.

Impact of CREATE facility

The study results show that the program was successful in improving the welfare and income of farmers. The CREATE Fund improved smallholder farmer’s access to credit, particularly for women. Approximately 52% of the farmers that obtained the CREATE credit were female and this resonates with the Sustainable Development Goal 5 (SDG 5) of promoting gender equality and women empowerment (Ferguson, 2011). Results also show that farmers have limited access to credit from other sources. This reflects the importance of CREATE facility in addressing credit constraints among smallholder farmers. Farmers that participated in ZADT programme had better access to extension services. In addition, to government extension support services that are provided to all farmers, about 42% of farmers that participated in CREATE programme obtained additional extension support from borrowers. Availing extension support helps in building capacity among farmers and also improves productivity. This has spillover effects towards economic development.

Approximately 43% of the crops sales were obtained from the value chains supported by the CREATE facility. The CREATE Fund was instrumental in creating a stable, viable and guaranteed market for smallholder farmers. In addition, the introduction of new high value chains such as Michigan Pea bean among smallholder farmers is crucial. Crops sales from value chains supported by the CREATE facility contributed about 58% to total crop revenue generated in 2016/17 season. The regression results also showed that an extra dollar obtained from CREATE facility increases agricultural income by 110% and 55% for cereal crop and sugarcane farmers respectively. The results also show that sugarcane (Chiredzi), banana (Chipinge), tea (Mutasa) and sorghum (Binga) value chains performed better in terms of income generation. Michigan Pea Beans (Buhera) value chain was average. Income obtained through the borrower accounted for a greater proportion of income that was obtained from all crops sales. Mung beans (Mt Darwin) and maize (Murehwa) were the only value chains that did not perform well in the 2016/17 season. Sesame value chain was not functional in 2016/17 season, therefore farmers did not sell any crops through the borrower. Sidella Trading did not maintain the relationship with the farmers after the maturity of the facility. Overall, approximately 34% of the households earned more than US\$2 per day from the sales that were channeled through the borrower. Most of the income generated from crop sales under the CREATE facility (36%) was used to purchase food thereby improving dietary diversity. The regression results showed that a unit increase in the initial credit leads to a 2.4% and 3.7% increase in household dietary diversity and food consumption score respectively. Some of the farmers used the income to pay for school fees (28%). This has a positive and long-term effect on development. Farmers also reinvested income into agricultural activities (20%). The ability to reinvest ensures sustainability of farm enterprise.

Despite having impacted the farmers' livelihoods, the programme was not spared from drawbacks. Delays in disbursing credit undermined the impact of the CREATE facility. Approximately 37% of the farmers highlighted that they encountered delays in receiving credit / inputs. Delays in giving farmers inputs/credit results in late planting which usually leads to yield losses. Nearly 31% of farmers indicated that the repayment procedure and conditions were not clearly articulated. Lack of transparency usually leads to lack of trust and has negative effects on the farmer-borrower relationship.

Recommendations

There is need to increase the amount of credit offered to farmers as well as improve market linkages opportunities for farmers who are supported by the funded agricultural value chain actors. The results showed a positive relationship between amount of credit given to farmers and agricultural income. Market linkages could be improved by encouraging contractual arrangements that are beneficial to both the borrower and the farmer. These contractual arrangements should be in the form of written contracts as they show better levels of commitment. Efforts should also be channeled towards financing of crops that farmers are familiar with. It will be easier for farmers to produce good quality of the crops they are used to grow. The major crops grown by farmers include maize, groundnuts, sorghum and sugar beans. However, for common crops, measures to avoid challenges associated with side selling must be put in place.

The borrowers should be encouraged to give a comprehensive, business-oriented training to farmers. This is likely to enhance decision making (judgement) and also help farmers understand all deductions made on their revenue. Alternatively, farmers could be encouraged to form associations which would be used as a vehicle for providing training. Training provided to farmers should deliberately focus on business management, record keeping, budgeting, and marketing (including packing, handling of their farm produce, etc.). There is need to identify transparent and efficient ways of providing the services to farmers at a realistic cost, such that the cost under the facility is not way above the cost of obtaining inputs directly from agro dealers. There were cases where farmers had to pay about 28% more than what they would have paid if they had obtained inputs directly from agro-dealers. Likewise, in order to improve on convenience and welfare of farmers, borrowers should make prompt payments to farmers after collecting the harvested crops. Avoiding delays in settling the payments also improves farmers' confidence on the borrower. Efforts should be put in place to promote youth participation in the programme in order to ensure maximum productivity and continuity. The youth may have a greater potential in exploring other agribusiness opportunities.

Study findings indicated that the CREATE facility had a positive impact on improving livelihoods of participants. Generally, the facility led to improvements in agricultural productivity and incomes. The facility also improved on women empowerment given that most of the participants were female. However, there is need to address factors that hinder the impact of the facility. Given

the positive contribution that the facility has, there is need to continue availing the credit facility to farmers. Policies that strengthen the functioning of agricultural credit need to be promoted.

1 INTRODUCTION

The Zimbabwe Agricultural Development Trust (“ZADT”) was established in 2010 with the objective of providing soft loans to agriculture value chain actors working with and for the benefit of smallholder farmers in Zimbabwe. The Trust established the Credit for Agricultural Trade and Expansion (“CREATE”) Fund in 2010 as a revolving facility for the purposes of supporting smallholder agriculture in Zimbabwe (ZADT, 2016). The facility promotes smallholder farmers through financing and facilitating market driven initiatives. CREATE Fund aims at improving food security and incomes of rural households through contributing towards the recovery and the improvement of smallholder farming sector in Zimbabwe. The ZADT channels money under the CREATE Fund to local financial institutions in Zimbabwe to on-lend to smallholder farmers and to agriculture value chain actors who demonstrate that their business operations benefit smallholder farmers in the country. These value chain actors include processors, manufacturers, agro dealers, traders, wholesalers, transporters and contracting companies. These organizations typically buy from, sell and provide services to smallholder farmers (ZADT, 2016).

The first programming phase under this facility was from January 2010 to December 2015 with the first disbursements being done in 2012. Initially three (3) commercial banks were engaged to disburse the Fund. The number of financial institutions have since been increased to twelve (12) as at 30 June 2017 comprising eight (8) commercial banks and four (4) microfinance institutions. The second phase started in 2016 and will be running up to 2020 (ZADT, 2016). ICRISAT conducted the first round of the 3-year longitudinal sentinel study for this phase. The sentinel study aims at tracking the impact of the CREATE Fund within the second phase. The second and third rounds of the sentinel study will build on the 2017 round.

2 OBJECTIVES

This study aimed at quantifying the impacts of the CREATE Fund on smallholder farmers and also serve as a baseline for the three-year longitudinal sentinel study. Specifically, the study assessed the impacts of the CREATE Fund on:

- (i) agricultural (crop and livestock) productivity
- (ii) asset accumulation
- (iii) annual household incomes

- (iv) percentage of smallholder farmers who are earning more than US\$2 per day as a result of their participation in the funded value chains
- (v) food and nutritional security status of target smallholder farmers.

In addition, the study also verified the extent of women empowerment as well as highlight challenges faced by the farmers. The evaluation also highlights key lessons learnt from the agricultural finance model based on experiences of the linked smallholder farmers and the funded agribusinesses.

3 MATERIALS AND METHODS

3.1 Data Collection and Analysis

This assessment is based on the first round of surveys. The survey training and pretesting was done on 21 to 24 November 2017 in Bulawayo. The survey was conducted from 28 November to 22 December 2017 including the travelling dates. The survey team consisted of 2 teams with 2 supervisors and 8 enumerators. Household questionnaire was administered to beneficiaries (participants) of the CREATE Fund and non-beneficiaries to collect primary data. The household survey questionnaires were employed in order to capture information on demographic and livelihood characteristics; agricultural production, household income, participation in CREATE facility, credit access from other sources, food and nutritional security of the farmers. Tablets were used to collect household data using Open Data Kit (ODK) applications. Details of the quantitative survey are discussed below:

3.2 Sentinel sites

The study was carried out at selected sentinel sites, which are namely: Binga, Buhera, Chiredzi, Chipinge, Mt Darwin, Murehwa and Mutasa. A representative sample of value chains was randomly selected with assistance from ZADT. The sampling approach ensured selection of both active and matured facilities. Matured facilities were included in order to evaluate sustainability of the intervention beyond project life. Each district was related to one borrower meant to support a certain value chain except for Chiredzi which had two borrowers (Table 1).

3.3 Sampling frame

Table 1 shows the sample sizes for the treatment and control farmers by district, borrower, value chain and status of the facility. Farmers that have a relationship with the borrower are referred to as treatment and those without are the control group. The updated lists of treated farmers were obtained from the respective borrowers and this constituted the sampling frame. Wards and clusters were randomly selected in consultation with the borrowers. Efforts to obtain control group for all the value chains was sought. However, owing to the nature of the relationships between the borrower and farmers, finding a control group was difficult for some value chains, especially tea, sugar cane, mung bean, Michigan Pea beans, sesame and bananas because all the farmers are linked to borrowers. Therefore, the study only managed to have control group for maize and sorghum value chain. The control group consisted of farmers growing the crop but not linked to the borrower or any contracting company. The control farmers were drawn randomly from the same villages that share the same agro-ecology. Lists of farmers in each village were obtained from AGRITEX. The selected households were assigned unique respondent codes and geocoded to enable easy tracking in subsequent rounds of the study. A total of 64 households were sampled per value chain. The sampling approach yielded a total of 513 households from eight value chains. The interviews were conducted with the *dejure* or *defacto* household head, in some cases both husband and wife were interviewed.

Table 1. Households interviewed in each district with respective value chains

District	Borrower	Value chain	Status	Treatment	Control	Total
Binga	Ingwebu Breweries	Sorghum	Active	50	14	64
Chiredzi	Sidella Trading	Sesame	Matured	64	0	64
Chiredzi	Hippo Valley Ltd	Sugarcane	Active	64	0	64
Murehwa	Intwasa Pfumvudza	Maize	Active	51	13	64
Mt Darwin	Green Trade	Mung beans	Matured	64	0	64
Buhera	Cairns Foods	Michigan Pea Beans	Active	63	0	63
Mutasa	Hippocrene	Tea	Active	65	0	65
Chipinge	Matanuska	Banana	Matured	65	0	65
Total						513

3.4 Analytical methods

The statistical package for social sciences (SPSS) and STATA were used to analyze data. Inferences and descriptive statistics were used to present study findings. The pseudo-fixed-effect

(Mundlak, 1978) and Ordinary least squares regression models were used to estimate the effect of the CREATE Fund on agricultural income, household nutrition, production and productivity. The explanatory variables included; individual variables such as gender, age, education, access to information, fertilizer application, production and yield.

Credit access: Two dummy variables were used to measure credit access. (i) Whether household accessed credit in the past 12 months, and (ii) whether household received credit from borrower, thus has a relationship with borrower. Receipt of credit was coded as one and zero otherwise.

Volume (intensity) of credit: This was calculated as the amount of credit borrowed. The in-kind was converted to cash or monetary equivalence. The volume of credit received when the farmer first borrowed from borrower and volume obtained in the past 12 months were used in this analysis.

Duration of relationship: This was calculated as the number of years the farmer has a relationship with the borrower.

Data transformation: We use the inverse hyperbolic sine transformation (IHS). The IHS transformation is unique because it is applicable in regressions where the variable to be transformed may be positive, zero, or negative (Friedline et al., 2015; Zhang et al., 2000). We apply the IHS transformation to credit volumes, harvest, yields, crop and farm income as some of the observations of these variable are zero.

4 RESULTS AND DISCUSSIONS

4.1 Socio-economic characteristics of farmers

The descriptive statistics differentiated by value chain are shown in Table 2. Seventy eight percent (78%) of the interviewed households were male-headed and the average age of the household head was 54 years. There was less involvement of youths (farmers below 35 years) across value chains. Results from the overall sample indicated that about 24% of the respondents accessed credit from other sources besides the borrower. Decision making on input purchases and agricultural credit was predominantly done by females in all the value chains. About 82% of the farmers across all the districts accessed information from public extension officers and 45.2% received extension

advice through radios. Over 55% of the sampled farmers in the sugarcane, mung bean, banana and Michigan Pea bean value chains received extension support from the borrowers. Farmers from the eight (8) value chains were on average located 12 km from AGRITEX offices. Suvedi et al. (2017) revealed that access to extension enhances farmer participation in extension activities and affects technology adoption. Access to extension is expected to enable farmers to make informed farm decisions which subsequently enhance crop productivity. Sugarcane farmers had an average arable land size of 18 hectares while for sorghum (Binga) it had about 6 hectares. The other districts tend to have smaller arable land, and this is attributed to population pressure. On average, mobile money agencies were located 9 km from the homestead across all value chains. Farmers indicated that they received some of their payments through phones and as such proximity to agents is necessary for easy of accessing their money. About 27% of farmers did not have enough food to meet their family requirements. Farmers who had shortages indicated that on average they experienced four months of food deficit.

Table 2. Socio economic characteristics of farmers and crops grown

Characteristic	Overall sample	Survey area							
		Binga	Buhera	Chiredzi (sugar cane)	Chiredzi (sesame)	Chipinge	Mutasa	Mt Darwin	Murehwa
Social factors									
Head gender (1=male)	0.78	0.89	0.80	0.84	0.59	0.75	0.77	0.83	0.73
Head age	53.9	49.9	53.56	55.7	54.9	54.85	57.94	0.83	55.31
Head marital status (1=yes)	0.78	0.89	0.80	0.83	0.63	0.63	0.80	0.84	0.69
Head education (years)	7.7	7.60	7.95	9.75	5.31	8.03	6.97	7.78	7.90
Household size	6.73	6.76	5.75	5.22	6.90	5.83	6.21	6.0	5.32
Sold crops (1=yes)	0.91	0.95	0.97	1	0.81	1	1	0.88	0.66
Decide on input purchase (1=female)	0.80	0.84	0.91	0.58	0.89	0.74	0.69	0.84	0.89
Decide on farm credit (1=female)	0.79	0.81	0.86	0.56	0.90	0.77	0.70	0.86	0.84
Public extension (1=yes)	0.82	0.71	1	0.66	0.87	0.83	0.88	0.88	0.70
Borrower extension (1=yes)	0.49	0.51	0.73	0.55	0.20	0.80	0.25	0.56	0.34
Demonstration trial (1=yes)	0.60	0.43	0.50	0.67	0.61	0.55	0.58	0.86	0.59
Field day (1=yes)	0.87	0.95	0.91	0.94	0.83	0.72	0.97	0.88	0.80
Group membership (1=yes)	0.33	0.86	0.61	0.81	0.66	0.48	0.73	0.64	0.70
Farming experience	24.8	17.9	26.0	18.7	30.1	26.7	30.5	22.9	25.6
Institutional factors									
Access to other credit (1= yes)	0.24	0.19	0.36	0.39	0.23	0.32	0.11	0.23	0.09
Access to ICT (1=yes)	0.18	0.20	0.16	0.20	0.20	0.15	0.02	0.27	0.22
Distance to AGRITEX (km)	11.6	14.5	3.9	27.3	15.2	5.1	12.3	8.4	6.2
Distance to mobile money (km)	8.8	13.3	9.3	15.2	4.3	5.8	4.9	11.5	6.0
Land endowments									
Arable area (ha)	5.1	6.5	2.94	18.55	2.36	0.73	2.69	3.25	3.49
Food security status									
Self-sufficiency (1= yes)	0.74	0.69	0.84	0.84	0.53	0.46	0.86	0.83	0.83
Received food aid (1=yes)	0.65	0.65	0.94	0.03	0.93	0.72	0.97	0.95	0.80
Household dietary diversity (Max=9)	7.72	5.90	7.17	8.25	6.28	7.51	7.56	7.58	7.23
Food consumption score (Max=126)	59.10	47.77	54.14	84.9	46.34	59.93	61.15	61.28	56.23
Livestock and asset ownership (1=yes)									
Cattle	0.51	0.97	0.59	0.17	0.69	0.38	0.10	0.63	0.53
Goats	0.59	0.81	0.86	0.10	0.77	0.54	0.59	0.58	0.52
Radio	0.45	0.39	0.31	0.64	0.52	0.49	0.20	0.42	0.32
Mobile phone	0.9	0.92	0.95	0.98	0.94	0.98	0.93	0.97	0.93
Wheelbarrow	0.37	0.44	0.63	0.84	0.67	0.52	0.78	0.56	0.61
Number of observations	513	63	64	64	61	65	64	64	63

4.2 Smallholder farmers' access to credit and relationship with the borrower

4.2.1 Nature of operation and challenges faced by smallholder farmers

Hippocrene (Tea value chain)

Hippocrene started distributing inputs in 2014 and most of the farmers borrowed once. Land and production was used as collateral to obtain credit and they used written contracts. The farmers complained that the price of fertilizer was relatively higher when contracted by Hippocrene as compared to purchasing on their own from agro dealers and other shops. The amount repaid for every 50-kg bag of fertilizer was around \$45 and according to farmers perceptions the charge was exorbitant. The requirements for accessing the credit facility was that for every 300 kgs of tea produced the farmer received a 50-kg bag of Tea Compound fertiliser. The price of tea per kg was \$0.16 and this was also regarded as unbearably low by the farmers as they failed to cover the production costs from the returns. Overall, farmers indicated that they would only borrow from Hippocrene if they reduce their interest rates and provide clear repayment procedures as the credits continued to be deducted from their production leaving them worse off.

Cairns Foods (Michigan Pea beans value chain)

Cairns Foods provided inputs in kind thus, fertilizers, seed and pesticides to farmers and it started giving out these during the 2016/17 farming season. The borrower also paid \$100 to cover the electricity bills for the farmers. The inputs received amounted to around \$163 for an area covering 0.2 hectare. Producer price was estimated at \$0.60 per kg. The main challenges which emerged were higher electricity bills. The farmers indicated that they were interested in growing Michigan Pea beans for the second time.

Green Trade (Mung beans value chain)

Farmers from Mt Darwin where Green Trade was operating received their credit in form of inputs like seed, fertilizers and pesticides. The costs of the inputs were as follows; Seed-\$11, fertilizer, pesticides and herbicides-\$94 to make a total of \$105 for the whole package. Group membership was used as a guarantee to obtain credit. Green Trade started contracting farmers in 2015/16 season in ward 23 and 40. Ward 12 and 18 received credit in 2016/17 season. The distribution of the

inputs was not equitable as some of the farmers reported that they didn't receive fertilizers and pesticides. Written contracts were made between the two parties (Farmers and Green Trade).

Regardless of the fact that the inputs were not sufficient, late disbursement of the inputs was found to be the main problem. Inputs were received between February and March resulting in many farmers failing to harvest as their crops were affected by late season drought and eaten by livestock while in the field. Some of the farmers also failed to plant the crop fearing that they won't be able to harvest anything as the rain season was approaching an end by the time they received the inputs. Faced with such challenges, some of the farmers in Mt Darwin are yet to repay their loans and some reported that they used income from other crops to repay the loans. Suggestions from farmers indicated that the crop (mung bean) was also not suitable for the type of soils in the area and it will be better if they try to introduce sugar beans. For those who managed to harvest the crop, they complained about the grading criteria of the produce. Only grade A was bought, and other poor grades were rejected leaving them with nowhere to sell the remaining produce as there were no other markets for the mung beans given that it is relatively a new crop on the market. Farmers suggested that it would be better if the Contractor could buy the poor grades at low prices.

Intwasa /Pfumvudza (Maize value chain)

Intwasa/Pfumvudza is contracting 3,030 maize farmers in Murehwa. There are 303 groups producing maize in this district under the program. Intwasa / Pfumvudza started operating in Murehwa in 2016. Group membership was used as a form of collateral to obtain credit. Farmers were given inputs in packs. Each pack contained lime, fertilisers and seed and it covers an area of 0.0625ha. One pack of inputs cost \$25 and each farmer was given 8 packs. The total value of inputs given to farmers amounted to \$200. Inputs were received from 5th of December 2016 to the first of January 2017. Farmers who borrowed in Murehwa reported that the inputs were received late. The farmers also expressed their concerns over the army worms which affected their maize crop in the field. Farmers also reported that they lack knowledge about the right pesticides to use in controlling the army worms. After harvesting G.M.B also delayed collecting the produce resulting in late repayment of the loan. Training farmers on how to manage their crop (weeding, pest control, and fertilizer application) and timely distribution of seed, fertilizers and pesticides may help to curb the problem of fall army worms and may enable farmers to attain higher yields.

Ingwebu Breweries (Red sorghum value chain)

Ingwebu Breweries contracted red sorghum farmers who are organised in groups in Lusulu area. Each member of the group received 10 kg seed of red sorghum covering an area of 2 hectares, but other farmers received more. The value of 10 kg seed given to farmers was \$40 and the farmers repaid \$45 after interest. Every member was expected to produce at least 3 tonnes of red sorghum during the 2016/17 season. Most farmers managed to produce the expected or set target yield of 3 tonnes. Most farmers requested for more seed to plant in the 2017/18 season.

Contracted farmers sell to Ingwebu Breweries at \$300 per tonne and control farmers sell to Grain Marketing Board at \$390. The farmers complained about the producer price which is very low as compared to G.M.B prices and are requesting for increases in the prices.

Ingwebu Breweries failed to make payments to farmers within 21 days as stated in the contract. For 2016/17 season, Ingwebu Breweries collected the produce in August and payments to farmers were made in November. Also, late disbursement of inputs affected the farmers during the 2016/17 farming season. Provision of fertilizers and encouraging use of labour saving technologies might increase yields and returns obtained by farmers. Ingwebu Breweries should also ensure that all inputs needed for red sorghum are available to farmers at affordable price and on time.

Matanuska (Banana value chain)

Farmers in Chipinge were contracted by Matanuska which provided working capital for the purchase of inputs in the production of bananas every year. Each farmer gets USD\$510 per 6 months. The money is used to purchase inputs (fertilizers, sleeves, bailing twine), payment of electricity bills. Farmers repay the loan at an interest rate of 12%. Matanuska also provides labour for the farmers and deducts their labour cost from the farmers' produce. This is called direct labour. Sleeves and bailing twines are also provided at a cost of 20c and 22c each respectively.

Farmers sell their produce to Matanuska at 22c per kg and their average harvest per 0.25 hectare of land was 12.5 tonnes per year. The loan should be fully paid within 6 months and thereafter the farmer gets another working capital.

The farmers in Chipinge reported that they are facing a number of challenges among them, price fluctuations and delay of addressing grievances, water shortages, high tax charges – they pay 15% vat, poor road networks - bridges should be constructed to facilitate smooth movement of produce from the farm to the market, the borrower is failing to produce financial statements for farmers. Last statements were issued in July 2017 and finally load shedding is also affecting their farm operations. The farmers were requesting improvements in the quality of products being provided (sleeves and bailing twine), renovation of irrigation equipment and reduction in the VAT and electricity tariffs.

Sidella Trading (Sesame value chain)

Farmers in Chiredzi district did not grow sesame under Sidella Trading contract in 2016/17 season; they only grew it in 2014/15. Some of the farmers stopped producing sesame because they failed to secure a market since Sidella Trading did not come back after maturity of the facility. Most farmers failed to harvest sesame because of inadequate rainfall, high temperatures and high pest infestation. In 2014/15 season Sidella Trading sold seed, lambda and acetamac to farmers and promised to come back and buy the produce at a price of \$0.80 per kg. Farmers bought inputs voluntarily at a price of \$9 per 3 kg. There was no signed contract between farmers and Sidella Trading as it was a verbal agreement. The agreement was that Sidella Trading would come and buy the produce and farmers were supposed to sell to Sidella Trading only.

Sidella Trading came late to buy the produce and they had reduced the price to \$0.60 per kg. Most of the farmers refused to sell their produce to Sidella Trading and decided to sell through the black market at \$1 per kg. Some farmers who sold their produce to Sidella Trading reported that the company paid them late. In addition, Sidella Trading did not come back to monitor and evaluate the progress of the program. Hence the contractor failed to get the produce they expected from farmers due to inconsistency in their agreements. Farmers suggested that Sidella Trading should make prompt payments in order to attract more farmers and also consider increasing the producer price. Both parties (Farmers and Sidella Trading) failed to respect verbal agreement. This suggests that written agreements are essential in obtaining stable contractual arrangements. In addition, they signify better levels of commitment.

Discussion with Sidella Trading revealed that they received a loan of USD150 000. In Chiredzi, they worked with 1000 farmers. In addition to inputs (seed, fertilizer and chemicals) farmers were trained on pre and post-harvest handling. Sidella Trading had technical officers on the ground and used a lead farmer approach. On average farmers were getting USD0.70 per Kg. The company sold part of the product as grain, while some was processed to sesame oil. Sidella Trading had some challenges in getting cash in time and therefore delayed in collecting produce and in paying farmers. This exacerbated the problem of side selling. Farmers are assumed to have sold their produce to traders from Mozambique, who were offering \$1 per kg. Sidella indicated that they gave farmers written contracts, however this claim contradicts the claim by farmers, who indicated that they had a verbal agreement. On a positive note, Sidella indicated that the facility helped the company to grow (increase its capacity) by 90%. The loan they obtained under CREATE facility in 2014/15 accounted for approximately 90% of their operating capital. This enabled the company to take-off and establish sesame value chain in other districts. The company is currently getting loans from NMB Bank and is looking forward to accessing the CREATE facility again. The company suggest that ZADT could provide some technical support to farmers and also monitor the facility before maturity so as to get a good picture on what is taking place. The company has also arranged with Net one (mobile service provide) to use mobile transfer as mode of payment for future programs so that they avoid delays in paying farmers

Hippo Valley (Sugarcane value chain)

The farmers and the borrower both signed a contract called Cane Purchasing agreement (CP). The agreement is for sugarcane farmers to sell their sugarcane to Hippo Valley and the later to buy the produce from farmers. Hippo Valley sold inputs required in sugarcane production on both cash and credit. Inputs sold to farmers included fertilizers; murate of potash (MOP), urea and mono-ammonium phosphate (MAP), herbicides and pesticides. Hippo Valley provided extension services to farmers on land preparation, planting, harvesting, application of fertilizer and chemicals. This agronomy extension support by borrowers is crucial for farm decision making, enhanced production and productivity.

The amounts of fertilizers needed per hectare were; MAP (87 kg for ratoon crop and 100kg for new seedlings), MOP (100kgs) and Urea (350kgs). Farmers also applied Sango (metrabizine), Anaconda (Ametrine), Harness and prowl at a rate of 2 litres per hectares. 10 tonnes (2 bundles)

of raw cane is used to plant one hectare. One bundle of raw cane which weighs approximately 5 tonnes cost \$350. Land preparation costs \$600 per hectare which is expensive according to farmers' perceptions. Price of raw sugar in 2017 was \$571.61 per tonne. Challenges faced by farmers included, high cost of production, price fluctuations caused by changing international market forces, late disbursement of inputs and poor road networks and drainage systems.

On a positive note, farmers can obtain additional credit facilities from the bank using the relationship they have with the borrower. The borrower acts as the guarantor when farmers apply for bank loans (outside CREATE facility). The banks provide loans at an interest rate of 18% (estimate). Before giving loans, the banks assess farmers' fields (plots) to determine if they are capable of producing high yield. Farmers have choice of the bank they want to borrow from and currently CABS, CBZ and BancABC are offering loans to farmers. Such borrower - farmer relationship may be a good indicator of sustainable relationship which can be expected to continue after maturity of the facility or beyond project life.

4.2.2 Conditions required to obtain the credit?

Approximately 43% of the farmers highlighted that borrowers required collateral (Table 3). More than three quarters of the farmers who borrowed from Intwasa / Pfumvudza, Green Trade and Hippocrene indicated that collateral was required to obtain the credit. Farmers who were contracted by Sidella Trading reported that they only had verbal agreement therefore they were not required to have collateral. Generally, the type of collateral which the borrowers require usually influences the uptake of the credit by farmers. Failure to have collateral has been identified as one of the major factors hindering smallholder farmers from accessing credit.

The main form of collateral used was land (34%), group membership (29.7%) and ownership of livestock (23%). Other forms of collateral such as farm equipment and vehicles were less prominent. Livestock owned, and size of arable land was used for assessing farmer's potential to produce rather than just being used as assets to be forfeited in the event of default. Though in strict terms, collateral usually has a monetary value, requirements such as group membership does not have a monetary value but possesses administrative value. It becomes easier to work with coordinated group members than dealing with individual farmers. If the group is homogenous (having members with similar incentives), farmers can monitor one another thereby reducing the

transaction costs. However, the strength of this approach depends on how heterogeneity within groups is managed so as to reduce conflicts. Putting conditions such as group membership may prove to be more accommodative and may be convenient for smallholder farmers who usually lack collateral.

Table 3. Collateral required to obtain credit by type of collateral and value chain (%).

Borrower	N	Percentage indicating that collateral required	Conditions required to obtain the credit					
			Land	Group membership	Animal	Farm equipment	Vehicle	Others (house, account)
Ingwebu Breweries	50	24	-	100	-	-	-	-
Intwasa Pfumvudza	48	85.4	2.4	19.5	51.2	26.8	-	-
Sidella Trading	61	0	-	-	-	-	-	-
Green Trade	64	78.1	6.0	78.0	10.0	6.0	-	-
Cairns Foods	63	41.3	4.0	-	88.0	8.0	-	-
Hippocrene	63	79	98.0	2	-	-	-	-
Matanuska	65	3.1	50	50	-	-	-	-
Hippo Valley	64	41.5	65.4	3.8	-	3.8	19.2	7.6
<i>Overall</i>	<i>479</i>	<i>42.8</i>	<i>34.4</i>	<i>29.7</i>	<i>23.0</i>	<i>8.1</i>	<i>2.4</i>	<i>1.0</i>

4.2.3 Percentage of farmers who borrowed disaggregated by gender

Figure 1 below shows female participation in the credit facility programs from different value chains. Generally, the results indicate that females were more dominant compared to male counterparts. More than 50% of the smallholder farmers that accessed the CREATE facility were female. Females were less dominant in tea production (Hippocrene, 29%) and in sugarcane production (Hippo Valley, 26.2%), indicating that women are not yet actively involved in these value chains. As such there is need for programs and interventions which also empower women. Sesame value chain (Sidella Trading) was dominated by women (80.6%) with only about 20% males having borrowed. Sesame production is labour intensive, and the crop is easily affected by birds, pests and diseases thus making the crop less attractive for males. In most smallholder farming communities, bird scaring is usually done by women and children.

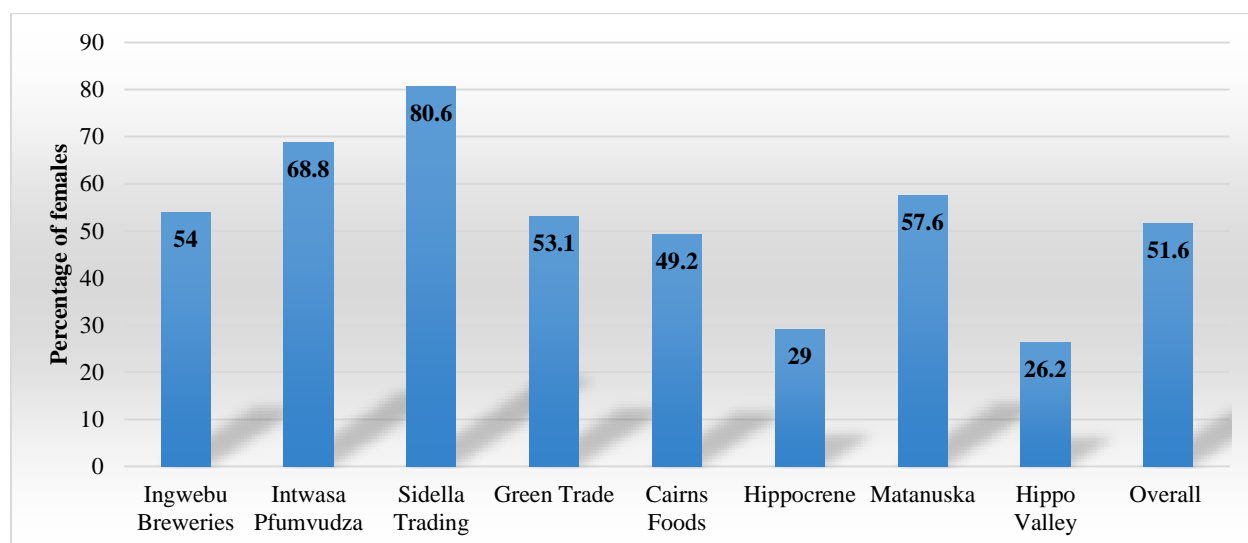


Figure 1. Percentage of female farmers who borrowed by borrower (%)

4.2.4 Form of credit accessed by smallholder farmers.

Farmers received credit in different forms as illustrated in Table 4 below. The majority of the farmers received credit in kind (in form of agricultural inputs). All of the farmers who borrowed from Ingwebu Breweries, Intwasa Pfumvudza, Sidella Trading, Green Trade and Hippocrene indicated that they were given inputs in kind. Approximately 19% of the farmers from Cairns Food reported that they accessed the credit both in cash and in kind. Matanuska and Hippo Valley provided part of the credit in cash with 25.8% and 41.5% of the farmers reported having received the credit in cash respectively. The cash was mainly borrowed to pay farm labour and cover transportation costs.

Table 4. Form of credit accessed by smallholder farmers (%)

Form of credit	Overall	Ingwebu Breweries	Intwasa Pfumvudza	Sidella Trading	Green Trade	Cairns Foods	Hippocrene	Matanuska	Hippo Valley
In kind (Inputs)	86.0	100	100	100	100	81	100	68.2	47.7
Cash	9.2	-	-	-	-	-	-	25.8	41.5
Both in cash and kind	4.2	-	-	-	-	19	-	3	9.2
In kind (Process)	0.4	-	-	-	-	-	-	1.5	-
In kind (Transport)	0.2	-	-	-	-	-	-	1.5	1.5
Total number of observations	480	50	48	62	64	63	62	66	65

4.2.5 Type of inputs received/purchased using cash from the borrower

Most of the interviewed farmers received seed (Table 5), with an exceptional case for Hippocrene where all farmers were given fertilizers only to use in their already established tea plantations. Approximately 20% of the farmers received pesticides. Farm machinery was more common in sugar cane production. This is expected given that the scale of production is larger compared to other value chains.

Table 5. Type of inputs received or purchased (multiple responses)

Type of inputs	Overall	Ingwebu Breweries	Intwasa Pfumvudza	Sidella Trading	Green Trade	Cairns Foods	Hippo- crene	Matanuska	Hippo valley
Seed	36.4	100	50	85.9	36	33.7	-	20.3	26.3
Fertilizer	33.6	-	50	-	32	33.7	100	39.9	25.4
Pesticides and herbicides	20	-	-	14.1	32	31	-	23.2	19.6
Farm machinery	5.6	-	-	-	-	-	-	10.1	17.5
Irrigation equipment	4.4	-	-	-	-	1.6	-	9.5	11.3
Number of Observations	1049	50	96	71	175	187	62	168	240

4.2.6 Challenges faced in accessing credit from the borrower

Table 6 shows the perceived challenges faced by contracted farmers in accessing credit. The credit/inputs were disbursed late across all eight value chains. Crops that were planted late were affected by late season drought which resulted in low yield. Unclear repayment procedure was also identified as one of the main challenges faced (31.4%). Farmers indicated that the costing of inputs allocated to them and the repayment plan were not transparent. In Mt Darwin, Green Trade only bought A grade produce. This left other farmers that could not meet the quality criteria without a market to sell their produce. Regardless of failing to meet the quality requirements, the borrower expected them to repay the credit therefore farmers complained that they wasted their time. Challenges associated with stringent requirements were less prominent, 3.8%, suggesting that the CREATE facility has improved farmers' access to credit.

Table 6. Challenges faced by farmers in accessing credit from the borrower (%)

Challenges	Overall Sample	Ingwebu Breweries	Intwasa Pfumvudza	Sidella Trading	Green Trade	Cairns Foods	Hippo – crene	Matanuska	Hippo Valley
Late disbursements	36.6	42.2	54.2	13.9	51.3	39.0	16.4	25.9	39.0
Unclear repayment	31.4	14.9	20.3	13.9	26.9	40.3	53.7	33.3	33.9
Stringent requirements	3.8	2.1	3.4	-	-	-	11.9	1.9	10.2
None	28.2	40.2	22	72.2	21.8	20.8	17.9	38.9	16.9
Number of Observations	477	47	59	36	78	77	67	54	59

4.2.7 Suggested solutions to the challenges encountered by farmers in accessing credit

Table 7 presents the suggested solutions to the challenges encountered by smallholder farmers in accessing the credit from the borrowers. Timely disbursements of credit after application was highlighted as the major solution across all value chains. If borrowers give attention to this suggested solution, it might lead to increased yield. Furthermore, farmers suggested that borrowers must have clear repayment procedure so that they gain trust from farmers. Transparency may strengthen the relationship between the farmer and the borrower. Suggestion on relaxing stringent requirements was less prominent (4.1%), implying that the conditions were accommodative. Most of the recommendations emphasised by smallholder farmers lead to improved production, income and livelihood of farmers participating in the programme.

Table 7. Solutions suggested by farmers to the challenges encountered in accessing credit (%)

Recommendations	Overall Sample	Ingwebu Breweries	Intwasa Pfumvudza	Sidella Trading	Green Trade	Cairns Foods	Hippo-crene	Matanuska	Hippo Valley
Timely disbursements after application	38.1	37.5	57.1	23.1	51.3	39.0	17.9	28.3	40.0
Have clear repayment procedure	36.1	25.0	19.6	19.2	28.2	41.6	52.2	54.3	38.0
Relax stringent requirements	4.1	2.5	1.8	3.8	-	-	11.9	2.2	12.0
None	21.8	35.0	21.4	53.8	20.5	19.5	17.9	15.2	10.0
Number of observations	441	40	56	26	78	77	87	46	50

4.2.8 Other services received from borrower (%)

Approximately 41% of the interviewed farmers indicated that they received extension support from the Borrower (Table 8). Extension support from the borrower is crucial as it improves on farmer's knowledge as well as helps farmers to know what is expected from them in terms of product quantity and quality.

Table 8. Services received from the borrower (%)

Services received	Overall	Ingwebu Breweries	Intwasa Pfumvudza	Sidella Trading	Green Trade	Cairns Foods	Hippo-crene	Matanuska	Hippo valley
Extension	41.0	46.2	39.2	29.5	65.7	71.0	26.9	46.7	28.0
Record keeping	9.9	5.8		1.6	4.3	1.6	17.3	16.7	16.0
Marketing (packing and handling)	8.4	3.8	5.9		4.3	21.0	13.5	2.2	12.3
Farm business management	4.3			1.6			14.4	2.2	7.5
Budgeting	3.0						1.0	10.0	7.5
None	33.4	44.4	54.9	67.2	25.7	6.5	26.9	22.2	35.8
Number of Observations	596	52	51	61	70	62	104	90	106

Training farmers on record keeping and marketing (packaging and handling of harvested crop) were other services provided by the borrower, accounting for 9.9% and 8.4% respectively. Providing advice and training on farm business management and record keeping might help farmers appreciate farming as a business. In addition, this may also help in strengthening relationships between borrowers and farmers, thereby reducing the chances of defaulting. An alternative approach that could be used to avail training to farmers so as to improve their level of financial literacy maybe through encouraging formation of farmers associations which would then be used as a vehicle for providing training. Access to extension and training improves farm decision making, marketing and business management. Worryingly, approximately 33% of the interviewed farmers indicated that they did not receive any of these other services from the borrower.

4.2.9 Other credit sources accessed by smallholder farmers

The other credit sources are presented in Table 9. There were a few scenarios where farmers obtained credit from other sources (24.2%). This result suggest that farmers have limited options in obtaining credit hence highlight the importance of the CREATE Fund. The credit sources reported in this section were not only limited to agricultural credit but includes credit for other non-agricultural activities. For those that received credit from other sources, most of them indicated that they obtained the credit from relatives (36.8%).

Table 9. Other sources of credit accessed by smallholder farmers

Source of credit	Overall (%)	Binga (sorghum)	Chiredzi (Sesame)	Chiredzi (sugar cane)	Murehwa	Buhera	Mutasa	Mt Darwin	Chipinge
Relative	36.8	68.8	31.3	17.2	50.0	20.8	28.6	13.3	82.6
Bank	16.9	6.3	12.5	55.2	-	-	-	13.3	-
Informal money lender	14.0	-	12.5	13.8	16.7	20.8	42.9	20.0	4.3
Private company	14.0	6.3	12.5	3.4	-	25.0	14.3	33.3	13.0
Government agency	9.6	12.5	-	6.9	-	25.0	-	20.0	-
Self- help group	7.4	6.3	25.0	3.4	33.3	8.3	-	-	-
NGO	1.5	-	6.3	-	-	-	14.3	-	-
Number of responses	136	16	16	29	6	24	7	15	23

Approximately, 17% of the farmers obtained credit from commercial banks (Table 9). Access to bank credit was more prominent in Chiredzi, for sugar cane farmers. There were instances where

farmers accessed credit from individual money lenders (14%). These constitute individuals who provide small amount of credit (informal credit) at a specified interest rate. Some farmers were able to secure credit from private companies (14%). Close to 10% obtained credit from government agents.

4.3 Crop production

4.3.1 Major crops cultivated by farmers in 2016/17 season

Maize, groundnuts, sorghum and sugar beans were the main annual crops grown by the majority of farmers (Table 10). The quantitative survey results show that farmers obtained high yields for maize, groundnuts and sorghum. These results show that there is need for promoting the production of maize, sorghum, groundnuts and sugar beans which are grown by the majority of farmers. Such interventions could be in form of credit access, linking farmers to local, regional and export markets and value addition. There is huge demand for aflatoxin free groundnuts by processing industries, for example Dairiboard. Agricultural finance mechanisms to support the groundnut value chains are needed in the country. Mung beans, Michigan pea beans and sesame were only confined to the districts where the value chains were being promoted. There is a potential for promoting the production of Michigan Pea beans in other irrigation schemes if markets are guaranteed. Mung beans and sesame, though they are potentially high-income crops, their production should only proceed if farmers are guaranteed of a market and reasonable prices. These are struggling value chains and this is also evidenced by other impact assessments of the Livelihoods and Food security program in Zimbabwe. The main perennial crops that were grown by farmers were tea, bananas and sugarcane. These perennial crops were only confined to the value chains that were funded under the CREATE facility except for bananas that were also produced under non-CREATE facility in Mutasa district. This suggest that there is potential for establishing banana value chain in Mutasa under the CREATE facility.

Table 10. Crops grown by farmers in 2016/17 season (n=513)

Crop	(% of total sample)	Area (hectares)	Yield (kg)/Ha
<i>Annual crops</i>			
Maize	78.6	0.83	1679.81
Groundnuts	33.1	0.34	1458.35
Sorghum	28.8	1.12	1219.46
Sugar beans	17.2	0.43	865.40
Bambara nuts	16.7	0.26	791.94
Cowpeas	13.1	0.34	594.43
Michigan pea beans	12.3	0.24	1449.71
Mung beans	10.5	0.40	242.72
Pearl millet	10.3	0.97	1134.63
Cotton	0.1	0.79	632.67
Tobacco	0.03	0.79	1370.53
Sesame	0.03	0.50	448.08
<i>Perennial crops</i>			
Tea	22.0	0.70	2020.51
Bananas	12.7	0.37	30504.59
Sugarcane	12.7	8.89	41182.16

4.3.2 Effect of credit that was accessed by farmers on cereal production and productivity

We estimated the effect of credit access on cereal productivity – maize and sorghum value chains for Binga and Murehwa farmers respectively. We implemented the pseudo-fixed-effect (Mundlak) model (Mundlak, 1978), in which a random effect model is ran while simultaneously controlling for unobserved heterogeneity by adding the mean values of plot-varying explanatory variables in an auxiliary regression in order to account for the possible correlation of plot-invariant unobserved heterogeneity with observed covariates. This model is appropriate for our plot-level data given that a household could have 2 or more plots of cereals. The plot level variables that are used in the model include, fertilizer applied (topdressing), production and yield. Household characteristics included in the model are gender, age, education level as well as access to information. Results from the pseudo-fixed-effect model are shown in Table 11. Access to CREATE facility through the borrowers had a positive and significant impact on cereal production. Holding other things constant, this suggest that the ZADT program enabled smallholder farmers to obtain higher cereal production. The late disbursement of credit to smallholder farmers had a negative relationship with

both cereal production and productivity for the 2016/17 season. Late credit disbursements reduced cereal yields by 63%. The majority of the smallholder farmers in the study area depend on rainfed agriculture and a delay in planting due to late credit inputs results in farmers missing on the planting window. This subsequently reduces productivity. These results demonstrate the importance of timely credit access.

Table 11. Effect of past year credit on cereal production and productivity

	Harvest		Yield	
	Coef	Std. err.	Coef	Std. err.
Past year credit	1.046***	0.313	0.458	0.304
Credit late	-0.716***	0.277	-0.632**	0.269
Head age	0.005	0.009	0.003	0.009
Head gender	0.247	0.281	0.143	0.274
Head education	0.040	0.035	0.061*	0.034
Fertilizer quantity	0.014***	0.003	0.006**	0.003
Decide on credit	-0.450	0.315	-0.139	0.306
Own cattle	0.653**	0.260	0.184	0.252
Extension	-0.156	0.267	-0.376	0.259
ICT	0.399	0.271	0.280	0.264
Radio	0.085	0.213	0.400*	0.207
Demonstration	-0.146	0.220	0.043	0.214
Field day	0.805*	0.478	0.529	0.465
Mean fertilizer quantity	-0.010	0.007	0.007	0.007
Constant	4.405***	0.865	5.641***	0.840
Observations	378		378	
Loglikelihood	0.000***		0.016**	

*, **, ***. Statistically significant at the 10%, 5%, and 1% level, respectively.

The application of top dressing fertilizer increased both cereal production and productivity by 1.4 and 0.6% respectively. The policy implication is that credit, extension and agricultural programs by both public and private sectors should ensure that farmers have access to fertilizers and trained on appropriate types and use of fertilizers to improve cereal productivity. Vanlauwe et al. (2014) highlights that appropriate use of fertilizer can substantially increase crop productivity in sub-Saharan Africa.

4.3.3 Effect of credit on Michigan Pea bean and Mung bean production and productivity

Results in Table 12 show the Ordinary Least Squares regression estimates of the amount of credit borrowed last year on Michigan peas and Mung bean production and productivity. Results show the credit amounts received through borrower had no significant effect on production and

productivity of these two value chains. Despite access to credit, Michigan Pea bean farmers complained about intermittent irrigation water cuts by ZESA due to outstanding electricity bills. This greatly affected production and productivity. At one-time Cairns Foods even paid \$100USD per farmer as advance payment towards electricity bills. This advance payment was recovered from the sales incomes.

Table 12. Effect of credit volume on Michigan peas and mung beans production and productivity

	Michigan peas		Mung beans	
	Harvest b/se	Yield b/se	Harvest b/se	Yield b/se
Credit volume	-0.002 (0.108)	-0.027 (0.126)	-0.285 (0.223)	-0.327 (0.351)
Credit late	0.208 (0.412)	0.245 (0.481)	-2.064* (1.121)	-2.199 (1.765)
Head age	0.005 (0.019)	0.007 (0.022)	-0.026 (0.023)	-0.035 (0.036)
Head gender	0.976* (0.500)	1.191** (0.584)	0.231 (0.787)	-0.153 (1.240)
Head education	0.027 (0.058)	0.026 (0.068)	0.170** (0.080)	0.198 (0.127)
Fertilizer quantity	0.007 (0.008)	0.000 (0.009)	0.023* (0.012)	0.014 (0.018)
Decide on credit	-0.245 (0.518)	-0.220 (0.604)	-0.222 (0.715)	-0.071 (1.126)
Own cattle	-0.228 (0.353)	-0.258 (0.412)	0.353 (0.585)	0.472 (0.922)
ICT	-0.803 (0.483)	-0.784 (0.564)	0.238 (0.636)	0.528 (1.001)
Radio	-0.598 (0.396)	-0.657 (0.462)	-0.075 (0.573)	0.096 (0.902)
Demonstration	0.718* (0.364)	0.656 (0.425)	2.825*** (0.717)	3.415*** (1.129)
Field day	-0.570 (0.609)	-0.587 (0.710)	-0.593 (0.812)	-0.561 (1.279)
Constant	5.346*** (1.626)	6.949*** (1.898)	2.474 (2.273)	3.297 (3.579)
Observations	63	63	57	57
P	0.063*	0.195	0.000***	0.000***
Log likelihood	-97.646	-107.399	-103.156	-129.039

*, **, ***. Statistically significant at the 10%, 5%, and 1% level, respectively.

The late disbursement of credit among mung bean farmers reduced crop production. These results were supported by farmer and key informant interviews in Mt Darwin. Owing to late planting, the majority of the mung beans failed to reach physiological maturity and this affected production. Some farmers were complaining that they wasted their land by engaging in mung bean production.

4.4 Crop sales and access to market

Table 13 shows the output market for all the crops sold differentiated by district. As expected, most of the farmers sold their produce to the borrowers (43.4%). These results show the additional benefit of the CREATE Fund. Apart from improving access to credit the Fund also played an important role in the development of markets. The second main market was neighbours, accounting for 19.5% of marketed crops. In the absence of alternative markets, selling to other farmers (neighbours) has been a traditional channel for smallholder farmers. This is usually associated with low sales and less profits. On the other hand, lack of alternative markets might imply less risk associated with side selling. A total of about 10% of the produce was sold to the Grain Marketing Board (G.M.B). The lack of alternative markets for smallholder farmers justifies the need for channelling efforts towards promotion of viable value chains and linking farmers to markets. As such the CREATE Fund need to be strengthened to enhance credit and market access for smallholder farmers.

Table 13. Output market for the bulk of crops sold (includes all crops)

Output market	Overall	Binga	Chiredzi (sesame)	Chiredzi (sugar cane)	Murehwa	Buhera	Mutasa	Mt Darwin	Chipinge
Borrower	43.4	43.2	-	82.1	31.3	45.1	50.4	21.1	80.7
Neighbours	19.4	17.1	36.2	7.7	43.8	12.7	9.4	32.1	9.6
G.M.B	9.8	17.1	39.1	1.3	10.9	-	-	13.8	1.2
Local market (Growth point)	7.8	5.4	2.2	1.3	1.6	25.4	4.7	5.5	6.0
Distant informal market	7.6	3.6	1.1	1.3	4.7	12.0	22.0	5.5	1.2
Distant formal market	6.1	4.5	2.2	5.1	3.1	0.7	11.0	18.3	1.2
Other contracts	4.6	7.2	14.1	1.3	3.1	4.2	2.4	3.7	-
NGO, School, Hospital	1.4	1.8	8.7	-	1.6	-	-	-	-
Total	807	111	92	78	64	142	127	109	83

4.5 Distance from the output market

T-statistic tests were used to analyse the significance of the differences between distances travelled by farmers to their markets (to the borrower and other markets) (Table 14). Overall, the average distance travelled by farmers going to sell to other markets was 23.1km whereas the farmers who sold to the borrowers travelled a mean of about 14km. This implies that the borrowers used markets that are closer to farmers except for farmers in Chiredzi (sugar cane) and Chipinge who had to travel longer distances to sell to the borrower than to other markets. In Murehwa and Chiredzi

(sesame) there were no significant differences in distances travelled. Across all value chains, results show that the ZADT program was instrumental in reducing output market distances for farmers. This is crucial as it reduces transaction costs.

Table 14. Distances travelled to the market and borrower (km).

District	Distance travelled to sell to other markets (km)	Distance travelled to sell to the borrower (km)	Difference (km)
Binga (Sorghum)	21.9	1.6	20.7***
Chiredzi (Sesame)	8.1	6.0	2.1
Chiredzi (Sugarcane)	43.4	60.7	-17.3***
Murehwa (Maize)	10.2	10.5	-0.29
Buhera (Michigan peas)	5.3	3.9	1.38***
Mutasa (Tea)	59.7	2.0	57.6***
Mt Darwin (Mung bean)	37.2	20.5	16.6*
Chipinge (Banana)	3.2	16.7	-13.5**
Overall	23.1	13.5	9.6***

t-statistic test. *, **, ***. Statistically significant at the 10%,5% and 1% level respectively.

4.6 Level of market participation

Table 15 presents crop sales differentiated by crop and district. The table categorizes crops by whether they fall under funded value chains or not. The majority of the farmers sold maize (17.8%). The results show that maize was mostly sold in Murehwa and this is expected given that Intwasa Pfumvudza supported the maize value chain in this district. Higher crops sales for each value chain crop were confined to the districts which were actively supported by the borrower. These results highlight the importance of the ZADT program in increasing market access and higher crop sales. Maize sales were also higher in Mt Darwin, Binga and Chiredzi. Trade in Banana was mostly confined to Mutasa and Chipinge. Sidella Trading did not operate in Chiredzi in 2016/17 season therefore low sales were recorded for sesame. Farmers indicated that they were not keen to produce the crop without a secured market.

Other common crops that were sold by farmers even though they were not part of the funded value chains were, sugar beans and groundnuts. Sugar beans were more common in Buhera and Chipinge, while Groundnuts were common in Murehwa and Mt Darwin. This may be suggesting that there is potential for these crops. Future ZADT programs might consider funding sugar beans and groundnuts value chains. It is easier for farmers to produce crops they are used to growing. This may have a positive impact on sustainability and continuity of value chains. However, on a

negative note, common crops have high risk of side selling. The policy implication is that the promotion of crop value chains should be guided by suitability of areas for crop growth.

Table 15. Crop sales by district for 2016/17 season

CROP	N	Overall (%)	Binga	Chiredzi (Sesame)	Chiredzi (Sugarcane)	Murehwa	Buhera	Mutasa	Mt Darwin	Chipinge
<i>Crops that fall under funded value chains</i>										
Maize	144	17.8	27.0	36.0	4.8	62.5	2.8	1.6	28.4	2.4
Banana	114	14.1	-	-	-	-	-	36.2	0.9	80.7
Sorghum	85	10.5	49.5	29.1	2.4	1.6	1.4	-	-	-
Tea	64	7.9	-	-	-	-	-	50.4	-	-
Sugar cane	64	7.9	-	-	76.2	-	-	-	-	-
Michigan pea bean	58	7.2	-	-	-	-	40.8	-	-	-
Mung beans	20	2.5	-	-	0.6	-	0.7	-	16.5	-
Sesame	4	0.5	2.7	1.2	0.6	-	-	-	-	-
<i>Other common crops (not falling under funded value chains)</i>										
Sugar beans	62	7.7	1.8	-	2.4	1.6	29.6	2.4	0.9	13.3
Groundnuts	47	5.8	5.4	3.5	1.2	18.8	7.7	-	12.8	-
Cotton	32	4	6.3	17.4	2.4	-	-	-	7.3	-
Cowpeas	17	2.1	1.8	1.2	1.2	-	-	-	11.9	-
Tobacco	17	2.1	-	-	-	-	-	-	15.6	-
Bambaranuts	12	1.5	5.4	-	-	6.3	1.4	-	-	-
Other crops	67	8.4	0.1	11.6	8.2	9.2	15.6	9.4	5.7	3.6
Total number of observations	807		111	86	170	64	142	127	109	83

4.7 Economic value of crops grown, and contribution of CREATE Fund to total sales

Typical smallholder farmers produce for both consumption and trade. Therefore, to understand the net worth of smallholder agricultural production, there is need to include the portion of harvest that was not traded. The total economic value of all crops grown in 2016/17 season was obtained from multiplying the average unit price of different crops with total quantities harvested by each household. In other terms, economic value of all crops grown can be viewed as an estimate of revenue that was going to be obtained by farmers if they had sold all their produce. Revenue obtained from crop sale denotes the value of harvested crop that was actually traded (sold). As shown in Table 16, this is split into two (i) revenue from all crop sales and (ii) revenue obtained through trade that was made under the CREATE facility (borrower). Economic revenue of all crops less the actual revenue from all sales will give the value of crop that was consumed or used for other purposes such as giving away. The economic value of crops that was not traded was approximately US\$1500 for Chiredzi (sugarcane), Binga, Mutasa and Mt Darwin. In the other

districts, Chiredzi (sesame), Chipinge and Murehwa, the economic value of crops that was not traded was less than US\$600. This value is crucial when analyzing the total net worth of farmers.

The contribution of the sales from CREATE value chain crop sales to the total revenue generated from actual crop sales is shown in Table 16. This provides a proxy indicator of the performance of the CREATE Fund towards enhancing market access and revenue generation. The results show that in Chipinge and Chiredzi (sugar cane) most of the crop revenue was obtained through the value chains supported by CREATE facility and this accounted for 97% and 96% respectively. In Binga and Mutasa, the CREATE facility contributed approximately 74% and 61% of the total crop revenue, respectively. In Buhera, sales through the CREATE facility contributed 54% to the total crop revenue. Farmers in Murehwa mainly traded maize and obtained the least amount of revenue for both sales of all crops and sales made through the borrower. Farmers indicated that their maize crop was significantly affected by army worm. In Mt Darwin, farmers had a challenge in meeting quality requirements and recorded the least percentage contribution of sales under CREATE. The borrower only bought the 'A' grade product from the farmers and this reduced the amount of revenue received under the CREATE facility. Sesame producing farmers in Chiredzi sold their produce through other channels. Sidella Trading did not contract farmers in 2016/17 season. Farmers are expected to develop long lasting relationships with the borrowers. However, this was not the case with Sidella, where linkages with farmers did not continue after maturity of the facility. On a positive note, some farmers in Mt Darwin indicated that they still have links with the borrower and expected to receive input support in future.

Table 16. Contribution of crop sales under CREATE Fund to total household sales

Value Chain (District)	N	Monetary value of harvested crops (US\$)	Revenue obtained for traded crops			
			N	All Sales (US\$)	Sales to borrower (US\$)	Contribution of CREATE facility to total sales (%)
Sugarcane (Chiredzi)	65	309374.09	65	307800.72	298602.13	96.7
Banana (Chipinge)	65	4120.31	65	3820.47	3711.93	96.1
Sorghum (Binga)	64	2428.11	50	970.78	645.19	73.5
Tea (Mutasa)	66	4242.21	65	2545.43	843.54	60.9
Michigan Pea (Buhera)	63	1386.74	61	793.01	338.29	53.5
Maize (Murehwa)	63	732.36	34	275.39	130.52	48.3
Mung Bean (Mt Darwin)	63	2768.20	55	1350.36	183.87	16.4
Sesame (Chiredzi)	64	1031.22	53	439.94	0	-
Total	513		448			58.3

4.8 Effect of the CREATE facility on crop and agricultural (farm) income

Table 17 shows the estimated results of the effect of CREATE facility on crop income and farm income among sorghum and maize farmers. Access to CREATE facility in the past 12 months (through borrowers) had a positive and significant association with crop and agricultural income for both sorghum and maize farmers in Binga and Murehwa respectively. An additional dollar borrowed increased crop and agricultural income among sampled farmers by 92% and 110% respectively. These results resonates with previous studies highlighting the importance of credit on household welfare (Bocher et al., 2017). Policy intervention to increase crop and agricultural income should emphasize on promoting credit access to smallholder farmers. In addition, timely credit disbursements in line with the agricultural season are critical for improved household welfare.

Table 17. Effect of credit access on crop and agricultural income (Binga and Murehwa)

	Crop income		Agriculture income	
	Coef	Std. err.	Coef	Std. err.
Past year credit	0.917**	0.350	1.105***	0.355
Credit late	-0.590**	0.285	-0.600**	0.289
Head age	0.014	0.010	0.019*	0.010
Head gender	0.019	0.301	0.089	0.305
Head education	0.039	0.038	0.058	0.038
Arable land	0.012	0.034	0.028	0.034
Decide crop to grow	-0.693*	0.350	-0.534	0.355
Decide on credit	-0.212	0.390	-0.294	0.395
Own cattle	0.724**	0.304	0.831***	0.308
Extension	0.519*	0.289	0.638**	0.293
ICT	-0.012	0.296	-0.159	0.300
Radio	0.583**	0.224	0.531**	0.227
Demonstration	-0.066	0.233	-0.039	0.236
Field day	2.898*	1.679	3.414**	1.702
Constant	1.773	1.791	0.538	1.815
Observations	81		81	
P	0.001***		0.000***	
Log likelihood	-100.226		-101.317	

*, **, ***. Statistically significant at the 10%, 5%, and 1% level, respectively.

Table 18 shows the effect of the volume (intensity) of credit on crop and farm income among sampled farmers in Binga and Murehwa. Credit tends to have significantly positive impacts on crop and agricultural income for farmers receiving larger credit volumes. These results suggest that larger credit volumes tend to have higher welfare gains (Luan and Bauer, 2016). These results demonstrate the need to disburse meaningful credit amounts to smallholder farmers if welfare gains are to be achieved.

Table 18. Effect of credit volume on crop and agricultural income (Binga and Murehwa)

	Crop income		Agriculture income	
	Coef	Std. err.	Coef	Std. err.
Credit volume	0.155**	0.063	0.168***	0.064
Credit late	-0.568*	0.336	-0.585*	0.338
Head age	0.007	0.010	0.013	0.010
Head gender	0.318	0.327	0.331	0.329
Head education	0.035	0.042	0.052	0.042
Arable land	0.037	0.025	0.037	0.025
Decide crop to grow	-0.242	0.383	-0.191	0.385
Decide on credit	0.350	0.411	0.245	0.413
Own cattle	0.717**	0.327	0.838**	0.329
Extension	0.313	0.279	0.383	0.280
ICT	-0.050	0.308	-0.191	0.309
Radio	0.461*	0.247	0.417*	0.248
Demonstration	0.238	0.242	0.203	0.243
Field day	1.345***	0.493	1.182**	0.496
Constant	2.586***	0.903	2.414***	0.908
Observations	102		102	
P	0.000***		0.000***	
Log likelihood	-149.047		-149.629	

*, **, ***. Statistically significant at the 10%, 5%, and 1% level, respectively.

Table 19 shows the effect of credit obtained in the last 12 months (through borrower) on crop and agricultural income among tea, banana and sugarcane farmers. The amount of money borrowed in the past 12 months had no significant income effect on tea, banana and sugarcane farmers. Given that perennial crops have longer production period, longer term credit provision for these crops should be encouraged. Results in the next subsection and Table 20 discuss the positive implications of long term credit for perennial crops.

Table 19. Effect of credit access and volume on perennial crop and agricultural income

	Tea		Banana		Sugarcane	
	Crop income Coef	Agriculture income Coef	Crop income Coef	Agriculture income Coef	Crop income Coef	Agriculture income Coef
Past year credit	-0.803 (5.646)	-0.941 (5.660)	-3.711 (3.492)	-3.674 (3.492)	19.913 (29.837)	19.404 (29.536)
Credit volume	-0.088 (1.142)	-0.037 (1.145)	0.566 (0.465)	0.560 (0.465)	-1.947 (3.058)	-1.895 (3.027)
Credit late	1.268 (1.417)	1.107 (1.420)	-0.042 (0.369)	-0.045 (0.368)	0.000 (.)	0.000 (.)
Head age	-0.009 (0.018)	-0.008 (0.018)	-0.007 (0.011)	-0.007 (0.011)	-0.019 (0.019)	-0.019 (0.019)
Head gender	0.446 (0.502)	0.477 (0.503)	0.183 (0.306)	0.176 (0.306)	-0.241 (0.548)	-0.225 (0.542)
Head education	0.086 (0.071)	0.092 (0.071)	-0.036 (0.044)	-0.035 (0.044)	0.062 (0.047)	0.061 (0.047)
Arable land	0.150* (0.089)	0.157* (0.089)	0.032 (0.146)	0.034 (0.146)	0.024 (0.030)	0.023 (0.030)
Decision on crop to grow	-1.603 (0.987)	-1.296 (0.990)	-0.373 (0.552)	-0.376 (0.552)	1.138 (1.104)	1.120 (1.093)
Decision on credit	1.390 (1.062)	1.129 (1.065)	0.919* (0.528)	0.920* (0.528)	-1.059 (1.081)	-1.056 (1.070)
Own cattle	0.695 (0.671)	0.791 (0.672)	-0.187 (0.217)	-0.185 (0.217)	-0.705 (0.504)	-0.690 (0.498)
Extension	0.737 (0.523)	0.712 (0.524)	-0.107 (0.320)	-0.108 (0.320)	0.074 (0.408)	0.078 (0.403)
ICT	-0.552 (1.658)	-0.597 (1.662)	0.307 (0.305)	0.317 (0.305)	0.387 (0.512)	0.370 (0.507)
Radio	0.758 (0.484)	0.764 (0.485)	0.036 (0.243)	0.038 (0.243)	-0.394 (0.421)	-0.380 (0.417)
Demonstration	0.044 (0.358)	0.041 (0.359)	0.157 (0.230)	0.157 (0.230)	-0.430 (0.433)	-0.431 (0.429)
Field day	1.660 (1.139)	1.561 (1.142)	-0.040 (0.244)	-0.042 (0.244)	-0.230 (0.815)	-0.214 (0.807)
Constant	4.388*** (1.477)	4.379*** (1.481)	8.273*** (1.038)	8.278*** (1.038)	13.553*** (1.668)	13.563*** (1.651)
Observations	64	64	65	65	64	64
P	0.033**	0.026**	0.612	0.607	0.599	0.609
Log likelihood	-94.981	-95.141	-67.925	-67.914	-104.879	-104.229

*, **, ***. Statistically significant at the 10%, 5%, and 1% level, respectively. Standard errors are shown in parenthesis.

Table 20 shows the effect of initial amount of credit borrowed and the duration of relationship with borrower on perennial crop income and farm income. The coefficient of credit volume and duration of relationship were not statistically significant among tea farmers. Tea farmers

contracted by Hippocrene ended up paying \$45 per 50kg fertilizer bag (compound T) inclusive of interest compared to those found in local shops which were being sold for \$35 per bag. This resulted in fertilizer inputs from Hippocrene being quite expensive (28.6% more) and this together with perceived low tea prices of \$0.16 per kg (after transport costs deducted) resulted in reduced tea revenues. Farmers also complained that there were unclear loan repayment deductions.

The initial amount of credit borrowed and the duration of relationship with borrower had a positive and significant association with crop and agricultural income for sugarcane farmers. An additional dollar borrowed increased crop and agricultural income among sugarcane farmers by 56% and 55% respectively. These results are in line with previous studies highlighting the importance of credit on household welfare (Bocher et al., 2017). Credit tends to have significantly positive impacts on crop and agricultural income for those receiving larger credit volumes. Results imply that households with larger credit volumes (Luan and Bauer, 2016) and longer term relationship with credit providers tend to benefit from accessing rural credit. The initial amount of credit did not have significant effect on crop and agricultural income for banana farmers. However, the duration of relationship with borrower had a significant effect and increased both crop and agricultural income by 17%. Interventions that seek to increase crop and agricultural income should emphasize on nurturing and promotion of long-term relationship between credit providers and farmers to enhance household welfare.

Table 20. Effect of initial credit borrowed and duration on perennial crop income and farm income

	Tea		Banana		Sugarcane	
	Crop income	Agriculture income	Crop income	Agriculture income	Crop income	Agriculture income
	Coef	Coef	Coef	Coef	Coef	Coef
Credit volume (initial amount)	0.039 (0.170)	0.060 (0.170)	0.123 (0.202)	0.126 (0.202)	0.561** (0.241)	0.551** (0.238)
Duration	0.122 (0.106)	0.099 (0.106)	0.174** (0.076)	0.173** (0.076)	0.415* (0.239)	0.408* (0.236)
Head age	-0.012 (0.018)	-0.011 (0.018)	-0.013 (0.009)	-0.013 (0.009)	-0.017 (0.018)	-0.017 (0.018)
Head gender	0.326 (0.476)	0.361 (0.478)	0.213 (0.292)	0.207 (0.292)	-0.119 (0.530)	-0.104 (0.525)
Head education	0.090 (0.063)	0.095 (0.063)	-0.039 (0.042)	-0.038 (0.042)	0.049 (0.046)	0.047 (0.045)
Arable land	0.125 (0.090)	0.132 (0.090)	0.097 (0.141)	0.098 (0.141)	0.009 (0.031)	0.009 (0.031)
Decision on crop to grow	-1.189 (0.885)	-0.907 (0.889)	-0.503 (0.506)	-0.504 (0.506)	1.191 (1.052)	1.175 (1.042)
Decision on credit	0.881 (0.934)	0.663 (0.938)	0.965* (0.502)	0.966* (0.502)	-1.035 (1.030)	-1.033 (1.021)
Own cattle	0.634 (0.660)	0.742 (0.663)	-0.120 (0.209)	-0.118 (0.209)	-0.718 (0.510)	-0.700 (0.505)
Extension	0.592 (0.515)	0.589 (0.517)	-0.166 (0.306)	-0.167 (0.306)	0.083 (0.386)	0.088 (0.382)
ICT	-0.546 (1.360)	-0.611 (1.366)	0.332 (0.294)	0.342 (0.294)	0.477 (0.488)	0.458 (0.484)
Radio	0.746 (0.474)	0.757 (0.476)	0.075 (0.229)	0.076 (0.229)	-0.478 (0.399)	-0.463 (0.395)
Demonstration	0.174 (0.352)	0.150 (0.354)	0.152 (0.210)	0.153 (0.210)	-0.222 (0.410)	-0.227 (0.407)
Field day	1.433 (1.111)	1.331 (1.115)	-0.039 (0.229)	-0.041 (0.229)	-0.034 (0.786)	-0.020 (0.779)
Constant	4.540*** (1.451)	4.451*** (1.457)	7.453*** (1.549)	7.434*** (1.548)	7.222** (2.867)	7.329** (2.841)
Number of observations	64	64	65	65	63	63
P	0.021**	0.017**	0.306	0.299	0.230	0.242
Loglikelihood	-94.998	-95.245	-66.107	-66.059	-100.171	-99.587

*, **, ***. Statistically significant at the 10%, 5%, and 1% level, respectively. Standard errors are shown in parenthesis.

4.9 Reasons for selling crops

Most of the farmers (35%) indicated that they used income obtained from crop sales to buy food (Table 21). Ability to sell part of their produce enables farmers to buy other food items which are important for dietary diversity. The second main use of income obtained from crop sales was payment of school fees (27.8%). Investment in education has a positive effect on development. Part of the income was reinvested in to agricultural activities through purchases of farm inputs. Farming becomes sustainable if farmers are able to reinvest. Use of income to pay for hired labor, buy livestock or cover medical expenses was less prominent. Use of crop income to hire labour

was more prominent in Chiredzi for sugar cane producers (19%). This is expected given that sugar cane producers cultivate larger areas and therefore require hired labour. This suggests that job creation can be attained when farmers operate at a larger scale. Increasing scale of production should be encouraged across value chains. Operating on large scale enables farmers to get benefits associated with economies of scale.

Table 21. What were the reasons for selling your produce? (%)

Reasons for selling	Overall	Ingwebu Breweries	Sidella Trading	Hippo Valley	Intwasa Pfumvudza	Cairns Foods	Hippo-crene	Matanuska	Green Trade	Other channels
Wanted to buy food	35.5	33.6	37.2	23.8	40.7	30.0	37.5	49.0	39.2	38.5
Wanted to pay fees	27.8	29.7	30.9	22.8	25.9	32.3	25.7	29.8	26.4	33.3
To buy inputs for next season	20.0	14.1	19.1	23.8	20.4	27.6	23.7	7.9	25.6	10.3
To pay hired labour	5.8	4.7	2.1	19.9	1.9	2.4	3.9	0.7	0.8	2.6
Buy livestock	6.1	11.7	8.5	3.9	3.7	6.3	7.2	4.6	4.0	5.1
Medical costs	4.8	6.3	2.1	5.8	7.4	1.6	2.0	7.9	4.0	10.3
Total	1076	128	94	206	54	127	152	151	125	39

4.10 Challenges encountered by smallholder farmers during crop sales

Farmers across all value chains faced a wide range of challenges during the selling of their products (Table 22). Results show that across all value chains, farmers indicated that the prices of the products were low, suggesting that they did not get the revenue they expected from their crop sales. Delays in receiving payments was also one of the main challenges highlighted by farmers (16%). This challenge was more prominent for farmers in Binga and Murehwa. Farmers also indicated that the transport costs that they incurred were too high. Exorbitant transport cost reduces profitability. Usually transport costs tend to be high if there is uncoordinated selling. Organised / coordinated selling enables farmers to pull resources so as to capitalise on economies of scale. Farmers also faced challenges of markets oversupply which lowered prices.

Table 22. Challenges faced by farmers in selling their produce (%)

Challenges	Overall	Ingwebu Breweries	Sidella Trading	Hippo valley	Intwasa Pfumvudza	Cairns Foods	Hippocrene	Matanuska	Green Trade	Other channels
Low prices	37.9	21.6	32.8	32.4	29.0	40.7	43.6	60.4	35.8	34.6
Delayed payments	16.9	34.1	14.8	5.6	16.1	6.7	12.9	34.1	17.0	26.9
Expensive transport	16.2	21.6	4.9	50.0	14.5	11.9	10.7	1.1	14.2	-
Market flooded	9.4	2.3	9.8	2.8	11.3	16.3	15.0	2.2	10.4	11.5
No transport to market	8.1	5.7	6.6	1.9	11.3	11.1	14.3	-	10.4	7.7
Failing to meet quality	1.6	-	1.6	2.8	1.6	1.5	1.4	2.2	1.9	-
No willing buyer	2.1	1.1	-	-	1.6	8.1	0.7	-	2.8	-
Failing to meet quantity	1.1	1.1	3.3	0.9	-	1.5	0.7	-	1.9	-
No challenges	6.7	12.5	26.2	3.7	14.5	2.2	0.7	-	5.7	19.2
Number of responses	817	88	61	108	62	135	140	91	106	26

4.11 Livestock Production

4.11.1 Types of animals owned

Livestock improve food supply and nutrition, income, livelihoods, agricultural diversification and sustainable agricultural production. Table 23 presents the types of animals currently owned by smallholder farmers across all districts. The majority of the farmers own, cattle, goats and chickens accounting for 50.7%, 59.3% and 75.8% respectively. Cattle and goats are normally used as a store of value. Improvements in livestock production contribute to rural development. Furthermore, livestock production enhances economic viability and sustainability of a farming system.

Table 23. Types of animals owned by farmers (%) (n=513)

Type of animal	Overall	Binga	Chiredzi (Sesame)	Chiredzi (Sugarcane)	Murehwa	Buhera	Mutasa	Mt Darwin	Chipinge
Cattle	50.7	96.8	68.9	20.9	53.1	60.3	9.1	62.5	38.5
Donkeys	8.2	28.6	14.8	4.5	1.6	7.9	3.0	6.3	-
Pigs	5.7	23.8	14.8	3.0	1.6	-	1.5	-	1.5
Sheep	3.7	4.8	3.3	6.0	-	15.9	-	-	-
Goats	59.3	81.0	77.0	11.9	51.6	85.7	59.1	56.3	55.4
Chicken	75.8	95.2	50.8	35.8	92.2	90.5	90.9	82.8	69.2
Ducks	6.8	1.6	42.6	3.0	1.6	4.8	-	-	3.1
Guinea Fowl	10.5	39.7	16.4	6.0	-	14.3	4.5	1.6	3.1
Turkey	10.5	7.9	19.7	10.4	14.1	12.7	7.6	9.4	3.1
Rabbits	2.7	1.6	1.6	0	10.9	4.5	3.1	3.1	-

Table 24 shows the number of livestock animals that are currently owned by farmers in the survey district. Cattle, goats and sheep are the majority of animals owned by farmers. On average, farmers in Binga and Chiredzi (sugarcane) own more cattle relative to other farmers in the other districts. These two districts lie in the sweet veld which is conducive for livestock ranching compared to the other districts which are located in the sour veld. From a policy perspective, interventions for livestock production; for example, livestock finance and feeder scheme should be targeted to these districts. Of course, the major challenge is that Chiredzi and Binga border national parks and animals are susceptible to foot and mouth diseases. Hence there is need to invest in fencing by the government to demarcate game parks from communal areas of the country.

Table 24. How many livestock animals do you currently own?

Livestock owned	Overall	Binga	Chiredzi (Sesame)	Chiredzi (Sugarcane)	Murehwa	Buhera	Mutasa	Mt Darwin	Chipinge
Cattle	6.7	10.9	5.6	14.99	5.3	4.8	4.0	3.5	4.6
Donkeys	3.7	4.6	3.0	2.0	4.0	3.8	1.5	3.5	0
Pigs	4.0	2.5	6.4	6.5	3.0	0	2.0	0	1.0
Sheep	7.5	7.0	3.5	11.0	0	7.0	0	0	0
Goats	6.9	10.1	6.0	16.1	3.8	9.5	4.4	4.0	5.8
Chicken	12.8	15.0	8.2	17.1	11.1	11.4	15.2	10.7	14.2
Ducks	6.8	5.0	7.6	9.2	2.0	3.0	0	0	3.0
Guinea fowls	7.0	6.4	5.0	3.3	0	9.9	18.3	2.0	4.5
Turkeys	5.2	2.2	5.3	5.9	4.9	6.3	3.6	6.7	8.0
Rabbits	5.9	25.0	2.0	0	4.7	0	5.0	4.0	0

4.11.2 Output market of the livestock and livestock products

Farmers provided information on their livestock output market. Table 25 presents the output markets differentiated by the type of livestock. The major output market for livestock is local markets (neighbours) (46.7%). There were a few scenarios where farmers indicated that they sale to formal markets. This result reveals a lack of market for livestock hence presents an opportunity for developing interventions in livestock value chains.

Table 25. Where did you sell your livestock?

Output market	Cattle	Pigs	Sheep	Goats	Chicken	Ducks	Guinea fowls	Turkey	Rabbit
Local (neighbours)	46.7	75.0	66.7	78.8	89.7	100	0.2	85.7	0.4
Distant formal market	25.0	16.7	-	2.5	-	-	-	-	-
Local (Growth point)	15.0	8.3	-	11.3	4.1	-	-	14.3	-
N	60	12	3	80	97	5	1	7	2

Figure 2 below shows the proportions of the whole sample of who produced different livestock products across all the districts. Eggs and chicken were recorded as the most produced products with over forty percent respectively. Cow milk was the third most common livestock product that was produced and sold (17.2%). Livestock interventions should promote the breeding and

production of broilers, indigenous chicken and layers. Where appropriate access to rural finance to support these livestock value chains should be encouraged as they provide farmers with quick returns when sold.

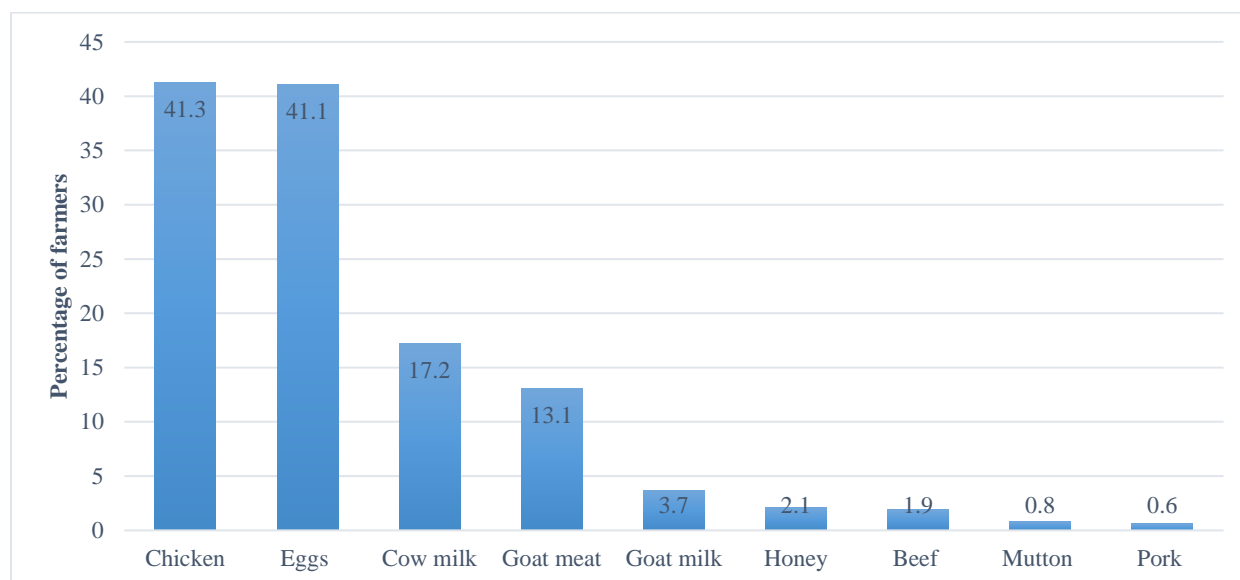


Figure 2. Livestock products produced in the last 12 months, % (n=513)

4.12 Off-farm income and other livelihoods strategies

In addition to agricultural income, household have other off farm income sources. Across all the districts, remittances and income from non-agricultural businesses were the dominant income and livelihood strategies accounting for 39% and 36% respectively (Table 26). Labour sales accounted for 33.3%. These results demonstrate low off-farm income diversification among smallholder farmers. Strategies that increase income diversification are required in the smallholder farming communities. A growing number of studies demonstrate the positive impact of off-farm income on household food security and nutrition (Babatunde and Qaim, 2010; Owusu et al., 2011).

Table 26. Off-farm income sources in the past 12months, % (n=513).

Type of off farm income	Overall	Binga	Chiredzi (Sesame)	Chiredzi (Sugarcane)	Murehwa	Buhera	Mutasa	Mt Darwin	Chipinge
Remittances	38.6	23.8	34.4	40.3	64.1	28.6	43.9	40.6	32.3
Business	35.5	34.9		48.4	31.3	20.6	28.8	34.4	36.9
Labour sales	33.3	31.7	47.5	6.0	51.6	38.1	22.7	34.4	36.9
Pension/retirement Package	11.3	3.2	4.9	35.8	14.1	3.2	13.6	7.8	6.2
Wage Employment outside agriculture	9.7	14.3	8.2	9.0	6.3	14.3	6.1	12.5	7.7
Sale of forest product sale	5.8	7.9	3.3	1.5	1.6	14.3	-	6.3	12.3
Wage from machinery services	2.9	4.8	4.9	6.0	-	3.2	-	3.1	1.5
Renting out draft animals	1.9	3.2	4.9	3.0	1.6	3.2	-	-	-
Marriage gifts	1.8	-	1.6	3.0	-	3.2	3.0		3.1
Leasing out land	0.2	1.6	-	-	-	-	-	-	-

4.13 Annual income generated by smallholder farmers (all sources)

Efforts were made to obtain a detailed understanding of annual levels of income that is generated by farmers. Firstly, economic value of agricultural products was used to compute economic agricultural income. This aimed at considering the value of all the agricultural produce including the portion that was not channeled to the market. Suppose farmers had not produced the crop, there were going to buy the crop from other farmers or from the market at a given price. The agricultural economic income was computed as the total agricultural economic value less the total cost of production (column 1 in Table 27). The cost of production in this case included only variable cost such as seed and fertilizer. The economic agricultural income is therefore a proxy of the income that farmers were going to obtain if they had sold all the agricultural produce at an average market price.

Income from other sources (mainly off farm) was also computed for each household. This was computed as a summation of all household income obtained from other sources such as off farm businesses, remittances, wage income and gifts, among other things (Column 2 in Table 27). Total household annual income comprised of both the economic agricultural income and total off farm income (column 3 in Table 27). Column 4 and 5 in Table 27 shows the incomes generated from actual sales. Income obtained from all crops sales (column 4 in Table 27) was computed as revenue from all crops less total cost of production (only variable cost). The same formula was used to compute income that was generated under borrower (CREATE facility). The only difference

between column 4 and 5 if that column 4 considered all crops that were sold, while column 5 considers only crops that were sold through the borrower (CREATE facility).

Results in Table 27 show that farmers in Chiredzi (sugarcane) obtained higher incomes across all proxies. This generally shows that the farmers in Chiredzi are better off compared to farmers from other districts. However, the real incomes for these farmers might be lower than what is presented in Table 27 if fixed cost are considered. Nevertheless, the used measures of income are sufficient to show the difference across districts and the performance of different value chains. Most of the income for Chiredzi (sugarcane) smallholder farmers was obtained through the borrower. Income obtained through the borrower accounts for approximately 87% of the economic agricultural income. Similarly, farmers in Chipinge also obtained most of their income from sales made through the borrower, accounting for approximately 90% of the economic agricultural income. This suggest that in terms of incomes, the sugarcane and banana value chains performed well and made impact.

In Mutasa and Mt Darwin, most of the agricultural income was obtained from sales made through other channels. Incomes obtained through the borrower contributed relatively less. In Mutasa, some farmers produced bananas though they were not funded under CREATE facility and therefore, they might have obtained higher incomes from the non-funded value chain. In Mt Darwin, farmers failed to meet the required quality of Mung beans therefore obtained less income from sales made through the borrower. Farmers in Buhera obtained generally low incomes from agricultural activities regardless of the channel used in selling their produce. Their production of Michigan Pea Beans was negatively affected by intermittent irrigation water cuts by ZESA due to outstanding electricity bills. Compared to all study districts, Murehwa had the lowest agricultural incomes. Farmers in Murehwa indicated that their maize production was affected by the army worm infestation, resulting in getting an average economic agricultural income of US\$ 543.34. Likewise, they obtained less incomes from crop sales made both through other markets and through the borrower. Farmers from Chiredzi (sesame) did not sell any crops through the borrower. Sidella Trading did not maintain the relationship with the farmers after the maturity of the facility.

Overall, the results show that sugarcane (Chiredzi), banana (Chipinge), tea (Mutasa) and sorghum (Binga) value chains performed better in terms of income generation. Michigan Pea Beans

(Buhera) value chain was average while mung beans (Mt Darwin) and maize (Murehwa) did not perform well. The results also highlight the importance of agricultural income to smallholder farmers. In five districts, namely, Chiredzi (sugarcane), Chipinge, Mutasa, Binga and Mt Darwin, the average value of income received from actual crop sales was higher than income obtained from other sources (Comparing column 4 and 2).

Table 27. Level of annual income generated by smallholder farmers

Value Chain- (District)		Column 1	Column 2	Column 3		Column 4	Column 5
	N	Economic agricultural income (US\$)	Total off-farm income (US\$)	Total household income	N	Average agricultural income (US\$)	Average income under borrower (US\$)
Sugarcane –(Chiredzi)	65	136845.39	7193.17	144038.56	65	135272.02	119670.49
Banana –(Chipinge)	65	3366.34	610.95	3977.29	65	3066.50	3030.87
Tea – (Mutasa)	66	4017.93	1379.91	5397.84	65	2319.52	725.27
Sorghum –(Binga)	64	2281.10	763.41	3044.51	50	864.54	553.36
Michigan Pea-(Buhera)	63	940.92	1012.17	1953.10	61	343.57	208.59
Mungbean –(Mt Darwin)	63	2395.84	897.14	3292.98	55	934.69	65.70
Maize –(Murehwa)	63	542.34	833.46	1375.80	34	63.81	53.59
Sesame – (Chiredzi)	64	941.50	1183.63	2125.13	53	340.51	-
Total	513				448		

4.14 Using annual income as a measure of wellbeing

The income generated by farmers was used as a proxy for wellbeing. Farmers' annual income were classified into two categories (i) farmers earning less than US\$2 per day and (ii) farmers earning more than US\$2 per day. Farmers' that had an annual income that was above US\$730 were classified as household leaving above US\$2 per day and likewise, farmers that earned less than US\$730 per year were classified as households leaving below US\$2 per day. Basing on the economic agricultural income, in almost all the districts, more than 50% of the sampled farmers were living above US\$2 per day except for Murehwa and Buhera. This implies that most of the farmers in these districts produced crops that could generate more than US\$730 if they had sold everything they produced. Overall, about 63% of the sampled household fell above US\$2 per day mark when this measure of income is used (Table 28).

When only off farm income is used to classify farmers, results show that most of the farmers fall below the US\$2 per day mark, except for Chiredzi (Sugarcane). This suggest that agricultural income contributes relatively more to farmers' livelihoods. When total household income (Column 1 and 2 are added to get a proxy of total household income) is used to classify farmers, approximately 79% of the interviewed farmers would live above US\$2 per day.

Considering the actual income obtained from crop sales (Column 4), most farmers from Chiredzi (sugarcane), Chipinge, and Mutasa obtained income that was above US\$730. If farmers depended solely on actual agricultural income, then approximately 47% could have lived above US\$2 per day. When income obtained from crop sales that were channeled under the borrower is used (column 5), the results show that overall, about 34% of the farmers earned more than US\$730. In Buhera and Mt Darwin, very few farmers generated above US\$2 per day. Addressing challenges faced by farmers might lead to improved productivity hence increase the incomes obtained by farmers. Farmers in Buhera indicated that they faced challenges with irrigation water supply while farmers in Mt Darwin indicated that they failed to meet quality requirements. Considerations of targeting other crops could be taken as an option in cases where there is huge difference between income obtained from sales of all crops and income obtained from sales made through the borrower (differences in Column 4 and 5). The differences would be suggesting that there are other potential crops that are not funded under the CREATE facility. For example, in Mutasa, its bananas, in Mt Darwin its groundnuts, in Buhera its sugar beans and in Chiredzi (sesame wards) its sorghum and maize. However, if value chains are to include common crops, there is need to put measures in place in to avoid challenges of side selling.

Table 28. Percentage of farmers leaving at above USD2 per day.

Value Chain / District	Percentage of farmers living above 2 dollars a day						
	N	Column 1 <i>Economic agricultural income</i>	Column 2 <i>Total off-farm income</i>	Column 3 <i>Total household income</i>	N	Column 4 <i>Average agricultural income</i>	Column 5 <i>Average income under borrower</i>
Banana-Chipingwe	65	90.77	30.77	90.77	65	84.62	84.62
Sugarcane -Chiredzi	65	87.69	67.69	87.69	65	87.69	78.46
Tea - Mutasa	66	56.06	43.94	77.27	65	60.00	29.23
Sorghum -Binga	64	85.94	28.13	92.19	50	46.00	26.00
Mungbean – Mt Darwin	63	66.67	31.75	82.54	55	32.73	3.64
Michigan Pea-Buhera	63	33.33	23.81	55.56	61	14.75	3.28
Maize - Murehwa	63	25.40	34.92	65.08	34	02.94	0
Sesame-Chiredzi	64	54.69	31.25	76.56	53	18.87	-
Total	513	62.77	36.65	78.56	448	47.32	34.380

4.15 Asset accumulation

4.15.1 Type of assets usable and repairable owned

Table 29 shows status of asset accumulation within a period of 5 years. Survey results show that there is a positive change in terms of asset ownership. The positive change was noticed in assets like cellphones, solar panel, solar lamps, radio, television, ox/Scotch carts, borehole and improved granary. Worryingly, a negative change was noticed in assets like plough, cultivator, harrow and wheelbarrow. Decrease in number of farmers with such assets may suggest two things, (i) on a positive note, some farmers could have changed the farming practices too use tractors, making investment in assets such as ploughs less important (ii) on a negative note, farmers might be failing to replace worn out farm equipment. If the latter is true, then this might be attributable to lack of income to purchase/to service the assets since most of income obtained from crop sales is used to purchase food items and to cover education expenses. As such, increasing agricultural income might enable farmers to have enough to purchase food, cover education expenses and also remain with some income to invest in agriculture. Future studies have to also focus on the reasons for observed trends in asset ownership.

Table 29. Asset accumulation over 5 years ago

Asset	Mean of number owned 5years ago	Mean of number currently owned	Change
Plough	0.78	0.76	-
Ox/Scotch Cart	0.41	0.44	+
Cultivator	0.14	0.12	-
Harrow	0.12	0.13	-
Tractor	0.05	0.05	
Wheelbarrow	0.89	0.83	-
Bicycle	0.76	0.67	-
Television	0.38	0.42	+
Radio	0.71	0.72	+
Cellphones	1.52	1.98	+
Borehole	0.09	0.11	+
Water pump	0.07	0.08	+
Water tanks (JoJo)	0.03	0.05	+
Solar panel	0.58	0.86	+
Solar lamp	0.43	0.66	+
Motorcycle	0.04	0.05	+
Improved storage facility	0.20	0.24	+

4.16 Food availability and access at household level

4.16.1 Food security measurements

Household dietary diversity

A modified Household Dietary Diversity Score (HDDS) (Swindale and Bilinsky, 2006) was calculated for each household using data on consumption of food groups over the previous 24 hours. The shorter recall period improves the accuracy of estimates compared with longer recall periods (Swindale and Ohri-Vachaspati, 2004). Food items were categorized into 9 different food groups with each food group counting toward the household score if a food item from the group was consumed by anyone in the household in the previous 24 hours. The modified HDDS, then, is a count variable from 0 to 9. The food groups used to calculate the modified HDDS included: cereals; roots and tubers; vegetables; fruits; meat, eggs and fish; pulses and nuts; milk and milk products; oils and fats; sugar and sweets.

Household Food Consumption Score

Food Consumption Score (FCS) is a composite score based on dietary diversity, food frequency, and relative nutritional importance of different food groups (Jones et al., 2014; Swindale and Bilinsky, 2006). The FCS is calculated using the frequency of consumption of different food groups consumed by a household during the 7 days before the survey. The consumption frequency

of eight food groups (i.e. staple grains and tubers, pulses, vegetables, fruits, meat and fish, dairy products, sugar and oil) is multiplied by a group assigned nutrient weight, and the resulting values are summed to obtain the FCS (Kennedy et al., 2010). This score is then recorded to a three-level categorical variable (poor, borderline, or acceptable food consumption) using standard cut-off values. The assigned weights for each food group are based on the energy, protein and micronutrient densities of each food group. In this study we used the count FCS variable rather than the three-level categorical variable to prevent the loss of data (Jones et al., 2014).

4.16.2 Effect of credit on food security

Table 30 shows estimates of the effect of credit obtained in the past 12 months (through borrowers) on household nutrition. The amount of credit borrowed in the past 12 months had no effect on household dietary diversity and food consumption. The gestation period of the credit to produce desirable effects may be quite short in our study. In the next subsection, we account for the amount of credit initially borrowed and assess its effect on household nutrition.

Table 30. Effect of credit borrowed last 12 months on household food security

	HDDS		FCS	
	Coef	Std. errs.	Coef	Std. errs.
Credit volume last year	0.001	0.006	-0.001	0.002
Food aid	-0.032	0.041	-0.086***	0.014
Age of head	0.001	0.001	0.003***	0.001
Gender of head	0.031	0.099	-0.046	0.036
Head marital status	-0.018	0.095	0.093***	0.034
Head education	0.011*	0.006	0.020***	0.002
Sold crop	0.064	0.066	0.147***	0.025
Arable land	0.002	0.003	0.012***	0.001
Decision on crop to grow	0.013	0.093	-0.002	0.032
Decision on crop area	-0.039	0.104	0.020	0.036
Decision on credit	0.018	0.084	-0.049*	0.029
Own cattle	-0.032	0.035	0.006	0.012
Extension	0.039	0.048	-0.007	0.016
ICT	0.040	0.046	0.090***	0.016
Radio	-0.016	0.037	0.003	0.013
Demonstration	0.068*	0.036	0.073***	0.013
Field day	0.003	0.054	0.029	0.019
Constant	1.710***	0.144	3.545***	0.050
Observations	481		481	
P	0.301		0.000***	
Loglikelihood	-979.424		-2800.670	

*, **, ***. Statistically significant at the 10%, 5%, and 1% level, respectively.

Table 31 shows estimates of the association of initial amount of credit borrowed and household nutrition for borrowers only. Regarding our key policy variable of interest, results from the poisson regression shows that credit amount has a positive effect on household dietary diversity and food consumption score. A unit increase in the initial credit leads to a 2.4% and 3.7% increase in household dietary diversity and food consumption score respectively. Bocher et al. (2017) report similar results that access to credit improves household welfare in Ethiopia. In addition, Bidisha et al. (2017) reveals that access to credit tends to improve food security and allows households to achieve greater dietary diversity. These results suggest that relaxing the credit constraints helps to improve the rural households' consumption in developing countries. This study therefore provides empirical evidence in favor of policies supporting accessible credit for smallholder households in Zimbabwe. Therefore, programs such as the ZADT need to be strengthened to ensure smallholder farmers have access to credit. Furthermore, results show that education, market access, land size, cattle ownership had positive associations with food consumption. The results on the positive role of market access on household nutrition resonates with Koppmair et al. (2017) for Malawi. Access to information through demonstrations increased both dietary diversity and food consumption among the smallholder farmers in the study sample.

Table 31. Effect of volume of credit initial borrowed on household food security

	HDDS		FCS	
	Coef	Std. err.	Coef	Std. err.
Credit volume (initial amount)	0.024***	0.009	0.037***	0.003
Food aid	0.001	0.043	-0.034**	0.015
Age of head	0.001	0.002	0.002***	0.001
Gender of head	0.040	0.099	-0.032	0.036
Head marital status	-0.026	0.095	0.080**	0.034
Head education	0.008	0.006	0.015***	0.002
Sold crop	0.037	0.067	0.099***	0.025
Arable land	-0.001	0.003	0.008***	0.001
Decision on crop to grow	0.024	0.094	0.014	0.032
Decision on crop area	-0.037	0.104	0.024	0.036
Decision on credit	0.018	0.084	-0.048*	0.029
Own cattle	-0.000	0.037	0.057***	0.013
Extension	0.042	0.048	-0.002	0.016
ICT	0.038	0.046	0.082***	0.016
Radio	-0.021	0.037	-0.005	0.013
Demonstration	0.066*	0.036	0.072***	0.013
Field day	0.012	0.054	0.043**	0.019
Constant	1.614***	0.147	3.381***	0.052
Observations	481		481	
P	0.059*		0.000***	
Loglikelihood	-975.694		-2725.747	

*, **, ***. Statistically significant at the 10%, 5%, and 1% level, respectively.

5 CONCLUSION AND RECOMMENDATIONS

5.1. Summary of findings

This study highlighted the impact of the CREATE Fund on smallholder farmers livelihoods, agricultural productivity and food security in Zimbabwe in selected districts, namely: Binga, Chiredzi, Chipinge, Murehwa, Buhera, Mutasa and Mt Darwin. The study mainly focused on credit that was obtained by farmers through borrowers. The notable impacts of the CREATE Fund are summarized below:

i. Improved access to credit

The CREATE Fund improved smallholder farmer's access to credit, particularly for women. Approximately 52% of the farmers that obtained the CREATE credit were female. The conditions to get the credit were accommodative given that farmers were required to demonstrate their ability to produce crops through providing evidence of access to reasonable arable land, having animal

(draught power) to use, and also belonging to a group. There were rare cases in which farmers were asked to provide collateral that possessed monetary value such as houses, vehicles and bank statements. Results also show that farmers have limited access to credit from other sources. This reflects the importance of the CREATE facility to smallholder farmers.

ii. Improved access to extension

Farmers that participated in programmes financed by the CREATE Fund had better access to extension services. In addition to government extension support services that are provided to all farmers, about 42% of farmers that participated in the CREATE funded programme obtained additional extension support from borrowers. Availing extension support helps in building capacity among farmers and also improves productivity. This has spillover effects towards economic development.

iii. Contribution to incomes and market access

Approximately 43% of the crops sales were obtained from value chains supported by the CREATE facility. The CREATE funded programmes were instrumental in creating a stable, viable and guaranteed market for smallholder farmers. Crops sales that were channeled through CREATE facility contributed around 58% to total crop revenue generated in 2016/17 season. The regression results also showed that an extra dollar obtained from CREATE facility increases agricultural income by 110% and 55% for cereal crops and sugar cane respectively. The results also show that sugarcane (Chiredzi), banana (Chipinge), tea (Mutasa) and sorghum (Binga) value chains performed better in terms of income generation. Michigan Pea Beans (Buhera) value chain was average. Income obtained through the borrower accounted for a greater proportion of income that was obtained from all crops sales. Mung beans (Mt Darwin) and maize (Murehwa) were the only value chains that did not perform well in the 2016/17 season. Sesame value chain was not functional in 2016/17 season, therefore farmers did not sell any crops through the borrower. Sidella Trading did not maintain the relationship with the farmers after the maturity of the facility. Overall, approximately 34% earned more than US\$2 per day from the sales that were channeled through the borrower.

iv. Contribution to food security and livelihoods

Results show that access and volume of the credit obtained under the CREATE funded programmes had positive effects on dietary diversity and food consumption. Most of the income generated from crop sales under the CREATE facility (36%) was used to purchase food and subsequently improves dietary diversity. The regression results showed that a unit increase in the initial credit leads to a 2.4% and 3.7% increase in household dietary diversity and food consumption score respectively. Some of the farmers used the income to pay for school fees. This has a positive and long-term effect on development. Farmers also reinvested income into agricultural activities (20%). The ability to reinvest ensures sustainability of farm enterprise.

i. Sustainability of the established agribusiness links

Despite the fact that three of the facilities had matured at the time of the study, two of them maintained links with farmers. Matanuska (banana value chain) and Green Trade (Mung beans value chain) maintained their links with farmers. Only Sidella Trading (sesame value chain) did not maintain the link with farmers. This suggests that there are greater chances of continuity after the project life.

5.2. Factors undermining the impact of CREATE facility

One of the factors that undermined the impact of the CREATE facility was the delay in disbursing the funds (inputs). Approximately 37% of the farmers highlighted that they encountered delays in receiving credit / inputs. Delays in giving farmers inputs / credit results in late planting which usually leads to yield losses. Nearly 31% indicated that the repayment procedure and conditions were not clearly articulated to them. Lack of transparency usually leads to lack of trust and has negative effects on the farmer-borrower relationship. Overall, there was lack of youth participation (defined as individuals under the age of 35) in the CREATE funded programme, this undermines sustainability and continuity of agribusiness in the long run.

5.3. Recommendations

The recommendations presented aims at making sure that the identified positive contribution of the CREATE facility are maintained and improved. Suggestions on ways to address factors

undermining the impact of the CREATE facility are also presented. Basing on the study findings, key recommendations for the CREATE funded programme includes:

Increasing credit volumes and market linkages

There is need to increase the amount of credit offered to farmers as well as improve market linkages opportunities for farmers who are supported by the funded agricultural value chain actors. The results showed a positive relationship between amount of credit given to farmers and agricultural income. An additional dollar borrowed by sugar cane farmers led to a 56% increase in crop income and a 55% increase in agricultural income. These results suggest that increasing value of the credit will improve crop production and incomes. Increasing agricultural incomes might also enable farmers to reinvest in agricultural activities, increase production scale, and benefit from economies of scale. Market linkages could be improved by encouraging contractual arrangements that are beneficial to both the borrower and the farmer. These contractual arrangements should be in the form of written contracts as they show better levels of commitment.

Financing of crops commonly grown by farmers

The performance of some of the value chains, in particular mung beans and sesame were not impressive according to the farmers interviewed. Farmers highlighted that these were new crops and need a lot of extension backstopping. In addition, farmers perceived that it was better for borrowers to finance commonly grown crops, for example maize, sugar beans, sorghum and groundnuts for sustainability. It will be easier for farmers to produce good quality of the crops they are used to grow. In addition, producing crops they are used to growing would enhance chances of continuity. Some of the crops commonly grown by farmers have potential, for example, there is huge demand for aflatoxin free groundnuts by processing companies in Zimbabwe. In addition, farmers in Mt Darwin expressed high interest in sugar beans compared to mung beans.

Extension and farmer training

There is need for borrowers, private and public extension to continue providing extension support to farmers. Alternatively, farmers could be encouraged to form associations which would be used as a vehicle for providing training. Extension support is usually associated with improved productivity. Furthermore, providing extension support may be used as a vehicle to monitor quality of the product during growth so as to take corrective action in time and avoid losses. In addition to

general extension, there is need to provide training that would build farmers' financial literacy. Support provided by borrowers was mostly in the form extension (41%), there were few instances where farmers received training on business management (4.3%), record keeping (9.9%), budgeting (3%) and marketing (packaging and handling of harvested crop) (8.4%). Suspicion about lack of transparency is inevitable if farmers are not able read and correctly interpret summary of their financial statements (transactions). Comprehensive, business-oriented training is likely to enhance farmers' decision making (judgement) and also help them understand all deductions made on their revenue.

Transparent and efficient costing system

Results from the study indicated that some farmers had concerns about the cost of inputs obtained under the CREATE funded programmes. There were cases where farmers had to pay about 28% more than what they would have paid if they had obtained inputs directly from agro-dealers. There is need to identify transparent and efficient ways of providing the services to farmers at a realistic cost, such that the cost under the facility is not way above the cost of obtaining inputs directly from agro dealers. The program should strive to provide inputs at a cost that allows farmers to pay at most 15% more than the actual market price after factoring in interest, administrative and transport cost.

Timely disbursement of inputs (credit) and prompt payment to farmers

The CREATE Fund was successful in financing the respective value chains. However, most of the farmers raised concerns about the timing of the credit from the borrower regardless of the type of value chain. Granting farmers inputs in time permits farmers to plan and plant early, enabling them to utilize limited rains, meet required quality and quantity. Likewise, in order to improve on convenience and welfare of farmers, borrowers should make prompt payments to farmers after collecting the harvested crops. Avoiding delays in settling the payments also improves farmers' confidence on the borrower. Building farmers' confidence and trust is necessary if sustainable relationships are to be attained.

Participation of youths in the programme

The CREATE Fund was successful in addressing gender inclusivity, given that most women participated in the value chains. However, overall participation of youths in this credit programme

was limited (less than 10%). Most of the farmers interviewed in the study were beyond 35 years of age indicating that the majority of the active members in the programme were approaching the economically inactive group. There is need to make deliberate efforts to promote youth participation in the agricultural programmes in order to ensure maximum productivity and continuity. The youth may have a greater potential in exploring other agribusiness opportunities.

5.4. Conclusion

Our study findings indicated that CREATE facility was successful in availing credit to constrained smallholder farmers and in enhancing gender equality through women participation in the credit program. The ZADT programme had a positive impact on creating a viable market for smallholder farmers, improving agricultural productivity, incomes and food security. To consolidate the gains of the CREATE Fund there is need for timely disbursement of inputs, extension training, transparent cost structures and prices. There is also need to reconsider the viability of two value chains – sesame and mung beans given their poor performance. Potential crops that can be financed instead include sugar beans and groundnuts, which have ready markets in the country and regionally. Given the positive contribution that the facility has, there is need to continue availing the credit facility to farmers. Policies that strengthen the functioning of agricultural credit need to be promoted.

References

- Babatunde, R.O., Qaim, M., 2010. Impact of off-farm income on food security and nutrition in Nigeria. *Food Policy* 35 (4), 303–311. 10.1016/j.foodpol.2010.01.006.
- Bidisha, S.H., Khan, A., Imran, K., Khondker, B.H., Suhrawardy, G.M., 2017. Role of credit in food security and dietary diversity in Bangladesh. *Economic Analysis and Policy* 53, 33–45. 10.1016/j.eap.2016.10.004.
- Bocher, T.F., Alemu, B.A., Kelbore, Z.G., 2017. Does access to credit improve household welfare?: Evidence from Ethiopia using endogenous regime switching regression. *African Journal of Economic and Management Studies* 8 (1), 51–65. 10.1108/AJEMS-03-2017-145.
- Ferguson, L., 2011. Promoting gender equality and empowering women?: Tourism and the third Millennium Development Goal. *Current Issues in Tourism* 14 (3), 235–249. 10.1080/13683500.2011.555522.

- Friedline, T., Masa, R.D., Chowa, G.A.N., 2015. Transforming wealth: Using the inverse hyperbolic sine (IHS) and splines to predict youth's math achievement. *Social science research* 49, 264–287. 10.1016/j.ssresearch.2014.08.018.
- Jones, A.D., Shrinivas, A., Bezner-Kerr, R., 2014. Farm production diversity is associated with greater household dietary diversity in Malawi: Findings from nationally representative data. *Food Policy* 46, 1–12. 10.1016/j.foodpol.2014.02.001.
- Kennedy, G., Berardo, A., Papavero, C., Horjus, P., Ballard, T., Dop, M., Delbaere, J., Brouwer, I.D., 2010. Proxy measures of household food consumption for food security assessment and surveillance: Comparison of the household dietary diversity and food consumption scores. *Public health nutrition* 13 (12), 2010–2018. 10.1017/S136898001000145X.
- Koppmair, S., Kassie, M., Qaim, M., 2017. Farm production, market access and dietary diversity in Malawi. *Public health nutrition* 20 (2), 325–335. 10.1017/S1368980016002135.
- Luan, D.X., Bauer, S., 2016. Does credit access affect household income homogeneously across different groups of credit recipients?: Evidence from rural Vietnam. *Journal of Rural Studies* 47, 186–203. 10.1016/j.jrurstud.2016.08.001.
- Mundlak, Y., 1978. On the Pooling of Time Series and Cross Section Data. *Econometrica* 46 (1), 69–85.
- Owusu, V., Abdulai, A., Abdul-Rahman, S., 2011. Non-farm work and food security among farm households in Northern Ghana. *Food Policy* 36 (2), 108–118. 10.1016/j.foodpol.2010.09.002.
- Suvedi, M., Ghimire, R., Kaplowitz, M., 2017. Farmers' participation in extension programs and technology adoption in rural Nepal: A logistic regression analysis. *The Journal of Agricultural Education and Extension* 23 (4), 351–371. 10.1080/1389224X.2017.1323653.
- Swindale, A., Bilinsky, P., 2006. Household dietary diversity score (HDDS) for measurement of household food access: indicator guide: Indicator Guide (v. 2): Food and Nutrition Technical Assistance Project. Academy for Educational Development, Washington, D.C.
- Swindale, A., Ohri-Vachaspati, P., 2004. Measuring household food consumption: a technical guide: Food and Nutrition Technical Assistance Project. Academy for Educational Development, Washington, D.C.
- Vanlauwe, B., Wendt, J., Giller, K.E., Corbeels, M., Gerard, B., Nolte, C., 2014. A fourth principle is required to define Conservation Agriculture in sub-Saharan Africa: The

appropriate use of fertilizer to enhance crop productivity. *Field Crops Research* 155, 10–13. 10.1016/j.fcr.2013.10.002.

ZADT, 2016. Annual Report. Zimbabwe Agricultural Development Trust.

Zhang, M., Fortney, J.C., Tilford, J.M., Rost, K.M., 2000. An Application of the Inverse Hyperbolic Sine Transformation—A Note. *Health Services and Outcomes Research Methodology* 1 (2), 165–171. 10.1023/A:1012593022758.