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Challenges facing agricultural cooperative system: Analysing participation using a discrete choice model for the southern communal area of Namibia

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The problem of trust, non-transparency, and dysfunctionality has been ascribed to the character and the nature of the agricultural cooperative system in Namibia. Perhaps the true characterisation of the problem is not known with certainty albeit, the concern about the role of the institution, government intervention and member laxity. Further insight from the institutional economics suggests that organisational behaviour has a much larger role to play. Using a survey of 340 livestock farmers in six regions of the Southern Communal Areas of Namibia and adopting a logistic probability outcome model, the study examines the relevance of agricultural cooperatives with regards to the extent members are willing to participate with due cognisance to these concerns. The result shows that the probability that a farmer will join a cooperative is 29.5%. Education and technical constraints such as lack of adequate market information and training negatively affect willingness to participate. Participation is region specific, the odds of participation increases by 65, 91 and 14% if they are from Hardap, Kunene South/Erongo and Omaheke respectively. Increases in farm credit increase the odds of participation by 34%. The study also found that younger and inexperienced farmers are more likely to join cooperatives than older and experienced ones. The results highlight a general lack of knowledge about the cooperative system which calls for the strengthening of the policy framework to incorporate the concerns raised by new institutional economics.

Key words: Cooperative, institution, livestock, probability, participation.

INTRODUCTION

The importance of cooperative system as a means of promoting economic and social development thus strengthening human capital has been overemphasized in literature (Cook, 1995; Royers, 1995; Ortmann, 2007;

Thomas and Hangula, 2011). It is a key development priority such that, it is encouraged and facilitated by government, stakeholders and non-governmental organisations (NGO). Fundamentally, in the agricultural

sector, farmers (especially the small-scale farmers in the rural communal areas) are encouraged to form or join agricultural cooperatives because it is an important organisational instrument for farmers' collective bargaining, growth and the development of the rural economy. To enhance this objective, section 3 under the Namibian National Cooperative Policy (1992) states the need to create an economic, legal and institutional environment which is conducive for the development and growth of all cooperatives in Namibia. With the collaboration of the public service, NGOs and major stakeholders, the institutional framework of cooperative is enhanced. Institutions under the public service, for example, the Ministry of Agriculture, Water and Forestry (MAWF) govern agricultural cooperatives with the sole aim of developing entrepreneurial, organisational and managerial skills for members through extension services, training, and mentorship programmes. Amongst all, create an adequate framework for improved knowledge of the benefit of cooperative especially amongst the communal farmers'. But to all effects, there is a major concern that the cooperative institution in Namibia (especially livestock cooperative) seem to be dysfunctional. This has been a major concern to policy makers and major stakeholders which have left a big question as to whether the agricultural cooperative system has lost its credibility hence in a state of institutional degeneration.

The credibility of livestock cooperatives was examined in this study with regards to the extent of the lack of trust and reliability amongst the communal livestock farmers in the South Communal Areas (SCA) by investigating the factors that influence the farmers' willingness to participate in livestock cooperatives, albeit allegation of mistrust and lack of transparency. The focus of the study is on cattle, fat-tailed sheep and goat livestock cooperatives in the SCA comprising: Kunene South, Otjozondjupa, Omaheke, Erongo, Hardap and Karas. It is part of the study conducted by the National Namibian Farmers' Union (NNFU) (2015), which investigated the alternative scenario to improve communal livestock marketing position in the southern communal area of Namibia. The Southern region was chosen for this study because of the outbreak of Foot and Mouth Disease (FMD) in the Northern region during the early part of 2015 when the study was on-going. Livestock agricultural enterprise was chosen for this study because the rural economy is mainly agro-pastoral and the majority of the communal dwellers derive their livelihood from livestock farming. According to the Namibian National Development Path 4 (NDP4) 2012/13 to 2016/17, priority 2, an increase in the livestock production will stimulate growth in the rural economy which constitutes 62% of the Namibian population (National Household Income and Expenditure Survey (NHIES), 2009/10), hence the justification for this study. Thomas and Hangula (2011) reviewed the principle of cooperative and highlighted some of the challenges

facing agricultural cooperative in Namibia without empirically investigating any of the parameters. This study explores the theoretical underpinnings and investigates some of the key challenges that influence cooperatives participation.

The role of government in cooperative development in Namibia

The government and other institutions such as financial institutions, non-governmental organisation, international agencies as well as cooperative movements support cooperative development through amongst others, financial incentives, training and logistics. For instance, a large amount of financial resources is committed since independence by the Namibian government to give financial support to cooperatives. However, the extent to which this support culminated into the transformation of cooperative has much to be desired. In the contrary, it was observed that the support actually contributed to the demise of most cooperative organisations in Namibia. This can be attributed to a lot of factors some of which are stressed in the Namibian National Cooperative Policy (1992).

Of paramount importance is the fact that cooperatives became an instrument of the state instead of a member-owned, member-run and member-serving business organisation. As a result, they become politicised, members no longer identify themselves with cooperatives as a result they lost interest in them. The nurture and care given to them sooner resulted in dependency syndrome, albeit incompetence and economically unviable. In addition, preferential marketing and supply transactions were given to them, yet to no avail, as these did not improve the situation; instead, most cooperatives became inefficient and costly to manage. In spite of this, an increasing number of public expenditure is often allocated to cooperative administration without adequate recourse as to the macroeconomic implications. The implication of this is more impactful on the future of cooperative than on government fiscal as cooperative dwindle into degeneration and less relevant. Evidence can be drawn from the existing documented records about cooperatives. The record shows that the oldest cooperatives in Namibia are Alfa cooperative formed in 1964 and Agra cooperative Pty formed in 1980 (Thomas and Hangul, 2011). Alfa cooperative became defunct for lack of viability, while Agra on the other hand, restructured into Investor-Oriented Firm (IOF) or public liability company. The aim of the restructuring is to adopt a strategic shift in the organisational structure, management and corporate governance - a feature that characterizes the IOFs. Since the restructuring, Agra has stepped up its operation in terms of horizontal and vertical integration and the investments in offshore markets through improved quality management, logistics,

and corporate development. The same cannot be said of the vast majority of cooperatives who are in various stages of development.

According to the registrar of cooperatives in Windhoek (2016), there are only seven existing fully registered cooperatives between 1998 and 2015 out of which three are multipurpose agricultural cooperatives. About a hundred and twenty-eight documented cooperatives are provisionally registered (Registrar of Cooperative, 2016). Provisional registration accords them the opportunity to operate only temporarily while waiting to complete the process of registration. They will become a legal entity upon full registration, then they can enter into contracts and own property. Out of the provisionally registered cooperatives, about sixty-two are agricultural cooperatives; nine are livestock cooperative whereas, fifty-three are non-agricultural, majority of which fall into the category of services cooperatives as compared to workers cooperative. Despite the records, there is the concern that the available number of existing, unregistered and undocumented cooperative abound. This has damning consequences on the understanding of, and the adherence to the principle, rules and regulations governing cooperatives by members.

The role of institutions in cooperative development

Cooperatives operate within sets of principles and rules centred on the interest of the members, voluntary participation, democracy, autonomy, equity and service (Ortmann and King, 2007). Yet there are legal frameworks that define how they are created, their *modus operandi* and their termination. The Namibian cooperative Act (No 23 of 1996), the Namibian National Cooperative Policy (1992), the Namibian National Agricultural Policy (revised and adopted in 2015) and the General Model By-Laws for the Namibian Cooperatives (in accordance with the Cooperative Act (No 23 of 1996), recognizes the importance of creating an economic, legal and institutional environment conducive enough for the growth and the development of cooperatives in Namibia. This is because institutional development plays a key role in the formation, organisation and development of cooperatives. It provides the foundation upon which cooperative principle and governance are built. It is said that, if institutions are the rules then the cooperatives are the players while the members are the goal. In the current status quo of cooperatives in Namibia, the question is which of the three is in the spotlight: The institution, the cooperatives or the members? The question can be answered by investigating the type of relationship among the three (this is outside the scope of this study). Exercising intuitive judgement one can infer an unidirectional cause-and-effect relationship flowing from institution to cooperative and to the members, on the premise that, weak institutions set pace for market

failure, whereby physical, legal and logistic infrastructural development are lacking, therefore, it is difficult to enforce contracts and anti-competitive laws, control prices and reduce transaction cost thus, resulting in high operational cost, non-compliance and poor performance of cooperatives. The poor performance of cooperatives discourages members from playing an active role and further engagement.

Within this descriptive paradigm, it will be of utmost importance to also consider the impacts of the oligopoly conglomerates to the development of local rivalry. In other words, concentration, vertical integration and anti-competitive behaviours may result in foreclosures at the farmers 'and cooperative level of market operation. Perhaps one would not understand the role of the institution in organisational design without understanding the true behavioural attributes of cooperatives and its members. Insight about this can be drawn from institutional economics discussed subsequently.

The institutional economics

Helmberger and Hoos (1962) used the neo-classical theory of the firm to describe the behavioural attribute of cooperatives, leading to one of the first organisational theory of cooperatives. According to Helmberger and Hoos (1962), cooperatives maximise benefits to members by maximising the per unit value (volume) of patronage or average price paid by members (in terms of service cooperative) for the commodities purchased, which they, by the provisions of most cooperative Acts, ought to fulfil (Ortmann and King, 2007:50; Torgerson et al., 1998:5). Accordingly, the Namibian cooperative Act (No. 23 of 1996), section 58, subsections (a) to (h) clearly stipulates the distribution of net surpluses to members. In other words, the theory is based on optimisation and profit maximisation behaviour by a firm under the assumptions of zero transaction and adjustment costs with full employment of resources (Royer, 1999:45; Ortmann, 2007).

Critiques argue that in the wake of the new institutional economics, the neoclassical paradigm for cooperatives operation leaves much to be desired (Staatz, 1994; Royer, 1999; Torgerson et al., 1998). This could perhaps be why the organisational form of most cooperatives self-destruct leading to higher rates of closures, mergers and conversions to IOFs. The new institutional economics (NIE) explain the shortfall in the neoclassical paradigm and possibly, the cause of the rise and fall of the cooperative organisations by considering the theory of transaction cost economics, the principal-agency relations and the property rights. According to the NIE, an economic transaction involving the exchange of goods and services is not costless. It involves the cost of search, transportation, information, bargaining and the cost of contracting and enforcement. These costs are

influenced by institutions - be it legal, political or economic (Ortmann, 2007). The failure of one or more of these institutions, results in the failure of service unit of the cooperatives - the market institution, leading to high transaction cost, asymmetric information, incomplete and unenforceable contracting. These often depict the market institution of a developing economy such as Namibia - a precarious situation for agricultural cooperative governance.

In the light of agency relations agreement, the situation is even a lot worst. Agency relationship occurs when an individual or more (principal) employs the cooperative organisation (agent) to perform a service on behalf of the principal. The principal-agent problem arises because there might be divergent objectives between the principal and the agent (Alchian and Demsetz, 1972; Royer, 1999; Sykuta and Chaddad, 1999). For example, while the principal might want to maximise returns, the agent might aim to maximise goodwill. Aligning the two interests have cost implications hinging on market efficiency and the competitiveness of the organisation. Property right also play a role in defining the existence of cooperatives. Like transaction cost, property right has significant consequences on the economic organisation, behaviour and performance (Sykuta and Chaddad, 199:73). According to Ortmann (2007:56), a well-defined property right is vital for cooperative performance. This has a strong bearing on the institutional obligations discussed earlier. Other problems include free-rider; the horizon, portfolio, control and influence cost problems discussed fully in Cook (1995), Ortmann (2007) and Thomas and Hangula (2011).

MATERIALS AND METHODS

Sample and sampling

The sample population comprises the livestock region in the SCA. Six representative regions in SCA were selected. The selected regions are as mentioned previously. Livestock farmers were randomly sampled from each region. A semi-structured questionnaire containing both open and closed-ended questions was used to gather information from farmers. The questionnaire was first pre-tested on selected farmers and later modified to include additional opinions. Farmers' were asked whether they belong to livestock cooperative group, if the answer is no, a follow-up open-ended question would be why?

A total of three hundred and forty respondents were interviewed in the survey. The total number of respondents in each region is shown in Table 1. The samples for Kunene South and Erongo were combined due to a small sample collected in each region. A total of 109 farmers were sampled in Otjozondjupa, Omaheke (96), Southern Kunene and Erongo (50), Hardap (51) and Karas (34). Note that the sample size per region is, however, not equal, so is the livestock production and marketing potentials in these regions. For example, according to the Namibian Statistical Agency (2012) livestock census, Otjozondjupa cattle population represented 16.6% of the national cattle herd, Kunene South (2.7%), Omaheke (15.6%), Erongo (2.8%). Hardap and Karas had 3 and 2.1% of the national herd size respectively. On the other hand, sheep production in Hardap and Karas alone constitute 74.3% of the

sheep herd, others are, Omaheke (11.4%), Otjozondjupa (2.6%), Erongo (2.8%), and Kunene South (1.7%).

Model specification

The concept investigated is that the structure, conduct and performance of cooperatives system have been influenced by a lot of factors, culminating into the belief that it has perhaps affected livestock farmers marketing positions in terms of price discovery, contracting and profitability albeit, with uncertainty. Therefore, a probability outcome decision model is needed to determine the probability that the envisaged event, that is, the probability that, given the circumstances discussed previously the livestock farmers in the study area would have a higher probability of belonging to a cooperative or not. The modelling framework for the outcome decision model is given subsequently.

The logistic model

A probability outcome decision model was used to determine the probability that farmers are willing to join a cooperative. The response variable for the model estimation is membership of a cooperative denoted MEMCOP. MEMCOP is a dichotomous variable taking the value of one if a farmer is a member of a cooperative, zero otherwise. This is an example of a binary decision outcome variable whereby the code 1 represents a positive outcome indicating that an event occurred, whereas, zero is a negative outcome whereby an event did not occur. The aim is to estimate the relationship between MEMCOP and a set of independent variables namely; FARMER EXPERIENCE (Continuous variable), GENDER (male = 1, female = 0), AGE (Continuous variable), farmer's indebtedness (whether farmer has a loan = 1, 0 otherwise), EDUCATION (which includes, no education = 1, 0 otherwise, secondary education = 1, 0 otherwise and tertiary education = 1, 0 otherwise), FARMERS CONSTRAINTS (No cooperatives = 1, 0 otherwise; lack of information = 1, 0 otherwise and No benefit = 1, 0 otherwise) and lastly, set of regional dummies comprising; one for a region, zero otherwise.

Modelling the above hypothesized discrete choice relationship requires the assumption of utility maximization. The farmers i are faced with alternatives j whereby decisions are made based on the alternatives that maximize their utility subject to observed deterministic and unobserved random components, given as; $U_{ij} = V_{ij} + \varepsilon_{ij}$. The utility maximization of this form is additive and random, consisting of observed farmer characteristic and technical constraint listed above plus unobserved idiosyncrasies. Therefore,

$$
\begin{aligned}
\Pr(y_i = j) &= \Pr(U_{ij} \geq U_{ik}), \; \textit{for all } k \\
&= \Pr(U_{ik} - U_{ij} \leq 0), \; \textit{for all } k \qquad (1) \\
&= \Pr(\varepsilon_{ik} - \varepsilon_{ij} \leq V_{ij} - V_{ik}), \; \textit{for all } k
\end{aligned}
$$

According to the specification of the response variable, MEMCOP, a qualitative dichotomous regression analysis was applied assuming utility function Equation 1. A model of dichotomous nature has mutually exclusive outcomes (Cameron and Trivedi, 2010:459). It is either that an outcome is observed or not observed, therefore, the aim is to determine the probability (p) of the occurrence of one outcome rather than the alternative that occurs with a probability of $(1 - p)$. Suppose y represent the outcome

Table 1. Farm and farmer characteristics.

Farm and farmer characteristics	Hardap	Karas	South Kunene and Erongo	Omaheke	Otjozondjupa
Average farmers age	52	48	50	40	45
Average farming experience	19	19	27	21	23
Average herd size cattle	22	19	46	67	81
Average herd size sheep	49	99	80	44	40
Average herd size goat	66	77	69	52	46
Total herd size cattle	809	427	2182	6139	8646
Total herd size sheep	1772	2376	2390	2319	3433
Total herd size goat	3151	2553	2914	3873	4053
Average number of secondary education (%)	53	65	46	59	59
Average number of tertiary education (%)	6	15	26	18	17
Number of farmers with No Education (%)	41	21	28	23	24
Number of male farmers (%)	53	65	92	82	94
Number of female farmers (%)	47	35	8	17	6
Number of respondents-farmers	51	34	50	96	109

variable, an outcome is observed for $(y = 1)$ with probability p or not observed $(y = 0)$ with probability $(1-p)$. According to the specification of the discrete model, the nature of the observed data dictates the special treatment of a binary dependent variable model (Greene, 2012:724). The interest is to model a positive outcome of p as a function of a set of covariates, x. The probability mass function for the observed outcome, y is $p^y(1-p)^{1-y}$, with $E(y) = p$ and $\text{Var}(y) = p(1-p)$ (Cameron and Trivedi, 20105:460). The conditional probability takes the form:

$$p_i \equiv (\Pr(y_i = 1 \mid x) = F(x_i^{'}\beta) \tag{2}$$

Or simply

$$Logit\,(PX) = \alpha + \sum \beta_i x_i + \mu_i \tag{3}$$

Where

$$(PX) = \frac{1}{1 + e^{-(\alpha + \sum \beta_i x_i)}} \tag{4}$$

Where x is a vector of regressors, α, β_i are vectors of unknown parameters to be estimated, μ_i is a random disturbance term. The set of parameters β_i reflects the impact of changes in x on probability of y (Greene, 2003:665). It represents the change in the log odds that will result from a one unit change in x while other variables in the model remain constant (Kleinbaum and Klein, 2010:21). Another interpretation of logistics coefficients is in terms of odds ratio obtained by exponentiation of the log odds. The odds ratio represents the number of times or percentage points the outcome variable will change given a one unit change in x. The function $F(.)$ is the cumulative distribution function which ensures that $0 \leq p \leq 1$ is satisfied (Cameron and Trivedi, 2010:460). This

specification is applied to the data described above using logistic binary outcome model. This was preferred to other binary outcome models such as probit model because of its mathematical simplicity. The major difference between logit and probit is in their distributional assumption about error variance. The probit model assumes error variance of 1 for a standard normal distribution whereas, it is $\pi^2/3$ for a logistic distribution (Long and Freese, 2001), this notwithstanding, the results under both models do not differ greatly (Greene, 2003:667; Gujarati and Porter, 2009:571; Cameron and Trivedi, 2010:472).

In estimating the probability of an outcome as shown in Equations (2) to (4), it should be noted that the probability p_i is non-linearly related to β and x. Therefore, ordinary least square (OLS) estimator cannot be used to estimate the parameters. As a result, the logit model is evaluated through an iteration process by using a non-linear maximum likelihood estimation technique. The likelihood function for a logit model is:

$$\ln L = \sum_{i \in s} \omega_i \ln F(x_i \beta) + \sum_{i \notin s} \omega_i \ln\{1 - F(x_i \beta)\} \tag{5}$$

Where s is a set of all observation i, such that $y_i \neq 0$. $F(z) = e^z/(1 + e^z)$, ω_i is an optional weight (Stata 13 documentation, 2014). The model was estimated assuming heteroscedastic error variance; robust standard errors are calculated instead of the usual standard error. Using the logistic model Equation 3, the following model was specified:

$$\begin{aligned} \ln(p_i/1-p_i) = {}& \beta_0 + \beta_1 Age + \beta_2 Gender + \beta_3 Farm\exp \\ & + \beta_4 Credit + \beta_5 Hardap + \beta_6 Karas \\ & + \beta_7 Kserongo + \beta_8 Omaheke + \beta_9 Sec + \beta_{10} Tert + \\ & \beta_{11} lack\inf + \beta_{12} Nobenefit + \mu_t \end{aligned} \tag{6}$$

Equation (6) was fit to estimate the probability of farmer participation in a cooperative. The assumption is that AGE,

EXPERIENCE, and the level of EDUCATION have a positive relationship with willingness to participate. Three levels of education dummies were considered; SECONDARY, TERTIARY and NO EDUCATION, with NO EDUCATION serving as the base category. Regional dummies were included by considering the location of the decision maker. Four regional dummies excluding the reference category OTJOZONDJUPA were included. Technical constraints such as INFORMATION and the perception of the farmers towards the BENEFIT they can derive from cooperative membership are other variable included in the model. The third category for technical constraints, NOCOP, was omitted.

EMPIRICAL RESULTS AND DISCUSSION

Descriptive statistics

The descriptive statistics for the variables are given in Appendix Table A1. The mean of the MEMCOP variable is 0.2941 with a standard deviation of 0.4563. The result shows that on average, 29.41% are willing to participate. Average age and farm experiences are 46 and 22 years respectively. The most experienced farmer in the sample is 65 years. The youngest farmer is 18 years of age whereas, the oldest is 83 years - indication that the communal livestock farming community in the study area is made up of an aging population.

Farm and farmer characteristics

The farm and farmer characteristics are shown in Table 1. The average farmers' age ranges from 40 years for farmers in Omaheke to 52 years for those in Hardap. The least experienced farmer on average in Hardap is 19 years old whereas the most experienced farmer has farmed for at least 27 years in South Kunene and Erongo regions. Education is important in the farming enterprise because educated farmers are likely to have more technical knowledge on farm management than non-educated ones. They are better disposed of in terms of decisions making and price discovery, therefore, the literacy level of farmers in the sampled regions was determined. On average 33 and 30% of the respondents in Otjozondjupa and Omaheke respectively have secondary and tertiary educations, whereas 29 and 24% in these regions respectively do not have formal education. About 23% in Hardap and 16% in Southern Kunene and Erongo have no education. Gender demography shows that 81% of the total numbers of farmers sampled are men while 19% are women. The ratio of men to female in the five regions is Otjozondjupa (94%), Southern Kunene and Erongo (92%), Omaheke (82%), Karas 65% and Hardap 53%.

Membership of a cooperative

The study investigated the number, the level of participation and reasons for participation by these farmers. The number of cooperatives was found to be 47 in all the sampled regions. About (19) of these are in Omaheke, Southern Kunene and Erongo have (10), Otjozondjupa (8), whereas Hardap and Karas have (5) each. According to the Registrar of cooperatives (2016), there are only three multipurpose fully registered and about nine provisionally registered agricultural co-operatives. The number of forty-seven obtained in the survey is an indication that there are some cooperatives that are not on record. Perhaps these are the unregistered and undocumented multi-purpose cooperatives.

Out of the 340 respondents, 41% are members of various cooperatives. The largest number of participation was in Southern Kunene and Erongo region, with 38% participation, others are Omaheke (28%), Hardap (20%), Otjozondjupa (9%) and Karas (7%). The farmers were further asked to state reasons for not joining a cooperative. This question helps to capture the farmers' perception about the cooperative system of marketing. Forty-three percent of the respondents said they have no knowledge of the existence of cooperatives in their area. This is an indication that information dissemination is a major challenge. Thirty-one percent have no interest in becoming a member in the future because of the perception that cooperative system is dysfunctional and does not offer many benefits to its members. Other concerns are about trust and non-existence of livestock cooperatives in their area. Nine percent of the respondents do not trust livestock cooperatives, due to lack of transparency, they would rather operate alone than join a cooperative. About 11% claim cooperative system is good but it is difficult to organise farmers into the cooperative group.

Using Equation 6, some of the factors that influence farmers' decision to participation were investigated. The hypothesized relationship between farmers' participation in cooperatives and sets of covariates are shown in Table 2. The sign of the coefficients for the Secondary and Tertiary education variables are both negative and statistically significant. The result shows that the education level of the farmers' negatively and significantly influences the log odds of the decision to join a cooperative. Contrary to expectation, farmers seem to become more independent as their education level increases. With more skill and technical knowledge about market price discovery mechanism they seem to become averse to cooperative governance because according to them, they rather operate alone than join dysfunctional farmers' cooperatives system. The odd that farmers will join cooperatives with respect to their academic level is 0.0003 times smaller if they had a secondary education or a decrease of 0.03%.

Technical constraints such as lack of information and the perception of "no benefit" with coefficients (-2.7757) and (-2.2926) respectively also have a negatively and

Table 2. Parameter estimates of farmers' membership of a cooperative.

Variables	Coefficients	z-statistics	P-value	Odds ratio	z-statistics	P-value
Age	-0.0198	-1.2900	0.1950	0.9804	-1.2600	0.2080
Gender	-0.3639	-1.0100	0.3130	0.6950	-1.0000	0.3170
Farming experience	0.0066	0.4400	0.6590	1.0066	0.4300	0.6650
Loan	1.2082***	3.1600	0.0020	3.3474***	3.0400	0.0020
Hardap	2.1584***	4.6900	0.0000	8.6573***	4.3700	0.0000
Karas	0.8581	1.4900	0.1350	2.3587	1.5900	0.1110
Kunene South and Erongo	1.0711**	2.3300	0.0200	2.9187*	2.3400	0.0190
Omaheke	1.9668***	4.8300	0.0000	7.1477***	4.9000	0.0000
Secondary	-7.9658***	-15.4000	0.0000	0.0003	-0.0100	0.9900
Tertiary	-15.8545***	-19.9800	0.0000	0.0000	-0.0100	0.9900
Lackinfo	-2.7757***	-3.1200	0.0020	0.0623***	-3.5600	0.0000
Nobenefit	-2.2926***	-3.0100	0.0030	0.1010***	-2.8500	0.0040
Constant	-8.6399***	-9.3400	0.0000	0.0002	-0.0100	0.9890
Diagnostic tests						
Wald / LR (χ^2)	521.9			83.05		
Probability > χ^2	0.0000			0.0000		
Pseudo R^2	0.202			0.202		
Log-Likelihood	-164.096			-164.096		
Number of observation	339			339		

The signs ***, ** and * Signifies statistical significance at 1, 5 and 10% levels, respectively.

statistically significant influence on participation given other variables are constant. This implies that an increase in the availability of information about the benefit of cooperatives results in an increase in the log odds of joining a cooperative. If there is an increase in the deterioration of the information system the odds that farmers' will participate will decrease by 6.23%. The lack of adequate information dissemination framework about cooperative system results in increased perception that it is not beneficial. A one unit increase in farmers' perception results in the decrease in the odds of their participation by 10.10%. A positive influence of information dissemination was also found in Jari and Frasers (2012:80).

It was found that an increase in the availability of farm credits statistically and significantly increases the likelihood that farmers will join a cooperative. This result lends credence to the influence of farmer support programmes that increases the sense of belonging to farmers thus increasing their enthusiasm and confidence. Increasing the level of farm credit increases the odds of their participation 3.34 times or by 34%. The result also shows that the odds of participation increase by 65, 91 and 14% if farmers were from Hardap, Kunene South / Erongo and Omaheke, respectively.

The diagnostic tests for the model estimated via a logistic distribution are shown in the lower panel of Table 2. The first row shows the chi-square statistics for the

Wald test of the joint statistical significance of the estimated coefficients. The null hypothesis of the test is that the coefficients of the estimated model are all zero. The null hypothesis is rejected at one percent level of significance, signifying that at least, one of the regressors is different from zero. The test of joint statistical significance of the proportional odds ratio is a Likelihood ratio (LR) test which is similar to Wald test. The null hypothesis of zero coefficients is rejected as in the Wald test. The McFadden's (1974.) pseudo R^2 is estimated as measures of goodness of fit of the model. It is not equivalent to the R^2 obtained in linear ordinary least square models but mimics it. The pseudo R^2 value of 0.2020 calculated for the model is high, an indication of the goodness of model fit.

Marginal effects of regressors on the farmers' membership of a cooperative

In the linear regression models, the coefficients are interpreted as having marginal effects on the conditional mean of a one unit change in the relevant regressor(s), but in a non-linear model such as logistic regression, the coefficients are interpreted as the marginal effects on the conditional probability of an event happening, such as the probability of joining a cooperative. Three types of marginal effects are usually estimated namely; (a)

Table 3. Marginal effects of the explanatory variables on the likelihood of farmers' membership of a cooperative.

Variables	AME			MEM		
	Margin	Z-stats	P-value	Margin	Z-stats	P-value
Age	-0.0032	-1.31	0.192	-0.0034	-1.3	0.194
Gender	-0.0581	-1.02	0.306	-0.0617	-1.02	0.31
Farmexpr	0.0011	0.44	0.658	0.0011	0.44	0.658
Credit	0.193***	3.39	0.001	0.2048***	3.23	0.001
Hardap	0.3448***	5.18	0.000	0.3659***	4.87	0.000
Karas	0.1371	1.49	0.137	0.1455	1.49	0.137
Kunene South and Erongo	0.1711*	2.38	0.017	0.1816*	2.4	0.017
Omaheke	0.3142***	5.56	0.000	0.3334***	5.06	0.000
Secondary	-1.272***	-11.23	0.000	-1.3504***	-9.38	0.000
Tertiary	-2.533***	-12.43	0.000	-2.6876***	-9.88	0.000
Lackinfo	-0.443***	-3.4	0.001	-0.4705***	-3.39	0.001
Nobenefit	-0.366***	-3.1	0.002	-0.3886***	-3.08	0.002

***, ** and * Signifies statistical significance at 1, 5 and 10% levels respectively.

Average marginal effects (AME) that is, evaluation is at the sample value and then averaged, (b) Marginal effects at the mean - evaluation is at the sample means of the regressors and (c) Marginal Effects at a Representative value (MER) - evaluation is at a representative value. Two of these are estimated in this study; the AME and MEM. The parameters of the marginal effects for the logistic model are shown in Table 3. It can be seen that the results for AME and MEM are almost the same. This implies that either method can be used to explain the marginal effects of the coefficients on the conditional probability. On average, a unit increase in the level of secondary and tertiary education decreases the probability to join farmers' cooperative by 1.2720 and 2.533 units respectively. This is because, as previously discussed, when farmers gain knowledge about the industry through experience or by learning, they seem to be independent especially when they do not have the trust that their interest will be adequately protected by a cooperative. A unit increase in the technical constraints such as the lack of information results in a 0.443 and 0.366 unit decreases in probability to join cooperative. In contrast, improved infrastructural development increases the likelihood that a farmer will join a cooperative by the same amount. This is because; infrastructural develop-ment plays a key role in the development of efficient production and marketing system. For instance, lack of access to information results in the production and supply of livestock to the market when price signal is not favourable. Members of a farmer cooperative are less likely to experience this compared to non-participants. This is because cooperative gather and disseminate information about production inputs, market price and other logistics to their members such as (a) increased capacity and bargaining power, (b) access to new markets and marketing channels, (c) access to credit and

support programmes, (d) access to better technical and market information, (e) more opportunities for exchanging experiences, and (f) greater access to training programmes (Santacoloma et al., 2009).

Regional effects were found to increase the conditional probability of participation. The marginal effects of joining a cooperative will increase by 34, 17.1 and 31.42% if the respondents are from Hardap, Kunene South and Erongo and Omaheke.

Predicted probabilities of joining of a cooperative

Here, the conditional probabilities that the outcome variable occurred as opposed to not occurred are estimated. This is equivalent to estimating the probability that the outcome variable is equivalent to one. The estimation is evaluated at the mean and at the individual representative sample. According to the result in Table 4, on average, the probability that farmers will join a cooperative, that is, the outcome variable Memcop = 1, is 29.50% given that all predictors are set at their mean. The reason for this low probability can be attributed to the challenges discussed previously; some of these were investigated with findings that are consistent with expectation. The average predicted probability by the logit model is 0.2950 compared to the average sample mean of 0.2941 shown in Table A1. There is actually no difference between the two implying that the model has a good predictive property and fits the data well.

Further in the analysis, the probabilities at a representative sample were also estimated. The aim was to investigate the cumulative impacts of variables of interest on the probability to join cooperative. The result in Table 5 shows that the young and inexperienced male farmers with secondary education from all the selected

Table 4. Average predicted probabilities

Variable	Margin	Std.Error	Z-stat	P-value	[95% Conf. interval]	
Membership of a cooperative	0.2950***	0.0203	14.5100	0.0000	0.2551	0.3348

***, ** and * signifies statistical significance at 1, 5 and 10% levels respectively.

Table 5. Predicted probabilities for farmers' willingness to participation in cooperatives.

Sensitivity	Farm EXP	Gender	Age	Hardap	Karas	Kunene South and Erongo	Omaheke	Secondary	Tertiary	Margin	Z-stat	P-value
	10	1	25	1	0	0	0	1	0	0.3156***	3.0700	0.0020
Young	10	1	25	0	1	0	0	1	0	0.1116*	1.9100	0.0570
and inexperience	10	1	25	0	0	1	0	1	0	0.1346**	2.4300	0.0150
	10	1	25	0	0	0	1	1	0	0.2757***	4.1800	0.0000
	35	1	62	1	0	0	0	1	0	0.2075***	3.0400	0.0020
Old	35	1	62	0	1	0	0	1	0	0.0666**	1.9700	0.0490
and experienced	35	1	62	0	0	1	0	1	0	0.0811***	2.6400	0.0080
	35	1	62	0	0	0	1	1	0	0.1777***	3.2500	0.0010

***, ** and * signifies statistical significance at 1, 5 and 10% levels respectively.

regions are more likely to join cooperatives than the elderly and experienced male farmers with secondary education. For example, a 25 years old male livestock farmer from Hardap region with ten years farming experience who have secondary education has 31.56% probability of joining a cooperative compared to the probability of 20.75% for an old and experienced male farmer of 62 years from the same region who have secondary education and have farmed for 35 years. The result shows that new entrants in the livestock business are likely to strive to capture favourable market position and price discovery mechanism through liaising and partnerships with stakeholders or through cooperative system. This association becomes a less popular option as the farmer becomes establish in the business, therefore, the willingness to pay a premium for a similar service for which he/she has the disposition to acquire at reduced cost declines.

Conclusion

This study investigated the challenges facing agricultural cooperative system by analysing the factors that influence farmers' willingness to participate. According to the literature review on the role of government and the theory of new institutional economics, government intervention, transaction cost, agency relations and property right have been found to play a crucial role in the organisation, growth and development of cooperatives. By embarking on this study, the extent of deterioration or breakdown in the cooperative order was put to a test. The result shows that farmers' demographic characteristics such as age, gender, experience do not contribute to explaining reasons why they join a cooperative. Farmer education and technical constraints such as information dissemination negatively affect the probability to join a cooperative. It was found in this study that, farmers are reluctant to participate in cooperative because of lack of trust, transparency and the suspect that their interest may not be adequately sustained. This attitude reflected in the findings of the study. On average, the probability that a farmer will join a cooperative was found to be 29.50%. It was further determined in the study that the younger and inexperienced farmers are more likely to join

cooperative than older and experienced one. The results highlight a general lack of knowledge about the cooperative system by farmers. Therefore, there is a need for information and training in the livestock sector about the benefits of having cooperatives. Policy directives are needed to either strengthen the existing cooperative system or encourage them to transform into Investor-Oriented Firms (IOF).

Conflict of interests

The authors have not declared any conflict of interests.

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APPENDIX

Table A1. Descriptive statistics of the variables.

Variable	Mean	Std.Dev	Min	Max
Memcop	0.2941	0.4563	0	1
Farm experience	22.1976	12.3867	1	65
Gender	0.8118	0.3915	0	1
Age	45.8088	12.6088	18	83
Loan	0.1471	0.3547	0	1
Hardap	0.1500	0.3576	0	1
Karas	0.1000	0.3004	0	1
Kunene South & Erongo	0.1471	0.3547	0	1
Omaheke	0.2824	0.4508	0	1
Secondary	0.5676	0.4961	0	1
Tertiary	0.1676	0.3741	0	1