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ROLE OF NETWORKING CAPABILITY, SOCIO-ECONOMIC AND INSTITUTIONAL CHARACTERISTICS ON ADOPTION TENDENCIES OF *CLEAN SEED* POTATO AGRI-ENTERPRISES IN CENTRAL RIFT VALLEY, KENYA

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ABSTRACT

Even though quality of seed is a major yield determinant in potato (*Solanum tuberosum* L.) production and global food security, inadequate availability of and access to high quality (certified) seed is a major challenge to potato producers in Sub-Saharan Africa. The objective of this study was to examine farmer's adoption tendency towards decentralised *clean seed* potato multiplication agri-enterprise (CSPMAE) in Central Rift Valley, Kenya, which aids in implementation of stage matched entrepreneurial interventions. A cross-sectional survey was conducted using a semi-structured questionnaire on 54 seed potato producers and 192 non-seed potato producers, through multistage sampling. Ordered logistic regression analysis, based on the trans-theoretical model, revealed that household head, partner knowledge, gender, land size allocated for potato production, level of education, ownership of transport and/or storage facilities, frequency of interaction with certified seed potato producers and agricultural extension officers influenced adoption tendencies of CSPMAE, positively and significantly. Seed potato value chain stakeholder platforms, development workers and donors should prioritise their support for *clean seed* agri-enterprises to farmers with such traits. This is likely to lead to increased supply of access to *clean seed*, thereby improving potato yields in Kenya.

Key Words: *Solanum tuberosum*, stakeholder platforms, Sub-Saharan Africa

RÉSUMÉ

Même si la qualité des semences est le déterminant majeur du rendement dans la production de pommes de terre (*Solanum tuberosum* L.) et la sécurité alimentaire mondiale, la disponibilité et l'accès inadéquats aux semences de haute qualité (certifiées) constituent un défi majeur pour les producteurs de pommes de terre en Afrique sub-saharienne. L'objectif de cette étude était d'examiner la tendance à l'adoption par les agriculteurs de l'agro-entreprise décentralisée de multiplication des semences de pommes de terre propre (CSPMAE) dans la vallée centrale du Rift, au Kenya, qui facilite la mise en œuvre d'interventions entrepreneuriales assorties par étapes. Une enquête transversale a été menée à

l'aide d'un questionnaire semi-structuré sur 54 producteurs des semences de pommes de terre et 192 qui ne sont pas producteurs des semences de pommes de terre, par échantillonnage à plusieurs degrés. Une analyse de régression logistique ordonnée, basée sur le modèle transthéorique, a révélé que le chef de ménage, les connaissances des partenaires, le sexe, la taille des terrains allouées à la production de pommes de terre, le niveau d'éducation, la propriété des installations de transport et / ou de stockage, la fréquence d'interaction avec les semences de pomme de terre certifiées, les producteurs et les agents de vulgarisation agricole ont influencé positivement et significativement les tendances d'adoption du CSPMAE. Les plateformes des parties prenantes de la chaîne de valeur des semences de pommes de terre, les agents de développement et les bailleurs de fonds devraient accorder la priorité à leur soutien aux agro-entreprises de semences propres aux agriculteurs ayant de tels traits. Cela devrait entraîner une augmentation de l'accès à des semences propres, améliorant ainsi les rendements de pommes de terre au Kenya.

Mots Clés: *Solanum tuberosum*, plateformes des parties prenantes, Afrique sub-saharienne

INTRODUCTION

Potato (*Solanum tuberosum* L.) is a major food security tuber crop in Kenya, ranking second after maize (*Zea mays* L.) (GoK, 2017). Quality seed potato is among the vital inputs with potential to stimulate agricultural productivity, economic growth, and entrepreneurial opportunities, particularly in the central Rift Valley region of the country (Louwaars and De Boef, 2012). According to Chindi *et al.* (2017), a seed system that ensures seed security to farmers is essential in realising the potential for potato production and its contribution to food security.

Despite the significance of the potato sub-sector in the country, its yields per unit area have declined way below potential, with poor quality seed being a major factor for this trend (Demo *et al.*, 2016; KEPHIS, 2016). Nearly 95% of smallholder potato farmers use degenerated seed due to inadequate supply and in-accessibility to quality seed in the country (McGuire and Sperling, 2016; NPCK, 2020). Although the formal sector is mandated to supply certified seed, its production is far below the annual demand exhibited by 600,000 to 800,000 potato farmers. Only 2 to 2.6% of these farmers access certified seed. Additionally, its centralised and oligopoly nature leads to high transactional costs and pricing of certified seed, which limits resource

constrained farmers from accessing certified seed (Okello *et al.*, 2017).

Despite a few collaborative efforts and interventions by the donor community to increase supply of certified seed, the capacity is still low, especially in the central Rift Valley region of the country (CIP, 2011; Demo *et al.*, 2016). Documented studies for mitigating the shortage of quality seed have focused on rapid multiplication technologies, such as aeroponics, hydroponics and tissue culture (apical rooted cuttings) (Muthoni *et al.*, 2011; Wasilewska-Nascimento *et al.*, 2020). Such methods are limited to the formal seed system due to stringent certification rules stipulated by the Kenya Plant Health Inspectorate Service (KEPHIS). On the other hand, the semi-formal sector, through guidance from trained agricultural officers, has potential for improving the supply of and access to *clean seed* potato through a decentralised CSPMAE (Chindi *et al.*, 2017; Okello *et al.*, 2018).

Clean seed refers to the first generation of seed potato produced from certified seed potato by trained farmers, through guidance of trained agricultural officers, although not legally recognised by KEPHIS. Contrastingly, there is low uptake of decentralised CSPMAE among potato farmers, resulting into unsatisfied demand for quality seed potato (Kaguongo *et al.*, 2014; KEPHIS, 2016).

Even though salient studies have been done on adoption of new agricultural technologies, majority consider adoption as a binary decision, hence, limiting the respondents from revealing their gradual willingness to adopt a technology. Lemken *et al.* (2017), in a study on adoption tendency of mixed cropping, applied the Trans-Theoretical Model (TTM) of behaviour change by capturing adoption in four stages, i.e., pre-contemplation, contemplation, preparation and action) of increasing willingness to adopt. Klonek *et al.* (2015) earlier proposed the need to apply TTM to understand reasons why individuals were hesitant to exploit entrepreneurship opportunities. Identification of individual's entrepreneurial development stages (adoption tendencies/stage of change) might be key in application of stage-matched interventions, rather than imposing similar intervention for all individuals. Profiling of adopter (action stage) characteristics can also guide in selection of potential individuals for entrepreneurial uptake.

Networking approach to entrepreneurship posits that network resources, activities and networks support are vital for enterprise establishment. Bengesi and Roux (2014) consider networking as a necessary entrepreneurial capability, that can ease development and utilisation of linkages to gain access to resources, knowledge and complementary assets at minimal transaction costs, hence, improving enterprise performance. Parida *et al.* (2017) established that entrepreneur's networking capability (partner knowledge, relational skills, coordination skills, internal communication, and building new relations) had the potential to enhance SMEs performance. Demo *et al.* (2016) and Almekinders *et al.* (2019) proposed the need for seed potato multiplication agri-preneurs to develop linkages with other stakeholders in the potato value chain. However, the role of networking capability attributes on establishment of seed potato multiplication agri-enterprises is not clear. This

study, therefore, sought to determine the role of entrepreneurs networking capabilities, socioeconomic and institutional factors on adoption tendency of the decentralised *clean seed* potato businesses (CSPMAE) in Central Valley of Kenya.

METHODOLOGY

Study site and data collection. The study was conducted in Nakuru County, located within the Central Rift valley region of Kenya in the year 2019. Specifically, Nakuru County is located between Longitude 35° 28' and 35° 36' East and Latitude 0° 13' and 1° 10' South, at about 1848 to 2700 metres above sea level (CIDP, 2018). It is the second leading County in potato production in the country, with only three formal certified seed potato-producing merchants (Kibe *et al.*, 2018). Shortage of quality seed potato is a major challenge to potato farmers in the County. Three sub counties; namely, Kuresoi North, Kuresoi South and Molo were selected for the study due to their dominance in potato farming (CIDP, 2018).

A multistage sampling technique was used in selecting the three sub-counties and 10 wards based on guidance from Sub-County agricultural officers. A cross-sectional survey was conducted using a researcher-administered semi-structured questionnaire, to obtain primary data from 246 potato farmers. The questionnaire was pre-tested among 30 randomly selected potato farmers in Mau Narok and Mauche wards of Njoro Sub-County, which had similar characteristics as the study sites.

The total sample size 246, was computed using Cochran's (1963) formula due to the unknown population of ware potato farmers in the study area. The formula was harmonised following Singh and Masuku (2014) recommendation for adjusting the degree of variability in situations where majority of the population lacked the desired attributes. These farmers constituted 54 *clean seed* potato

multiplication agripreneurs (CSPMA) and 192 non-CSPMA, who were producing ware potato. Because *clean seed* potato multiplication agripreneurs (CSPMA) were only 54, they were all picked from the 10 wards using snow balling procedure, with guidance from agricultural extension officers. The remaining 192 were randomly selected from the 10 wards based on disproportionate distribution of 54 CSPMA in each ward.

Data analysis for adoption tendencies of *clean seed* potato multiplication agri-enterprise. Ordered logistic regression was preferred due to ordinal categorical nature of the dependent variables (Table 1). These categories included pre-contemplation stage (coded one), contemplation stage (coded two), preparation stage (coded three) and action stage (coded four). The categories symbolised increasing levels of contemplating behavioural change based on the trans-theoretical model. The stages of change captured the gradual attitudes in adoption decision towards CSPMAE and were adapted from Lemken *et al.* (2017) study.

The TTM is particularly essential in studies seeking stage-matched interventions, contrary to introducing similar interventions for the entire population (Prochaska and Velicer, 1997). In the present study, identification of characteristics for CSPMA could guide in identification and selection of potential farmers who can be targeted for CSPMAE, especially those in the preparation stage of change (Klonek *et al.*, 2015).

The questionnaire had specific questions that guided the researcher as well as the respondents in selecting their respective stage of change (adoption tendency). For instance, farmers in the pre-contemplation stage constituted all respondents who reported to have no information about *clean seed* and had never used it to produce their ware potatoes. Such farmers had no motivation to change, hence were not willing to take up CSPMAE. The contemplation stage constituted all respondents who reported to know *clean seed*

TABLE 1. Categories of dependent variable for adoption tendencies of *clean seed* potato multiplication agripreneurs in the central Rift Valley, Kenya

(Y)	Stages	Concept	Operationalisation
Y1	Pre-contemplation	The respondent had no intention to change, lacked information and motivation to change	Respondent not willing to try CSPMAE
Y2	Contemplation	The respondent had intention to change though still considering associated costs and benefits	The respondent was generally willing to try CSPMAE in long run
Y3	Preparation	The respondent had intention to change with concrete plan of action	The respondent willing to try CSPMAE in short run
Y4	Action	Behaviour change	The respondent was already practicing CSPMAE

potatoes; they had used it to produce their ware potatoes and further considered *clean seed* potato multiplication as an entrepreneurial opportunity due to inadequate supply and access of certified and *clean seed* at planting season. However, they had no plans of taking up the CSPMAE, in the short run, due to perceived costs involved.

The farmers in the preparation stage involved all respondents who reported to know *clean seed* and had used it to produce their ware potatoes. They also considered *clean seed* potato multiplication as a beneficial business opportunity and had access to sufficient information, resources and plans for taking up the CSPMAE in the short run (less than six month).

The action stage constituted all farmers who had taken up the *clean seed* potato multiplication agri-enterprise and were recognised as *clean seed* potato agri-preneurs by their fellow farmers and Sub-County agricultural officers.

Given the four choices, a respondent selected a stage based on description of his stage of adoption as shown in Table 1. The selected explanatory variables, their measurement and hypothesised effect are shown in Table 2

Networking Capability (NC) had five latent variables (Table 2), each with three indicators (questions) that were administered to respondents and measured on a five point Likert scale. Confirmatory Factor Analysis (CFA) was used to test consistency of the NC latent variable indicators. The NC data had overall Kaiser-Meyer-Olkin measure of sample adequacy of 0.903, scale reliability coefficient (α) of 0.8983 and a significant Bartlett's Test value of 0.000 which was adequate for subjecting it to CFA. The factor loading values for the 15 indicator variables ranged from 0.434 to 0.825. The five constructs of NC had Composite Reliability (CR) and Average Variance Extracted (AVE) values ranging between 0.551 and 0.811, and 0.292 and 0.589, respectively. This was a satisfactory indicator for convergent validity and reliability of the

constructs, except for the construct relational skills which had a low AVE of 0.292 and CR of 0.551 that is, lower than the recommended $AVE > 0.5$ and $CR > 0.6$; hence was exempted in further analysis (Harun and Ahmad, 2016). The scores for each of the NC latent variable were generated using the weighted means then used for further analysis in the ordered logistic regression.

Statistical and specification diagnostic tests. Prior to running Ordered Logistic Regression analysis, the data were subjected to multicollinearity, Heteroskedasticity, and Proportional Odds Diagnostic tests. Multicollinearity was tested using pair-wise correlation and Variance inflation Factor (VIF) for the categorical and continuous explanatory variables, respectively. The mean VIF was 1.45, not exceeding 5.0 as shown in Table 3, implying absence of correlation among the explanatory variables (Jamal, 2017). Harun and Ahmad (2016) postulate that correlation > 0.75 indicates high correlation. The pair-wise correlation for the categorical independent variable did not exceed 0.75 (Table 5), signifying absence of correlation.

The White test for Heteroskedasticity results in Table 4 had an insignificant value ($P = 0.1025$), indicating that the variance of the error term for the variables was constant, hence no Heteroskedasticity (Williams, 2020). The insignificant overall Chi-square value ($P > \chi^2 = 1.0000$) for Brant test indicated that the proportional odds assumption was not violated, hence qualifying the data for ordered logistic regression (Williams, 2019). The ordered logistic model fitness results presented in the panel of Table 7 showed a good model fit with McFadden's Pseudo R-squared (Pseudo R^2) of 0.3316, indicating a stronger exploratory power of the model.

RESULTS AND DISCUSSION

The descriptive statistics for adoption tendencies (stages of change) revealed that 53% (131) of the farmers were in pre-

TABLE 2. Selected independent variables for ordered logistic regression for a study on *clean seed* potato multiplication agri-enterprises in the central Rift Valley, Kenya

	Definition of explanatory variable and its measurement	Expected sign
X1	Agri-preneur socio-economic characteristics Age of the household head (HHH) in years (continuous)	+/-
X2	Gender of the HHH, (dummy 1 = male, 0 = female)	+
X3	Education level of the HHH, categorical, 1 = none, 2 = primary, 3 = secondary, 4 = college/university, 5 = others	+
X4	Total land size owned by the household in hectares (continuous)	+
X5	Size of land allocated for potato by household in Ha (continuous)	+
X6	Type of land ownership 1= Own with title deed, 0 otherwise.	+
X7	Number of dependents in the household. (Continuous)	+/-
X8	Off farm sources of income. 1= have other sources, 0 = otherwise.	+/-
X9	Agri-enterprise enabling institutional characteristics. Number of contacts with extension service providers in 2018 (Continuous).	+
X10	Participation in potato contract farming (1 if yes, 0 otherwise)	+
X11	Number of contacts with certified seed producer in 2018. (Continuous)	+
X12	Ownership of storage facility by household (1if yes, 0 otherwise)	+
X13	Ownership of transport means by household (1 if yes, 0 otherwise)	+
X14	Membership of HHH to potato related group (1 if yes, 0 otherwise). Entrepreneurial Networking capability related factors	+
X15	Relational skills of the HHH with other value chain actors/employees*	+
X16	Partner knowledge of the HHH*	+
X17	Internal communication of the HHH with employees*	+
X18	Coordination skills of the HHH with partners and employees*	+
X19	Ability of the HHH to build new relationships*	+

¹Networking capability dimensions (*) were adapted from studies by Bengesi and Roux (2014) and Parida *et al.* (2017)

TABLE 3. Variance inflation factor test for continuous independent variables in Ordered Logistic Regression model

Variable	VIF	1/VIF
Coordination skills (CS)	2.01	0.4987
Building new relations (BNR)	1.85	0.5407
Internal communication (ICM)	1.63	0.6130
Interaction with certified seed producer	1.48	0.6761
Partner knowledge (PKW)	1.39	0.7187
Interaction with extension officers	1.35	0.7405
Age of household head	1.15	0.8694
Household size	1.11	0.9007
Land allocated potatoes	1.09	0.9169
Mean VIF	1.45	

VIF = variance inflation factor; 1/VIF = 1/variance inflation factor

TABLE 4. Heteroskedasticity White test for the independent variables involved in the study about *clean seed* potato multiplication in the central Rift Valley, Kenya

Source	Chi ²	Df	P
Heteroskedasticity	186.25	163	0.1025
Skewness	30.83	17	0.0210
Kurtosis	1.90	1	0.1681
Total	218.97	181	0.0284

contemplation stage, hence not willing to try CSPMAE (Table 6). About 15% (37) were in contemplation stage with only 10% (24) in preparation stage (willing to take up the CSPMAE in short run); while the remaining 22% (54) were practicing CSPMAE hence in action stage.

Influence of agri-preneur networking capability. It is clear from the ordered logit results (Table 7) that partner knowledge of the household head, a construct of networking capability, positively influenced the adoption tendency of CSPMAE (1% significance level). An increase in the score of partner knowledge led to 1.56 increase in the log odds of being

in a higher stage of CSPMAE adoption tendency. Partners' knowledge is among the necessary networking capability attributes that enable an individual to identify partners with relevant capabilities and resources to complement their needs for better performance of their enterprises, as postulated by Bengesi and Roux (2014). Entrepreneurs with better partner knowledge attributes can also avoid enterprise instability resulting from partnership disputes. Therefore, farmers with stronger partner knowledge have better networks and linkages with other actors in the potato value chain, hence, enhancing their capacity to be in higher stage of CSPMAE. This was consistent with previous findings of positive

TABLE 5. Pair-wise correlation coefficients for categorical variables used in ordered logistic regression

	Gender	Land tenure	Educ level	Off farm income	Own transprt	Own storage	Group member	Participcontract
Gender	1.0000							
Land tenure	0.0791	1.0000						
Educ level	0.1590	0.0966	1.0000					
Off farm income	-0.0270	0.1026	0.0809	1.0000				
Own transprt	-0.0453	0.0020	-0.1034	0.1145	1.0000			
Own storage	0.0868	-0.0250	0.1325	-0.0179	0.0419	1.0000		
Mmberpotagr	-0.1094	-0.0157	0.0463	-0.0177	0.1069	0.0423	1.0000	
Particptcontract	-0.0155	0.0484	0.0972	0.0000	0.1186	0.1418	0.3443	1.0000

impact of entrepreneur networking capability on SMEs performance (Bengesi and Roux, 2014; Ajayi, 2016).

The empirical results also indicates a positive insignificant effect of building new relations on adoption tendency. However the internal communication and coordination skills dimensions of NC had a negative influence on adoption tendency of CSPMAE (Table 7). This is contrary to priori expectations of the study, although Bengesi and Roux (2014) in their study also found a negative influence of coordination skills on SME performance in Tanzania. There is limited literature to conclusively ascertain the relationship between networking capability and adoption tendencies, since most studies have focused on the influence of NC of firm performance and innovativeness. Further studies would, therefore, help to substantiate the relationship between networking capability and agricultural entrepreneurial adoption tendency.

Influence of agri-preneur socio-economic characteristics. Among the socio-economic aspects of the household head, gender, land allocated to potato and level of education had a positive influence on adoption tendencies of CSPMAE (Table 7). Being a male farmer increased the log odds of being in higher adoption tendency stage of CSPMAE by 0.65, as compared to female farmers, *ceteris paribus* (Table 7). This could be attributed to gender roles defined by the society, whereby male gender is less confined to domestic jobs, hence giving them freedom to participate in several meetings and trainings, as postulated by Wang *et al.* (2017). Such meetings may involve dissemination of useful information, which probably enhanced their uptake of CSPMAE. According to Rola-Rubzen *et al.* (2020), social-cultural values and norms give men authority over decision-making and ownership of productive resources such as land. This could have enhanced their adoption of seed multiplication agri-enterprise as compared to women. These findings are consistent with Wang *et al.* (2017), whose study found a

TABLE 6. Distribution of farmers in various stages of change

Stage of change	Frequency	Percentage (%)
Pre-contemplation	131	53.25
Contemplation	37	15.04
Preparation	24	9.76
Action	54	21.95
Total	246	100.00

TABLE 7. Factors influencing adoption tendency of *clean seed* potato multiplication agri-enterprises in central Rift Valley, Kenya

Stage of change/adoption tendency	Coefficient	Std. Err.	P>z
Agri-preneur networking capability characteristics			
Internal communication (ICM)	-0.1158	0.2099	0.581
Partner knowledge (PKW)	1.5581***	0.2564	0
Building new relations (BNR)	0.2593	0.3116	0.405
Coordination Skills (CS)	-0.122	0.3127	0.696
Agri-preneur socio-economic characteristics			
Gender of household head	0.6510*	0.3493	0.062
Age of household head	-0.0133	0.013	0.305
Household Size	-0.122	0.0739	0.099
Land allocated to potato	0.1779***	0.0551	0.001
Land ownership type	0.2738	0.3252	0.4
Level of education of household head	0.6172***	0.2182	0.005
Off farm income participation	0.3915	0.3728	0.294
Agri-enterprise enabling institutional characteristics			
Ownership of storage	1.0193***	0.329	0.002
Ownership of transport	1.7819***	0.5466	0.001
Membership to potato group	0.5445	0.337	0.106
Participation in contract farming	-0.4904	0.4365	0.261
Interaction with extension officers	0.1755*	0.094	0.062
Interaction with certified seed producer	0.6208***	0.1201	0
Number of obs = 246			
Log likelihood = -194.0824			
Prob>chi ² = 0.0000			
Pseudo R ² = 0.3316			
LR chi ² (17) = 192.59			

* and *** depicts 10% and 1% significance levels, respectively

positive influence of gender on adoption of hybrid maize in Kenya. Mwangi and Kariuki (2015) in their review of factors determining adoption of new agricultural technology by smallholder farmers in developing countries, also cited a positive influence of gender on adoption. This empirical findings indicates a significant role of gender in adoption tendency of CSPMAE. Amendment of gender equity and equality is, therefore, necessary for enhancing uptake of CSPMAE by female farmers too.

The size of land allocated for potato production significantly influenced the adoption tendency of CSPMAE ($P < 1\%$) (Table 7). A unit increase in size of land allocated for potato, *ceteris paribus*, leads to 0.18 increase in log odds of being in a higher stages of CSPMAE adoption tendency. Land is a crucial resource in *clean seed* potato multiplication (KEPHIS, 2016). Large farm size facilitates crop rotation, which helps to uphold the quality of seed against diseases such as bacterial wilt (Wasilewska-Nascimento *et al.*, 2020). Farmers with large land parcels, therefore, had relatively sufficient resources mandatory for participation in CSPMAE; compared to farmers with lower land acreage. Ownership of resourceful assets such as land was, therefore, an incentive to adopt agri-entrepreneurial opportunities such as *clean seed* potato multiplication. Onyeneke (2017) and Kapalasa *et al.* (2019) consistently found a positive influence of farm size in their adoption studies. Therefore, consideration of farmers with larger land acreage is key for projects seeking to recruit farmers into CSPMAE, rather than targeting all farmers. This findings suggests the significant role of land in adoption tendency of clean seed agri-enterprises in the Central Rift Valley in Kenya.

Level of education of the household head also influenced the uptake stage of CSPMAE (Table 7); suggesting that acquiring higher level education from college or university leads to 0.62 increase in log odds of being in a higher stage of adoption tendency of CSPMAE, *ceteris paribus*. This is consistent with the

results of Wang *et al.* (2017), who observed that farmers with college and higher education levels had a higher probability of adopting hybrid maize; and concluded that educated farmers were more likely to purchase hybrid seed and observe agronomic practices. Educated farmers tend to have comparatively greater access to information than their illiterate counterparts, thus increasing their level of awareness to new technology and entrepreneurial opportunities. Awareness likely enhances the adoption tendencies of CSPMAE, compared to lower awareness among farmers with lower level of education (Mwangi and Kariuki, 2015). Consequently, enhancement of capacity building among interested farmers in lower stages of adoption tendency and selection of educated farmers is a crucial intervention for engaging in CSPMAE.

Influence of agri-enterprise enabling institutional characteristics. Ownership of storage facility significantly influenced the stages of change of CSPMAE (Table 7) leading to a 1.02 increase in log odds of being in higher stages of adoption tendency for CSPMAE. Storage facility is a vital requirement in maintaining the quality of seed potato (Muthoni *et al.*, 2015). It aids in prevention of post-harvest losses associated with storage, such as rotting, greening and unnecessary sprouting of tubers due to short dormancy (Muthoni *et al.*, 2015). Farmers who owned storage facility were, therefore, more likely to be in the action stage of adoption tendency of CSPMAE, as compared to those without stores. Moreover, buyers are sensitive to the quality of seed, hence making storage facility a crucial requirement for CSPMAE. Ownership of storage facility, therefore, plays a vital role in adoption tendency of clean seed multiplication agri-enterprises. Targeting farmers with such profile, could increase the uptake of clean seed potato entrepreneurial opportunities.

Similarly, ownership of transport facility influenced the uptake stages of CSPMAE at $P < 1\%$ (Table 7). Owning a transport facility increased the log odds of being in a higher stage of adoption tendency for CSPMAE by 1.78. This means that farmers who owned transport had a higher probability of adopting *clean seed* potato multiplication agri-enterprises, than those without such infrastructure. Ownership of transportation assets such as motorcycle, vehicle or donkey cart facilitates efficient and effective mobility of farm inputs and outputs between the farm and the markets. This helps to reduce transaction costs incurred by the farmers. Due to the bulky nature of seed potato and their high demand during planting season, farmers who own transportation facilities were more likely to be in the higher stages of adoption tendency of CSPMAE compared to farmers without own transport means. Additionally, CSPMAE requires investment of bulky inputs such as certified seed and fertiliser, hence ownership of transport facilitates easy transportation from the market to remote areas (Muthoni *et al.*, 2013). Thus, ownership of transport plays a significant role in adoption tendency of CSPMAE hence a crucial trait when profiling farmers to participate in CSPMAE.

Interaction of the household head with extension officers had a positive significant influence on adoption tendency of CSPMAE (Table 7). A unit increase in number of interaction with agricultural extension officer increased the log odds of being in a higher stage of adoption tendency for CSPMAE by 0.18. Agricultural extension officers are equipped with agricultural knowledge and training skills, hence are useful human capital in dissemination of information (KEPHIS, 2016). Farmers who interacted frequently with such change agents seem to have gained more valuable information about *clean seed* potato multiplication, hence motivating them to take up the entrepreneurial opportunities. Kalibwani *et al.* (2017) and Lasway *et al.* (2020)

consistently found a positive effect of access to extension services on adoption of soil conservation technologies in east Africa. Due to its significant role in CSPMAE adoption tendency, employment and facilitation of more agricultural extension officers by the County Government would help to enhance diffusion of knowledge to farmers.

Access to certified seed positively influenced the uptake of CSPMAE (Table 7). A one unit increase in frequency of interaction with certified seed potato producers, increased the log odds of being in the higher stages of adoption tendency by 0.62. Farmers who got access to certified seed had higher propensity of taking up CSPMAE, compared to those without access *ceteris paribus*. Certified seed is scarce, but a crucial requirement in production of *clean seed* (Wasilewska-Nascimento *et al.*, 2020). Due to its scarcity, those farmers who interacted with the certified seed producers were frequently likely to get access to certified seed, hence gaining an advantage to participate in CSPMAE, compared to other farmers who did not interact with certified seed producers. Since certified seed plays a significant role in the adoption tendency of CSPMAE, the formal sector should increase their production capacity for enhanced supply of certified seed among the potential *clean seed* potato multiplication agri-preneurs.

CONCLUSION

It is clear from this study that among the networking capability constructs, partner knowledge of the household head and their ability to build new relations play a positive role in adoption tendency of CSPMAE in the central Rift Valley of Kenya (Nakuru). Gender of the household head, land allocated to potato and level of education of the household head are among the socio-economic factors that positively influence the uptake stages for decentralised CSPMAE in this region. Major institutional factors include ownership of

transport, ownership of storage facility, interaction with extension services and interaction with certified seed potato producer; all of which had effects on adoption tendencies of decentralised CSPMAE in the study area.

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