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Farmers Perspectives towards the Rehabilitation of the Irrigation Schemes in Sekhukhune District of the Limpopo Province, South Africa

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ABSTRACT The revitalisation of small-holder irrigation schemesprogram (RESIS) is one of the major irrigation programs introduced by the government of South Africa to support small-holder farmers. However, contrary to expectations, most of the government supported irrigation schemes have failed to meet the expectations of both the government and farmers. The aim of the present study is to determine the perceived reasons for the failure of the irrigation schemes. The study also seek to determine the association between socio-economic characteristic of farmers and the perceived reasons for the failure of the irrigation schemes. Multinomial regression analysis was applied to analyse the factors influencingfarmers perspectives towards the Rehabilitation of the Irrigation Schemes in Sekhukhune District of the Limpopo Province, South Africa.The results of the study reviewed that economic, competition and socio-cultural factors were perceived as having a large influence on the success of the schemes.The findings recommended socio-economic characteristics to be considered when planning developmental projects directed to small-holder farmers.

INTRODUCTION

Irrigated agriculture has been identified as a sector that can make an important contribution to food security, improved nutrition and rural prosperity (Smith 2004). From a livelihood perspective, small-holder irrigation schemes are assetsthat can be used to improve livelihood outcomes in rural communities (Van Averbeke and Mohamed 2006). Brabben et al. (2004) reviewed that irrigated agriculture can have a major influence on freeing rural people from the preoccupation of survival to focussing on other development issues. Rainfed agriculture is not reliable (Dinku 2004) and therefore, small-holder irrigation programs are very important mainly in those areas where rainfall iserratic. In dry areas irrigation prolongs the effective crop-growing period, thus, permitting multiple cropping where only a single crop could be grown (FAO 1997).

Irrigation rehabilitation can be defined as a process of technical, managerial and institutional upgrading, including rehabilitation, of irrigation schemes with the aim of enhancing resource utilization and improving water delivery to the schemes (Renault et al. 2007). The process is not limited to the upgrading of infrastructure, but also includes fundamental transformations to resource management techniques. In dealing with revitalisation, an interrelated concept, referred to as modernisation, is frequently encountered. The concept involves the introduction of modern hardware and software as well as upgrading the human resources to operate the new technology (Renault et al. 2007). Farmers' perceptions towards the rehabilitation of irrigation schemes is of paramount importance. Therefore, this makes it meaningful to determine the perceived reasons for the failure of irrigation schemes in Sekhukhune District of the Limpopo Province.

In South Africa, small-holder irrigation dates back to the homeland system before the political dispensation (Sishuta 2005). The concept of small-holder irrigation was promoted as a means of alleviating poverty and enhancing economic development in Black communities. Many of these irrigation schemes failed to achieve their intended objectives. The schemes had a combination of technical, institutional and organisational challenges. Sishuta (2005) argued that the major contributing factor towards failure of the schemes was the lack of a support structure which suited people's needs and aspirations.

Turner (2004) argued that externally imposed and managed schemes are usually less successful than irrigation schemes that are initiated and controlled by the farmers. A study done by Karamjavan (2014) in Iran noted that local farmers did not have positive attitudes towards participating in the management of irrigation schemes.

In an effort to revitalise the failed irrigation schemes and improve agricultural production, the Limpopo Department of Agriculture (LDA) identified potential farming areas to be developed into commercial irrigation schemes through the Revitalisation of Small Holder Irrigation Schemes programme (RESIS). In Sekhukhune District, seven (7) irrigation schemes were identified for revitalization. Due to the technical complexity of large scale irrigation and past experiences with the failure of irrigation schemes, a strategic partnership (SP) model was introduced to address the challenges of the small-holder-farmers in a commercial irrigation operation setup. The challenges included farmers' lack of technical skills in irrigation farming, lack of farming implements and production inputs by farmers and the government's desire not to be involved in daily operations of the schemes. The strategic partnership model was based on a tripartite alliance between the farmers on each scheme as producers, LDA as the facilitator and strategic private sector partner as an investor (LDA 2002). The appointed Strategic partner was expected to secure market, finance, produce in collaboration with farmers and offer technical advice to the irrigation farmers. The LDA's role was to create a framework within which the SP model operated through policy and principles and provision of infrastructure. Contrary to expectations, most of these irrigation schemes have failed to meet the desired outcomes.

Objectives

The present research seeks to investigate farmers' opinions on the government's revitalization of the irrigation schemes and determine the perceived reasons for the failure of the irrigation schemes. Furthermore, the study seekstodetermine the association between socio-economic characteristics of farmers and the perceived reasons for the failure of the irrigation schemes.

METHODOLOGY

Study Area

The study was carried out in Sekhukhune District, Limpopo Province, South Africa. Sekhukhune District is a semi-arid region receiving 450-500 mm rainfall annually, with most of it falling in summer. The Hutton soil form dominates in the irrigation schemes with variability in terms of soil depth, soil texture andstructure. Generally, the soil depth is above 60 cm, with (10%) clay (Mothapo et al. 2011). The agricultural potential of these types of soilsis high and is suitable for most agronomic crops and vegetables such as maize, wheat, sorghum and potatoes (Mothapo et al. 2011).

Data Collection

Both primary and secondary data sources were used in the research. Primary data sources included informal conversations and discussions, semi-structured formal and informal in-depth interviews, questionnaires, focus group discussions and workshops with various stakeholders. Secondary data sources included documents pertaining to relevant policy, legislation, strategies, programs and projects, community records etc. Socio-economic characteristics of respondents such as gender, farm size, level of formal educational attainment, economic status and farming experience were also be recorded. A total of 150 farmers participated in the study. Factors that farmers perceive as having influence on the success or failure of the irrigation schemes were grouped into different categories and these are; climatic/ecological, socio-cultural, economic, competition, management/administrative and technological.The issues considered under climate/ecological factors were seasonal rainfall, pests, dry spells during rainy seasons etc. Under economic factors, high price of inputs, high cost of water use, better off-farm income were considered. Competition factors were price of produce and market access while management/administrative factors were non maintenance of irrigation equipment and infrastructure, non-timely supply of inputs etc. Socio-cultural factors were land tenure system and level of formal education while technological factors were type of irrigation system, skills required for irrigation farming, manual planting,

weeding and harvesting. The effect of each factor was rated on a 1 to 4 Likert-type scale to depict the perceived impact of each category: 1- strongly agree, 2 - agree, 3 - disagree, and 4 - strongly disagree.

Data Analysis

Descriptive statistics was performed to provide a profile of the general characteristics of the farmers. The association between socio-economic characteristics and farmers perceptions was tested using the multinomial logistic regression model treating perception score (measured in rank scale) as categorical or numeric.

RESULTS

Socio-economic Characteristics of Farmers

The socio-economic characteristics of farmers are presented in Table 1. A large propotion (64%) of the farmers were over 50 years of age with over (40%) of the farmers being 60 years and above. About (16%) of the farmers were 40 years and younger while (55%) of the farmers were males and (45%) females. Majority (90%) of the farmers had no education beyond secondary level with close to (60%) having primary or no formal education. Over a third of the farmers considered themselves either illiterate or innumerate.

Table 1: Socio-economic and farming characteristics of the respondents

Characteristics	*Percentage*
Age (Years)	
< 30	8
30-40	8
41-50	20
51-60	24
> 60	40
Gender	
Male	55
Female	45
Educational Level	
No education	18
Primary	40
Secondary	32
Certificate	5
Diploma	5
Literacy Level	
Innumeracy	8
Illiterate	26
Partial literacy	30
Literate	36
Farming Experience/Training	
No training	35
Some form of training	65

A large percentage (67%) of farmers with some primary education considered themselves illiterate. Two-thirds (65%) of the farmers indicated that they had some form of training in irrigation farming. However, over (75%) of these farmers indicated that the training did not adequately equip them with skills and competences necessary to carry out irrigation farming tasks.

Stakeholder Perception on Strategic Model

The perceptions of different stakeholders on the strategic partnership model are depicted in Table 2. Farmers perceived the strategic modelasa set back as it deprived them of the sense of ownership and made them to be dependent entirely on the strategic partner. The LDA and local municipality officials shared similar perceptions with farmers while strategic partners though sharing the same sentiments regarding the balance of power, quantified the business risk they faced. The model based on stakeholder perceptions had more negative than positive attributes.

Farmers'Perceptions Ranking on Factors That Have Influence on the Success of Irrigation Schemes

As presented inTable 3, perceptions on factors that have influence on the success of irrigation schemes) ranked on a scale of 1 to 4 (1 - strongly agree, 2 - agree, 3 - disagree, 4 - strongly disagree). Lower values of the mean rank for a specific influence factor indicate that farmers perceive the factor as having large impact on the success of the irrigation scheme. Larger values denote that farmers perceive the factor as having less or no influence on the success of the scheme. Economic, competition and sociocultural factors were perceived as having influence on the success of the irrigation schemes while climate/ecological and technological factors were perceived as having less or no influence on the success of the schemes. Management and administrative factors were scored at 2.5, signifying their low influence on the success of the schemes.

Association between Farmers' Socio-economic Characteristics and Perceptions of Factors Influencing Success of Irrigation Schemes

Results of the association between farmers' socio-economic characteristics and perceptions

Table 2: Stakeholder perception matrix on the strategic partnership model

Stakeholders	*Perceptions on the strategic partnership model*	
	Positive	*Negative*
Irrigation Farmers	Low risk for farmers	Encourages dependency Discourages sense of ownership Does not promote commitment Requires farmers to operate as co-ops which is not mostly preferred by farmers It is not empowering them
LDA Officials	Commercially orientated Low risk for farmers	Rely mostly on the external person Does not encourage ownership Promote co-op formation though is not well understood by farmers Give power to people with capital Model is not balanced; in favour of farmers
Strategic Partners	Low risk for farmers	SP are more at risk Business orientated but farmers more subsistence orientated It is not balanced; skewed to the side of SP Promote only high capitalised people
Local Municipality Officials		They are not empowering the community

Table 3: Rank of influence of various factors on the success of the schemes

Influence factor	*Mean rank*
Climate/Ecological	2.9
Economic	2.0
Competition	2.2
Management/Administrative	2.5
Socio-cultural	2.4
Technological	3.3

1 = strongly agree, 2 = agree, 3 = disagree, 4 = strongly disagree

of factors influencing the success of irrigation schemes are presented in Tables 4 to 9. The number of farmers in a scheme had no influence on how farmers perceive climate/ecological as a contributing factor to the success of the schemes (Table 4). All socio-economic variables except literacy level had no influence on farmers perception towards economic factors contributing to the success of the schemes. A unit increase in the variable literacy is associated with an increase of 2.09 in the log odds of farmers perceiving economicfactorsas having influence on the successof the schemes (Table 5). None of the socio-economic characteristics of farmers had influence on how farmers perceive competition factors as having influence on the success of the schemes (Table 6). Age and number of farmers in a scheme had an association with farmers' perception of the role of management/administrative factors in influencing the success of the schemes. A one-unit increase in variables age and number of farmers in a scheme is associated with increases of 2.86 and 2.16 respectively, in the log odds of farmers perceiving management/

Table 4: Factors affecting farmers' perceptions of the success of irrigation schemes – Climate/Ecological Factors

Predictor/independent variable	*Coefficient, (b)*	*Standard error*	*Wald Chi-square*	*P-value*	*Odds ratio*
Gender	0.52	0.12	11.8	0.38	1.68
Age	-1.39	0.21	17.8	0.08	0.25
Education	0.85	0.27	14.1	0.22	2.34
Literacy	-0.50	0.13	11.5	0.40	0.61
Number of farmers in scheme	0.22	0.09	14.2	0.22	1.25
Training	-0.79	0.26	11.0	0.43	0.45
Constant	7.23	2.71	1.51	0.21	-

Significance test at 5% level

Table 5: Factors affecting farmers' perceptions of the success of irrigation schemes – Economic factors

Predictor/independent variable	*Coefficient, (b)*	*Standard error*	*Wald Chi-square*	*P-value*	*Odds ratio*
Gender	-4.78	1.12	13.9	0.30	0.008
Age	-1.96	0.07	12.2	0.42	0.14
Education	-2.32	0.43	9.6	0.62	0.09
Literacy	0.74	0.11	20.7	0.04*	2.09
Number of farmers in scheme	-2.77	1.04	9.9	0.61	0.06
Training	-0.77	0.17	12.3	0.41	0.46
Constant	50.5	14.6	0.12	0.73	-

*P<0.05

Table 6: Factors affecting farmers' perceptions of the success of irrigation schemes – Competition factors

Predictor/independent variable	*Coefficient, (b)*	*Standard error*	*Wald Chi-square*	*P-value*	*Odds ratio*
Gender	-1.26	0.33	18.1	0.15	0.28
Age	-1.62	0.34	15.7	0.26	0.20
Education	-0.87	0.37	14.9	0.31	0.42
Literacy	-0.77	0.28	15.2	0.29	0.46
Number of farmers in scheme	1.59	0.55	13.6	0.40	4.90
Training	-3.34	0.98	10.3	0.66	0.03
Constant	11.67	2.63	1.5	0.22	-

administrative factors as influencing the success of the schemes (Table 7).

Literacy level and number of farmers in a scheme had an association with the farmers' perception of the role of socio-cultural factors in influencing the success of the schemes. A one-unit increase in the variables literacy and number of farmers in a scheme of farmers perceiving socio-cultural factors to be influencing the success of the schemes will increase the log odds ratio by 4.89 and 21.43 respectively (Table 8). Age and literacy level had an association with the farmers' perception of the role of technological factors in influencing the success of the schemes (Table 9). The log odds of age and literacy of farmers perceiving technological factors to be influencing the success of the schemes will increase by 19.00 and 16.00 respectively when there is a one-unit increase in variables age and literacy.

DISCUSSION

Socio-economic and Farming Characteristics of the Respondents

More than two-thirds of the farmers were over 50 years of age with only 8% of farmers being less than 30 years old. This poses a problem in terms of the sustainability of the projects and the ability of the farmers to actively participate in the schemes. A number of studies have also shown low involvement of young people in agricultural activities (Kamara et al. 2001; Kepe

Table 7: Factors affecting farmers' perceptions of the success of irrigation schemes – Management/ Administrative factors

Predictor/independent variable	*Coefficient, (b)*	*Standard error*	*Wald Chi-square*	*P-value*	*Odds ratio*
Gender	0.74	0.10	5.8	0.56	2.09
Age	1.05	0.22	16.5	0.02*	2.86
Education	-1.08	0.20	7.6	0.36	0.34
Literacy	-4.03	0.98	11.7	0.11	0.02
Number of farmers in scheme	0.77	0.14	13.6	0.048*	2.16
Training	-3.11	0.76	2.6	0.9	0.04
Constant	4.23	0.99	0.41	0.51	-

Table 8: Factors affecting farmers' perceptions of the success of irrigation schemes – Socio-cultural factors

Predictor/independent variable	*Coefficient, (b)*	*Standard error*	*Wald Chi-square*	*P-value*	*Odds ratio*
Gender	-16.15	3.67	11.7	0.11	9.68
Age	-2.9	0.51	9.9	0.19	0.05
Education	-8.44	1.96	8.1	0.32	0.002
Literacy	38.43	9.89	14.9	0.04*	4.89
Number of farmers in scheme	7.67	1.00	15.5	0.03*	21.43
Training	-3.23	0.54	9.3	0.22	0.04
Constant	74.49	8.91	0.02	0.88	-

*P<0.05

Table 9: Factors affecting farmers perceptions of the success of irrigation schemes – Technological factors

Predictor/independent variable	*Coefficient, (b)*	*Standard error*	*Wald Chi-square*	*P-value*	*Odds ratio*
Sex	-16.32	3.45	12.8	0.08	0.001
Age	37.15	6.67	17.3	0.02*	19.0
Education	-49.35	7.88	2.5	0.92	0.001
Literacy	5.92	1.11	24.4	0.001*	16.0
Number of farmers in scheme	-6.77	1.21	7.0	0.42	0.001
Training	-0.68	0.21	5.1	0.64	0.51
constant	237.6	33.73	0.47	0.49	-

*P<0.05

2002; Sishuta 2005; Tekana and Oladele 2011). In South Africa, young people tend to associate agriculture with the negative experiences of the past political dispensation and as such this created a stigma attached to agriculture (Catling and Saaiman1996). Majority (90%) of the farmers had no education beyond secondary level with close to 60% having primary or no formal education. This also poses challenges with regards to farmers' comprehension and understanding of commercial farming operations. With low level of education and literacy, imparting skills technical, marketing and financial skills may not be easy. Low levels of education has been associated with low farming productivity and efficiency (Tilak 1993; Appleton and Balihuta 1996). Most of farmers in the irrigation schemes indicated that they lack skills in production management, marketing and financial management. They also expressed that they even lack basic book keeping skills. The low levels of education has been observed in other schemes (Moock 1981; Wu 1977; Bembridge 2000; Sishuta 2005). A study by Karamjavan (2014) informed that the majority of the farmers who participated in irrigation management were literate and educated.

Van Averbeke et al. (1998), and Das and Sahoo (2012) reported that illiteracy and old age of farmers have been linked to the lack of adoption of new technologies, innovations and this has been found to have a negative effect on provision of extension services and as a consequence on agricultural productivity.

Stakeholder Perception on Strategic Model

Farmers did not seem to have any major role to play and were largely 'observers' waiting to share on profits accrued from the farming operations. Though, they were involved in the physical farm work (especially in situations where the strategic partner had left the project taking with him some of the farming equipment) they had no role in acquisition of inputs, daily scheduling of farming activities, choice of crops, marketing and selling of produce etc. The farmers were, therefore, entirely dependent on the strategic partner and other stakeholders such as the LDA. The lack of any meaningful role on the part of the farmers could have been one of the

contributing factors to the demise of many of the schemes.

Karamjavan (2014) agued that farmers with a higher social status tend to show more interest in participating in the irrigation network management. The lack of participation by farmers in critical decision making on the farming activities could be responsible for the disagreements with the strategic partners and the breakdown in trust.In all of the schemes, the farmers did not trust the strategic partners. The feeling amongst many farmers was that the strategic partner was not sharing profits according to the contractual agreements. What is clear from these observations is that the strategic partnership model was not working as it was intended.

Kittel (2010) pointed out that strategic alliances are hard – they currently fail far more often than they succeed, always leaving huge untapped and even unseen potential. Kittel noted that interdependency between companies is increasingly important to provide complete solutions customers demand. Furthermore, business growth is dependent upon the development and management of long-term, value-producing, multidimensional business relationships. The root cause for alliance failure is a lack of respect, confidence and trust in the other partner or the alliance/partnership itself. Kittel (2010) further argued that trust is affected by the degree of openness in communication; and a lack in trust is also a root cause for poor communication. Therefore, trust is a fundamental issue, being both cause and effect. The analysis by Kittel (2010) completely fits the situation in most of the schemes. This lack of trust seems to have had a major impact on the success of the irrigation schemes.

Association between Farmers' Socio-economic Profiles and Perceptions on Factors Influencing Success of Irrigation Schemes

The profile of the farmers and number of farmers in a scheme had no influence on how they perceive climate as a contributing factor to the success of the schemes. Similar studies on the association between socio-economic profile of farmers and their perception on the impact of climate on success of irrigation scheme are not available. However, in a study on climate change perception, Ofuoku (2011) found a relationship between level of education and age on the perception of climate change. Montle and Teweldemedhin (2014) also found a positive association between age, gender, farming experience and the perception of climate change. Most of the farmer characteristics had no influence on how they perceive economic factors as contributing to the success of the schemes. However, literacy had influence. The literate farmers were three times more likely to indicate the importance of economic factors in influencing the success of the irrigation schemes. This is expected as literate farmers are more likely to comprehend that if input costs are high for-instance, profits will be small.They may also be able to understand trends on market price changes in inputs and farm produce.

Gender, age, education level, literacy level, number of farmers in a scheme and training had no influence on how they perceive competition as a contributing factor to the success of the schemes. This is contrary to findings by Ejieji- and Amodu (2008) who found a significant association between education level and perception on competition. Age and number of farmers in a scheme had influence on how farmers perceive the influence of management/administrative factors on the success of the schemes. In a study by Montle and Teweldemedhin (2014) on farmers' perceptions and the economic impact of climate change in Namibia. The findings of that study reviewed that household characteristics such as gender, age and farming experience of household head and extension advice have a positive influence on the farmers' perceptions of climate change.

In schemes with a large number of farmers, there was more likelihood of farmers to indicate management and/or administration as having influence on the success of the irrigation schemes. This could be expected since it has been observed in numerous studies that there are always management challenges and conflicts in group farming operations especially where groups are large. The findings have a bearing on how farmer groups are constituted and point to the need for farmer assistance on individual basis or small groupings.

Literacy and number of farmers in a scheme had influence on how farmers perceive the influence of socio-cultural factors on the success of the schemes. Farmers in schemes with a large number of beneficiaries and the less literate were

about 10 times more likely to perceive land ownership and level of formal education as important in the success of the irrigation schemes. The findings indicated the importance of improving the education and or training of farmers. This also may suggest the need for screening of beneficiaries. The issue of the land tenure system is likely to arise where there are many beneficiaries on a piece of land. The findings are, therefore, not surprising. The implication of the findings is that group farming with too many beneficiaries is not viable especially when the group dynamics are not closely managed and monitored.

Age and level of literacy had influence on how farmers perceive the influence of technological factors on the success of the schemes. Farmers in schemes with a large number of beneficiaries were more likely to indicate the importance of technological factors in influencing the success of the irrigation schemes. Farmers with low level of literacy were also highly likely to indicate the importance of technological factors in influencing the success of the irrigation schemes. Similar findings were observed by Kolawole et al. (2012) and Ejieji and Amodu (2008). Illiterate and older farmers are less likely to adopt new technologies which can negatively impact on the success of the schemes. As other findings above, the implication is that there is a need properly screen farmers especially when the objective is to produce at commercial scale where more technological advanced machinery and infrastructure is used.

CONCLUSION

The study showed that socio-economic profiles of farmers have an effect on how some factors are perceived as having influence on the success of the irrigation schemes. The results of the multinomial regression analysis indicated that economic, competition and socio-cultural factors were perceived as having a large influence on the success of the schemes. Gender, age and level of literacy had influence on how farmers perceive the influence of technological factors on the success of the schemes. The studyalso showed that farmers lacked experience in irrigated farming. Therefore, this contributed to their inability to cope when the strategic partner ceased participating in the schemes. Training offered to farmers was inadequate as evidenced by the collapse of the schemes and as per the assertion of the farmers themselves. An important finding that is of interest to policy makers is that most schemes collapsed when the strategic partner left. This was attributed to the fact that farmers lacked knowledge and skills on how to effectively run a commercial operation.The results also confirmed the lack of full farmer participation from the inception of the project.

RECOMMENDATIONS

The findings recommend socio-economic characteristics to be considered when planning developmental projects directed to small-holder farmers. The clustering of farmers according to similar characteristics should be matched to an appropriate type of farming operation**.** The findings also suggested that the type of farming (and the scale there of) should match the experience and capacity of identified beneficiaries. The issues related to literacy, education level and age should be considered when projects are planned especially large scale (commercial) farming operations. Management of power relations, conflict management and consensus building is crucial to the success of projects where many individuals are involved. There is need for a comprehensive and effective social facilitation process. Given the historical failures of group farming schemes, it may be important to consider government supported projects that are targeted towards committed individual farmers. Proper training and mentoring of farmers across the whole value chain (from production to marketing) should be put in place. This will be helpful especially when the strategic partnerpulls out of the partnership.

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