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RESOURCE CAPACITY PLANNING AND CLIMATE SMART AGRICULTURE IN LAIKIPIA COUNTY, KENYA

ABSTRACT

The purpose of this study is to establish the extent to which capacity planning influences the performance of climate smart agriculture projects in Laikipia County. Globally, food crisis and malnutrition have been on the rise. Hence, pursuit of the second Sustainable Development Goal: Zero hunger, which should be achieved in tandem with other related goals for food security, a healthy population and ecology. Mixed method approach was employed to study two World Bank-sponsored Kenya Climate Smart Agriculture projects namely, Kariunga-Mutirithia-Naibor Dam Project and Ndathimi Dam project with 300 and 212 small-scale farmers respectively. The respondents' opinion on capacity planning had a composite mean and standard deviation of 2.88 and 1.219 respectively. Capacity planning and the performance of climate smart agricultural projects had a strong correlation coefficient of $r=0.644$ and p-value $p=0.000<0.05$. Therefore, resource capacity planning is fundamental in enhancing climate smart projects, through proactive decisions, risk management and cost reduction.

Key words: climate smart agricultural projects, capacity planning, agricultural projects, small-scale farmers, healthy environment.

JEL Classification: Q18, Q15, Q14.

I. INTRODUCTION

With projected population growth, demand for food is on the increase. However, conventional methods of food production target yields ignoring the unintended outcomes. The resultant effects are over-cropping, over-grazing, and food loss; consequently, deforestation, soil degradation, depleted water and carbon sinks. Subsequently, climate crisis, which in turn obscures food production. The vicious cycle of population growth, demand for more food using conventional methods leading to degraded ecology result in food insecurity will persist unless a purposeful strategic decision is made to break the cycle. Over and above the predictable challenges that deter achieving food security, there are other unforeseen obstacles such as climate crisis, economic dips, desert locust invasion in Eastern Africa, and poverty.

Moreover, resources are scarce but the needs are unlimited, hence, demand for resources capacity planning. In Kenya, irrigation systems since the colonial era remain underdeveloped (Bjornlund, Bjornlund & Van Rooyen, 2020). In addition, the market and the government control resource allocation, disadvantaging social and ecological justice (Gupta & Lebel, 2020). Various empirical studies conducted globally and even in Laikipia County regarding food security differed from this study in methodology, context and concept, justifying the need for this study.

2. STATE OF KNOWLEDGE

Ascertaining what a project requires to achieve its goals is a primary process before engaging in any of the project's activities. In the same manner, the strategic process of determining the available resources and how they could be harnessed to achieve the climate smart food security projects to progressively increase the supply of safe, secure, acceptable, and nutritious food is a principal process. In addition, the fundamental question in food production globally is the sustainability of resources that are involved in food production (Pawlak & Kołodziejczak, 2021). Therefore, capacity planning of resources in food production is critical. The process guarantees the expected outcome, despite the existing constraints and ecological risks. This study will focus on the current capacity, desired capacity, and existing buffer capacity of the food security projects.

In consort with achieving the desired performance in climate smart food security projects, capacity planning is a vital element of assessing and estimating the available resources in pursuance of making sound decisions to achieve the desired goals. Though diverse capacity planning and management strategies may be applied, there is a relationship between the capacity planning of resources and the success of the projects (Nangulu *et al*., 2022). Moreover, capacity planning lays a foundation for resource allocation. Excellence and sustainability of food security projects require capacity planning of the available resources. By the year 2000, 2.06% of the earth surface was classified as urban land, and projections indicate an increase to 4.72% by 2040. Unfortunately, most of the urban land is located on land suitable for crop production (arable land). This would shrink food production capacity by 65 million tons. The highest share of arable land take for urbanisation occurs in Europe, China and the Middle East (Vliet, Eitelberg & Verburg, 2017). In addition, capacity planning is critical for effective and efficient utilisation of resources and risk management.

Over and above geographic factors, the capacity of resources is affected by unavoidable factors such as socio-economic and political factors. A study by Ragasa *et al*. (2016) in Congo focused on capacity planning of small-scale farming, and weak political context. The study found that capacity planning assisted farmers to respond to signals and improve their risk management capacity. In addition, study by Yao *et al*. (2022) found that capacity forecasting and production programming allowed the determination of seasons and inventory management. Nonetheless, a study by Addison *et al*. (2022) found that capacity planning required technology and innovation. However, technology uptake in agriculture is still low (Yokamo, 2020). Hence, the need to enhance extension programmes to help farmers to have flexibility in the adoption of new agricultural practices (Danso-Abbeam *et al*., 2018). Such practices include capacity planning for risks.

Risks are a major hurdle in food security projects, hence the need to plan for them beforehand. Delay *et al*. (2020), using modelling methodology on the Kansas-farm management association, found that insured farms operated smoothly even after suffering unforeseen losses. In addition, Jabbar *et al*. (2020) found that capacity planning through risk management promoted food security projects. Appreciating the many factors that affect food production, capacity planning could not be over-emphasized for providing food security globally.

Food production sets the countries' wealth formation on the right footing. Moreover, food security projects are the backbone of industries, economic growth through taxation, and the source of foreign exchange. The development transformation of England, America, and Japan confirms that the Agricultural Revolution heralded the Industrial Revolution (Praburaj, 2018). Furthermore, food security project capacity planning is vital as food security is a contributory factor for people's health, economic growth, and ecological sustenance. However, as economies develop, the importance of food security projects diminishes as countries diversify their sources of income. The resultant effect is that in the industrialisation age, the countries reduce their budg*et al*location quota in agricultural capacity planning, research, and development as they refocus on industrialisation, and this was evident in Sri Lanka, the Philippines, Egypt, and India (Payumo *et al*., 2018). Nonetheless, policies could be put in place to ensure that industrialisation does not trivialise food production. Capacity planning of agricultural development in Cape Verde led to the development of food security policies. As a result, the policies improved food production and prevented environmental degradation (Payumo *et al*., 2018). Capacity planning of food production helps to minimise surpluses and deficiencies in supply.

Due to the perishable nature of agricultural products, the market experiences a glut in the harvest season. This leads to the loss of surplus food and poor market prices. However, a few months later there is food deficiency (Morais *et al*., 2018). Capacity planning helps to identify the surplus and deficits and smoothen production, for a stable supply. In addition, it enhances the timely supply of inputs and reduces resource allocation anomalies. Capacity planning reduces resource constraints, ensures gender equality, and increases food supply (Makate *et al*., 2019). This demands availing farm inputs and finances. In addition, it requires guaranteed gender inclusivity and sufficient market for the farmers' products, a role that cooperatives would achieve through synergising farmers' capacity for enhancing the bargaining power of the small-scale farmers (Simelane *et al*., 2019). This is an indication that pooling the farmers enhances the possibility of capacity planning and improves allocation of the limited resources that are required by diverse competing factors.

Though capacity planning is costly in terms of time, labour, and resources, it is fundamental for any meaningful investment. However, for capacity planning to yield meaningful results, public participation is fundamental. Poku-Boansi (2021) studied capacity planning of the resources in Ghana, and found that there was no public participation involved. Esfandi & Nourian (2021) found that poor capacity planning of resources in Tehran districts, in Iran, led to poor resource allocation. Akuja and Kandagor (2019), who measured policies and agricultural productivity in Turkana County in Kenya, found that poor capacity planning, overlapping policies, and failure to adhere to the 10% budgetary allocation as per the Maputo agreement of 2003, contribute to poor food production. This points out on the efficacy introduced by policies, technology and investment in skills to promote capacity planning of rural-urban resources in order to facilitate leveraging on the available resources.

Technology is critical in promoting capacity planning. Addison *et al*., (2022) measured capacity planning in terms of technology uptake and farmers' revenue. The study found that if farmers could use selected technologies, it could have greater potential to fight rural poverty. This was also in line with Wordofa *et al*. (2021) who measured the relationship between advanced agriculture technology and small-scale farmer's revenue, and found that small-scale farmers who employed advanced technology had better incomes. Hence, the need for the governments in Africa to invest in technology and extension programmes in agriculture to promote resource capacity planning. Danso-Abbeam *et al*. (2018) measured the effectiveness of extension services in capacity planning in Ghana and found that extension programmes were critical for the periodic training of farmers. In addition, capacity planning helped to explore the available opportunities, maximize them, identify risks and mitigate them.

While focusing on institutional linkages only, Othieno, Aseey, and Rugendo (2021) measured the capacity of irrigation farmers in Migori County and found that networks are a critical investment in every industry. Moreover, the study found that institutional linkages influenced smallholder irrigation projects. Hence, capacity planning is critical to guarantee the harmonisation of the industry goals. In the year 2017, the Government of Kenya's ministries involved in agriculture and natural resources initiated the Climate Smart Agriculture strategy, which focused on climate crisis, development, ecology, and food security projects. However, the strategy and policy differed. In that, donors and state-led informal dialogues influenced policies and limited their effectiveness (Faling, 2020). Also, the available Climate Smart Agriculture toolkit in Kenya addressed technological factors but failed to address other factors such as social, economic, governance, and biophysical (Thornton *et al*., 2018). Hence the need for a multi-disciplinary stakeholder involvement to guarantee seamless coordination of all the industry players and the government.

With the devolved Government in Kenya, the capacity of the individual county to develop policies is fundamental. Laikipia County has emphasised capacity planning of resources. However, a study by Muhua and Waweru (2017) found that financing and coordination of the policies were poorly managed, late, and insufficiently funded, leading to resource underutilisation, a factor that has failed to transform the agriculture landscape of the county. Those results were supported by a similar study by Gitonga and Nderitu (2016), who found that Laikipia had a growing population with small parcels of arable land; additionally, core water sources were rivers and boreholes, and irrigation infrastructure is negligible (Lesrima *et al*., 2021); hence, complicating capacity planning of resources. Therefore, judicious capacity planning and top leadership support are pivotal for prudent resource allocation in the County.

The major Laikipia County's agricultural resources are land and water from sub-basin rivers (Lesrima *et al*., 2021). However, there is a need for the government to promote water harvesting and train farmers on water conservation and harvesting to be able to sustain modern agriculture. The County's land is mainly distributed into agricultural, forest, bushland, and grassland. Over time, grasslands and riverbed vegetation have increased by 72%, while agricultural land has increased by 600% through encroaching on other land uses (M'mboroki *et al*., 2018). Capacity planning, working policies, and the willpower to enforce the policies could guarantee equitable resource allocation, improved performance of food security projects, and flawless co-existence of pastoralists, crop farmers, and wildlife in a stable environment. Sadly, this scenario is lacking in the County.

3. MATERIAL AND METHOD

The main objective of this study is to examine whether resource capacity planning promotes climate smart agricultural projects in Laikipia County, Kenya. The research question can be stated as: Does resource capacity planning promote climate smart agricultural projects in Laikipia County, Kenya? Concurrent multi-methodology approach was used to allow collection of quantitative and qualitative data. Hence, cross-sectional survey and correlational design were employed. The study unit of analysis consisted of two World Bank-sponsored Climate Smart Agricultural dam projects namely, Kariunga-Mutirithia-Naibor project (Segera Ward) with 300 small-scale farmers and Ndathimi Dam project (Karaba ward), with 212 small-scale farmers respectively.

The study used Yamane (1967) formula to calculate the required sample size, and stratified and simple random sampling were used to select 130 small-scale farmers from Kariunga-Mutirithia-Naibor dam water project and 91 small-scale farmers from Ndathimi Dam water project. Also, several key informants were purposefully included: County Government, Ministry of Agriculture, Livestock and Fisheries officer and the two project managers. Data and information were collected using questionnaires for 203 small-scale farmers. The interview guide prompted the researcher while collecting information from the key informants and the observation guide had questions that prompted the researcher in observing the projects.

4. RESULTS AND DISCUSSIONS

Capacity planning and Performance of Climate Smart Agricultural Projects were assessed through various aspects, which included current capacity, desired capacity, existing buffer capacity, risk reduction and opportunities optimisation. Respondents were asked to indicate their opinion on a Likert scale of 1–5, where: 1 = strongly disagree 5 = strongly agree. Results are shown in Table 1.

Table 1

Capacity Planning and Performance of Climate Smart Agricultural Projects

	Statement	SD (1)	D (2)	N (3)	A (4)	SA (5)	TOTAL	M	SD
CP1	There is access to land for food production	36 (17.7%)	67 (33.0%)	55 (27.1%)	30 (14.8%)	15 (7.4%)	**203 (100%)**	**2.61**	**1.157**
CP2	There is access to water for food production	25 (12.3%)	56 (27.6%)	37 (18.2%)	69 (34.0%)	16 (7.9%)	**203 (100%)**	**2.98**	**1.196**
CP3	Food projects have constant supply of resources	23 (11.3%)	46 (22.7%)	45 (22.2%)	66 (32.5%)	23 (11.3%)	**203 (100%)**	**3.10**	**1.206**
CP4	There are mitigation measures for risks	38 (18.7%)	67 (33.0%)	30 (14.8%)	50 (24.6%)	18 (8.9%)	**203 (100%)**	**2.72**	**1.268**
CP5	Uptake of technological innovation is embraced	38 (18.7%)	55 (27.1%)	27 (13.3%)	68 (33.5%)	15 (7.4%)	**203 (100%)**	**2.84**	**1.277**
CP6	Farmers leverage on the existing extension services	21 (10.3%)	72 (35.5%)	34 (16.7%)	55 (27.2%)	21 (10.3%)	**203 (100%)**	**2.92**	**1.206**
CP7	Farmers have insured their agricultural activities	30 (14.8%)	47 (23.2%)	41 (20.2%)	68 (33.5%)	17 (8.3%)	**203 (100%)**	**2.98**	**1.224**
Composite mean (M) and composite standard deviation (SD)								**2.88**	**1.219**

Source: Authors'calculations.
Notes: 1 = strongly disagree (SD), 2 = disagree (D), 3 = neutral (N), 4 = agree (A), 5 = strongly agree (SA), CP= capacity planning statement.

Results in Table 1 show the line mean of each statement; lower item mean compared to composite mean translate into a negative opinion on the tested item, while a lower standard deviation as opposed to the composite standard deviation translate into respondents' convergence in opinion. For statement CP1, if there was access to land for food production, 36 respondents (17.7%) strongly disagreed, 67 (33.0%) disagreed, 55 (27.1%) were neutral, 30 (14.8%) agreed and 15(7.4%) strongly agreed. The mean 2.61 *versus* 2.88 as composite mean, implied that farmers had no access to sufficient land for food production. The item standard deviation and composite standard deviation of 1.157 and 1.219 respectively, indicated convergent respondents' opinion. This supported Gitonga and Nderitu (2016) who noted that Laikipia had a growing population with small parcels of arable land.

For statement CP2, regarding access to water for food production, 25 respondents (12.3%) strongly disagreed, 56 (27.6%) disagreed, 37 (18.2%) were neutral, 69 (34.0%) agreed and 16 (7.9%) strongly agreed. The mean 2.98 *versus* 2.88 as composite mean, implied that the projects had access to water for food production. The item standard deviation and composite standard deviation of 1.196 and 1.219 respectively, showed convergent respondents' opinions. This supported Lesrima *et al*. (2021) who found that the main water sources of Laikipia County sub-basin were rivers and boreholes. Therefore, the government should increase the irrigation infrastructure.

For statement CP3, if food security projects had a constant supply of resources to support productivity, 23 respondents (11.3%) strongly disagreed, 46 (22.7%) disagreed, 45 (22.2%) were neutral, 66 (32.5%) agreed and 23 (11.3%) strongly agreed. The mean 3.10 *versus* 2.88 as composite mean, showed that food security projects constantly supported the farmers with resources for productivity. Item standard deviation of 1.206 *versus* 1.219 as composite standard deviation pointed out convergent responses. This contradicted Akuja and Kandagor's (2019) study that found that poor capacity planning, overlapping policies, and failure to adhere to the 10% budgetary allocation as per the Maputo agreement of 2003, led to dismal food production in related projects.

For statement CP4, if there were mitigation measures for all the risk identified, 38 respondents (18.7%) strongly disagreed, 67 (33.0%) disagreed, 30 (14.8%) were neutral, 50 (24.6%) agreed and 18 (8.9%) strongly agreed. The mean 2.72 *versus* 2.88 as the composite mean pointed out that some identified risks had no prescribed mitigation measures. The item standard deviation of 1.268 *versus* 1.219 as the composite standard deviation implied divergent responses. This resonated with Jabbar *et al*. (2020), who found that risk management instruments in food production promoted food security.

For statement CP5, if uptake of technological innovation was embraced by farmers, 38 respondents (18.7%) strongly disagreed, 55 (27.1%) disagreed, 27 (13.3%) were neutral, 68 (33.5%) agreed and 15 (7.4%) strongly agreed. The mean 2.84 *versus* 2.88 as composite mean showed that uptake of technological innovation in food security projects was not embraced by all farmers. Item standard deviation of 1.277 and 1.279 as the composite standard deviation, revealed convergence of responses. This supported Addison *et al*. (2022) who found that agricultural technology was still low due to lack of knowledge and skills, but if farmers embraced selected technologies, this could have greater potential to fight rural poverty. It also supported Wordofa *et al*. (2021) who found that small-scale farmers who employed advanced technology had better incomes.

For statement CP6, if farmers leveraged on the existing extension services offered by the available agricultural research institutes, 21 respondents (10.3%) strongly disagreed, 72 (35.5%) disagreed, 34 (16.7%) were neutral, 55 (27.2%) agreed and 21 (10.3%) strongly agreed. The mean 2.92 *versus* 2.88 as composite mean implied that farmers attached to food security projects were using extension services by the agricultural research institutes. Line standard deviation of 1.206 *versus* 1.279 as composite standard deviation, translated to convergence in respondents' opinion. This supported Danso-Abbeam*et al*. (2018), who found that extension programmes had positive influence on farm output and farmers' income.

For statement CP7, if farmers have insured their agricultural activities, 30 respondents (14.8%) strongly disagreed, 47 (23.2%) disagreed, 41 (20.2%) were neutral, 68 (33.5%) agreed and 17 (8.3%) strongly agreed. The mean 2.98 *versus* 2.88 as composite mean implied that farmers had insured their agricultural activities. The item standard deviation of 1.224 *versus* 1.219 as the composite standard deviation implied divergent respondents' opinion. This supported Delay *et al*. (2020), who found that loss compensation for insured farms prevented farmers going under financially.

Results gathered from the interview showed that respondents had the same opinions about capacity planning of the food security projects. This is what they had to say:

"*Albeit, the effective capacity planning of the resources at Kariunga-Mutirithia-Naibor Dam Project and Ndathimi Dam project, due to emphasis on stakeholder involvement, leading to the projects' sustainability, the projects' capacity was constrained by the fact that Laikipia is majorly arid and semi-arid land, characterised by socio-cultural conflicts and insecurity*" (Respondent A).

"*Kariunga-Mutirithia-Naibor Dam Project and Ndathimi Dam project are great models of agricultural infrastructure in terms of irrigation systems. The projects could feed and provide income to the targeted members, but overstretch with the entry of new members without further investment. Also, members sometimes lack anything to show for it due to insecurity"* (Respondent B).

"*Capacity planning of the resources was critical to maintain the projects. However, the project seems to have used up all the buffer resources, hence, limited capacity to expand. In addition, the environment had an impact on the project, as water resource was in excess in the rainy period, but scarce in the dry period. In addition, during drought, farmers feared for their lives from cattle rustlers and wildlife, hence, security was primary"* (Respondent C).

"*Capacity planning of the resources would be practical with more of the government and private investors and development partners' intervention. This could be achieved through erecting sufficient security, agricultural infrastructure, provision of loans to farmers, and encouraging farmers leverage benefits of cooperatives in the purchase of inputs and sale of their products, eliminate middlemen, and avail ready market for their products*" (Respondent D).

The researchers were able to observe that the technology used by the Kariunga-Mutirithia-Naibor Dam Project and Ndathimi Dam project enhanced the capacity planning of the resources. Water was well utilised and reserved for the dry season, to avoid unreliability in climate-dependent food production. However, extended drought as that experienced from 2019 to 2022 had overstretched the project capacity.

The results from observation showed that there was stakeholder involvement in the capacity planning of the projects' resources. In turn, it assisted the project to serve the target community with much ease. Nonetheless, considering that the projects had a hostile environment in terms of drought and conflicts, this affected the projects' growth capacity. The County had idle resources that could not be planned to cope with climatic conditions, insecurity, and agro-pastoral conflicts.

4.1. CORRELATION ANALYSIS BETWEEN CAPACITY PLANNING AND PERFORMANCE OF CLIMATE SMART AGRICULTURAL PROJECTS

To examine capacity planning's relationship with the performance of climate smart agricultural projects at 0.05 level of significance, Pearson's Correlation Coefficient was used. The vector and extent of association were established through correlation analysis. The values of correlation analysis range from -1 to +1. The +1 and -1 values infer perfect-positive and perfect-negative correlation respectively, while zero implies no correlation. The modular values 0.001 to 0.250, 0.251 to 0.500, and 0.501 to 0.750 imply weak, moderately-strong and very strong correlation respectively. Table 2 shows the correlation results. It details correlation coefficient of (r=0.644) with a P-value of (p=0.000<0.05) for capacity planning and performance of climate smart agricultural projects. Hence, the null hypothesis H_0: Capacity planning has no significant relationship with the performance of climate smart agricultural projects was rejected. Therefore, it was concluded that there was association between capacity planning and performance of climate smart agricultural projects. The results supported the findings of Othieno *et al*. (2021) who found that farmer capacity building promoted subsistent irrigation projects.

Table 2

Correlation Analysis between Capacity Planning and Performance of Climate Smart Agricultural Projects

Variables		**Capacity Planning**	**Performance of climate smart agricultural projects**
Capacity Planning	Pearson Correlation	1	0.644**
	Sig. (2-tailed)		0.000
	N	203	203
Performance of climate smart agricultural projects	Pearson Correlation	0.644**	1
	Sig. (2-tailed)	0.000	
	N	203	203
****Correlation was significant at 0.05 level of significance (2-tailed)**			

Source: Authors' calculations.

4.2. REGRESSION ANALYSIS OF CAPACITY PLANNING AND PERFORMANCE OF CLIMATE SMART AGRICULTURAL PROJECTS

Demonstrating how capacity planning significantly predicted performance of climate smart agricultural projects was the justification of employing the simple regression model.

The following statistical model served in assessing the null hypothesis.

Performance of climate smart agricultural projects = capacity planning

Where: $Y = \beta_0 + \beta_1 X_1 + \varepsilon$

Y = Performance of climate smart agricultural projects

X_1 = capacity planning

β_0 = Constant term

β_1 = Beta coefficient

ε = Error term

Table 3 presents the regression results. It shows the model summary, it highlights presence of a positive correlation coefficient (R=0.644), linking capacity planning and performance of climate smart agricultural projects. The coefficient of determination $R^2 = 0.415$, translating to 41.5% of total variations in the performance of climate smart agricultural projects was explained by capacity planning.

Table 3

Regression Analysis on Capacity Planning and Performance of climate smart agricultural projects

Model Summary

Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	0.644[a]	0.415	0.412	0.40068

ANOVA

Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	22.867	1	22.867	142.439	0.000[b]
	Residual	32.269	201	0.161		
	Total	**55.136**	**202**			

Regression Coefficients

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	1.403	0.122		11.488	0.000
	Capacity Planning	0.493	0.041	0.644	11.935	0.000
	Predictors: (constant), Capacity Planning					
	Dependent Variable: Performance of climate smart agricultural projects					

Source: Authors' calculations.

The ANOVA results, indicating that F statistics (1,201) =142.439 was significant at P-value $0.000 < 0.05$. This implied that the predictor coefficient was at minimum not equal to zero and the regression model could allow prediction of performance of climate smart agricultural projects by capacity planning.

The results of simple linear regression suggest that capacity planning has significant influence on performance of climate smart agricultural projects.

The constant term coefficient of (β_o = 1.403; $P < 0.05$) and capacity planning (β_o = 0.493; $P < 0.05$) were statistically significant.

The capacity planning regression model was $Y = 1.043 + 0.493X_1$ indicating that one unit of performance of climate smart agricultural projects was marginally converted by 0.493 units of capacity planning. Hence, the conclusion that capacity planning and performance of climate smart agricultural projects were positively and linearly related. This supported Ragasa, *et al*. (2016) who found that increasing the farmers' capacity helped them to be proactive, increased their risk management ability and created an incentive to invest in agriculture productivity using high-yield technologies. In turn, higher agricultural productivity directly increased income and food security. These results are in line with Yao *et al*. (2022), who found that capacity planning and production scheduling models allowed joint determination of seasons, inventory management, and logistics plans to minimize costs with significant capacity and labour costs.

5. CONCLUSIONS

Capacity planning of food security projects was critical to promote efficient resource allocation. Moreover, capacity planning helped farmers to be proactive, increased their risk management ability and created an incentive to invest in agriculture productivity using high-yield technologies. Hence, promoted effective and efficient use of resources that led to access of the resources even beyond the dictates by weather patterns. In turn, higher agricultural productivity directly increased income and food security. In addition, capacity planning increased the determination of seasons, inventory management, and logistics plans to minimise costs with significant capacity and labour costs.

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