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# Role of Agriculture Technology for Sustainable Agriculture in Nepal

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## Abstract

This study examines the role of agriculture technology for sustainable agriculture in Nepal. Sustainable agriculture is the dependable variable. The independent variables are irrigation, climate change adaption, fertilizer, soil health, and hybrid crops. The primary source of data is used to assess the opinions of the respondents regarding the role of agriculture technology for sustainable agriculture in Nepal. The study is based on primary data of 150 respondents. To achieve the purpose of the study, structured questionnaire is prepared. The correlation coefficients and regression models are estimated to test the different factors affecting sustainable agriculture in Nepal.

The result shows that irrigation has a positive impact on sustainable agriculture. It indicates that increase in irrigation facility leads to an increase in sustainable agriculture. Similarly, climate change adaptation has a positive impact on sustainable agriculture. It shows that effective climate change adaptation leads to increase in the sustainable agriculture. Likewise, fertilizer has a positive impact on sustainable agriculture. It implies that better utilization of fertilizer leads to increase in sustainable agriculture. Furthermore, soil health has a positive impact on sustainable agriculture. It indicates that improve in soil health leads to increase in sustainable agriculture. Moreover, hybrid crops has a positive impact on sustainable agriculture. It states that the better use of hybrid crops leads to increase in sustainable agriculture.

*Keywords:* sustainable agriculture, irrigation, climate change adaption, fertilizer, soil health, hybrid crops

## 1. Introduction

Agricultural technology, often referred to as AgTech, involves the use of innovative tools, machines, techniques, and processes to improve the efficiency, productivity, and sustainability of agricultural practices. It encompasses a wide range of tools, machinery, processes, and practices that help farmers to optimize the way they grow crops, raise livestock, manage resources, and process food. Agricultural technology holds great promise for transforming farming practices by making agriculture more efficient, sustainable, and resilient. Agriculture is an activity carried out primarily to produce food, fibres, fuel and other commodities through the controlled use of mainly terrestrial plants and animals (Spedding, 2012). Sustainable agriculture is a system that enhances environmental quality and the resource base on which agriculture depends; provides for basic human food and fibre needs; is economically viable; and enhances the quality of life for farmers and society as a whole (Crews *et al.*, 1991). Technology in agriculture, also known as AgTech, has rapidly changed the industry in recent years, helping farmers improve efficiency and maximize yield by utilizing technologies like harvest automation, autonomous tractors, seeding and weeding, and drones (Sadiku *et al.*, 2020). In today's age, there are a great number of problems that threaten this ability of agriculture to fulfill human needs now and in the future, including climate change; a high rate of biodiversity loss; land degradation through soil erosion, compaction, salinization and pollution; depletion and pollution of water resources; rising production costs; an ever decreasing number of farms and, linked with that, poverty and a

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decrease of the rural population (Rivera-Ferre *et al.,* 2013**)**. Sustainable agriculture emerged as part of a growing critique of the negative environmental consequences of unquestioned modern farming methods (Keeney, 1989). The idea of sustainability agricultural has come to be associated with the maintenance of environmental quality both on and off the farm (Abubakar and Attanda, 2013).

Hyytiäinen *et al.* (2011) examined that the adaptive optimization of crop production and nitrogen leaching abatement under yield uncertainty. The study stated that the traditional farming applies inputs uniformly, regardless of potential variability or heterogeneity, throughout the field, which damages the environment. Similarly, Niwas *et al.* (2023) Studied on irrigation scheduling, moisture conservation practices and nutrient management on performance of wheat. The study stressed that the significance of water conservation methods, including rainwater harvesting, soil moisture monitoring, and crop selection. The study also explored the benefits of implementing water-saving practices, such as crop rotation, mulching, and deficit irrigation, to enhance water use efficiency. Likewise, Shadeed *et al.* (2020) analyzed that the rainwater harvesting for sustainable agriculture in high water-poor areas in the West Bank, Palestine. The study suggested that implementing ARWH using GIS and WOSP could promote sustainable water management and improve food security in arid regions. Further, Ramazan *et al.* (2014) assessed that the economic analysis of different drip irrigated date palm production. The study argued that the sprinkler and drip irrigation, mulching, and protected cultivation have contributed to improved water use efficiency in agriculture by significantly reducing runoff and losses of evapotranspiration. Moreover, Mallareddy *et al.* (2023) investigated that the maximizing water use efficiency in rice farming: A comprehensive review of innovative irrigation management technologies. The study displayed that the suitability of different water-saving rice production methods based on factors such as climate, soil type, labor, energy, and greenhouse gas emissions, as well as their prospects and challenges are evaluated. Additionally, Campbell *et al.* (2014) evaluated that the sustainable intensification: What is its role in climate smart agriculture? The study focused on the social dimension of agricultural systems, suggesting that these systems should be analyzed as complex socio-ecological systems, with attention to the varying perspectives of diverse stakeholders.

Scherr *et al.* (2012) investigated that from climate-smart agriculture to climate-smart landscapes. The study highlighted that the importance of adopting a climate-smart landscape approach in agriculture to achieve climate-smart objectives, such as improving food security, livelihoods, and climate adaptation and mitigation. Similarly, Kumar *et al.* (2021) studied on nano fertilizers and their role in sustainable agriculture. The study reviewed the benefits of Nano fertilizers in increasing nutrient use efficiency, crop productivity, and produce quality in general. Likewise, Hobbs *et al.* (2008) assessed that the role of conservation agriculture in promoting sustainable farming practices. The study concluded that conservation agriculture (CA), which integrates minimal soil disturbance, permanent soil cover, and crop rotations, is a more sustainable and environmentally friendly approach to cultivation. The study also evaluated that the potential of CA to improve soil properties, increase productivity, and reduce greenhouse gas emissions, positioning it as a promising solution for meeting future food production demands while minimizing environmental impact. Further, Nabi *et al.* (2017) examined that the Precision farming in vegetables. The study stated that the precision agriculture is defined as a highly effective farming system that utilizes the latest technology and management techniques to achieve maximum agricultural productivity. Moreover, Burney *et al.* (2009) analyzed that the greenhouse gas mitigation by agricultural intensification. The study estimated that high-yielding cropping systems have another important benefit: from 1961 to 2005, up to 161 gig tons of carbon emissions have been "avoided" due to higher yields. Additionally, Lal (2016) studied that the soil health and carbon management in *food and energy security*. The study emphasized that the importance of SOC in sustaining ecosystem services and achieving Sustainable Development Goals, such as poverty alleviation, hunger reduction, and improved health.

Kawalekar (2013) studied that the role of bio fertilizers and bio pesticides for sustainable agriculture. The study emphasized that the use of bio inputs, including bio pesticides that target specific pests without leaving harmful residues, offers a more sustainable and cost-effective solution for restoring soil health and improving crop yields, while also maintaining environmental balance. Similarly, Ronald (2011) examined that the plant genetics, sustainable agriculture, and global food security. The United States and the world face serious societal challenges in the areas of food, environment, energy, and health. The study focused on lessons learned from the integration of genetically engineered crops into agriculture and discusses their potential contributions to sustainable agricultural practices in the future. Likewise, Bagyaraj and Ashwin (2017) analyzed that the soil biodiversity: Role in sustainable horticulture. The study stated that the potential application of cultivating soil fungal biodiversity to improve soil quality and increase productivity of agricultural ecosystems has been highlighted as a new and very promising development in plant productivity. Further, Oldeman (1994) evaluated that the global extent of soil degradation. The study found that the inventories of soil productive capacity indicate human-induced degradation on nearly 40% of the world's agricultural land as a result of soil erosion, atmospheric pollution, extensive soil cultivation, over-grazing, land clearing, salinization, and desertification. Moreover, Bardi *et al.* (2013) investigated that the turning electricity into food: The role of renewable energy in the future of agriculture. The study revealed that increase in the quality as well as quantity of food production in several types of agricultural farms. Additionally, Tilman *et al.* (2001) assessed that the forecasting agriculturally driven global environmental change. The study demonstrated that the extensive use of chemical fertilizers and pesticides has resulted in eutrophication and habitat destruction, which in turn leads to ecosystem simplification, loss of ecosystem services and species extinctions.

In the context of Nepal, Rijal and Rijal (2019) examined that that the concept of climate smart agriculture and its adaptation in Nepal. The study stated that to address key climate challenges such as altered rainfall patterns, temperature variations, unseasonal rains, and prolonged droughts, all of which threaten agricultural systems, Climate Smart Agriculture (CSA) is being promoted as an approach to enhance food security under changing environmental conditions. Similarly, Devkota and Phuyal (2018) analyzed that the adoption practice of climate change adaptation options among Nepalese rice farmers: Role of information and communication technologies. The noticed that the need for further improvement on ICT devices and publicity of such ICT devices and proper investment to boost rice farmers' adaptation to climate change adaption, which will in turn help to improve their livelihoods and well-being. Likewise, Kharel *et al.* (2022) studied that the good agriculture practices for safe food and sustainable agriculture in Nepal. The study highlighted that the good agricultural practices (GAP) have the potential to significantly improve agriculture in Nepal. Further, Thapa *et al.* (2025) assessed that the fertilizer demonstration, agricultural performance, and food security of smallholder farmers: Empirical evidence from Nepal. The study indicated that participation in fertilizer demonstrations led to increased adoption of fertilizers, especially balanced fertilizers, and significantly improved rice productivity, household maize consumption, and agricultural commercialization. Moreover, Joshi *et al.* (2021) evaluated that the conservation agriculture for food security and climate resilience in Nepal. The study discussed that the challenges and potential solutions for achieving the United Nations' sustainable development goals in Nepal, particularly through agricultural innovations. However, Kattel and Acharya (2016) examined that the sustainable soil management practices: Adoption and its impact on farm income in Ramechhap District, Nepal. The study identified that the SSM technology as an environmentally friendly and improved rural farmers' income in a sustainable manner in Nepal. Additionally, Khatri *et al.* (2021) investigated that the perceived attributes and adoption of indigenous technological knowledge on agriculture-a case study from Bhirkot municipality of Syangja district, Nepal. The study recommended that the government should identify, preserve, and well document indigenous methods along with their comprehensive review for authenticating scientifically.

The above discussion reveals that the empirical evidences vary greatly across the studies concerning the role of agriculture technology for sustainable agriculture in Nepal. Though there are above mentioned empirical evidences in the context of other countries and in Nepal, no such findings using more recent data exist in the context of Nepal. Therefore, in order to support one view or the other, this study has been conducted.

The main purpose of the study is to analyze role of agriculture technology for sustainable agriculture in Nepal. Specifically, it examines the effect of irrigation, climate change adaption, fertilizer, soil health and hybrid crops on sustainable agriculture in Nepal.

The remainder of this study is organized as follows. Section two describes the sample, data and methodology. Section three presents the empirical results and the final section draws the conclusion.

## 2. Methodological aspects

The study is based on primary sources of data which were gathered from 7 different province of Nepal. For primary data a structured questionnaire was used. This study contains a sample of 7 province of Nepal whose respective data are collected from a total of 150 respondents. The respondents' views were collected on irrigation, climate change adaptation, fertilizer, soil health, hybrid crops and sustainable agriculture. This study is based on descriptive as well as casual comparative research designs.

*The model*

The model used in this study assumes that sustainable agriculture depends upon role of agriculture technology. The dependent variable selected for the study is sustainable agriculture. Similarly, the independent variables are irrigation, climate change adaption, fertilizer, soil health and hybrid crops. Therefore, the model estimated in this study is stated as follows:

$$SA= \beta_0 + \beta_1 IR + \beta_2 CC+ \beta_3 FE+ \beta_4 SH + \beta_5 HC+ e$$

Where,

SA= Sustainable agriculture

IR= Irrigation

CC= Climate change adaptation

FE= Fertilizer

SH= Soil health

HC= Hybrid crops

Sustainable agriculture measured using a 5-point Likert scale where respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "Sustainable agriculture ensures long-term food security", "Sustainable farming practices reduce dependency on chemical inputs" and so on.The reliability of the feature was measured by computing the Cronbach's alpha (α =0.859).

Irrigation was measured using a 5-point Likert scale where respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "Modern irrigation systems reduce water wastage effectively", "Smart irrigation technology ensures uniform water distribution" and so on. The reliability of the feature was measured by computing the Cronbach's alpha (α =0.854).

Climate change adaption was measured using a 5-point Likert scale where the respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items "Agricultural technology helps mitigate the impact of climate change adaption", "Climate-resilient farming practices ensure sustainable productivity" and so on. The reliability of the feature was measured by computing the Cronbach's alpha (α = 0.822).

Fertilizers were measured using a 5-point Likert scale where the respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "Precision agriculture technologies optimize fertilizer application", "Integrated nutrient management systems enhance crop yield sustainably" and so on. The reliability of the feature was measured by computing the Cronbach's alpha (α = 0.835).

Soil health was measured using a 5-point Likert scale where the respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "Soil testing technologies improve nutrient management and crop yield", "Maintaining soil health is critical for long-term agricultural sustainability" and so on. The reliability of the feature was measured by computing the Cronbach's alpha (α = 0.847).

Hybrid crops was measured using a 5-point Likert scale where the respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "Hybrid crops enhance resilience against pests and diseases", "Hybrid seeds increase resistance to climate change adaption impacts" and so on. The reliability of the feature was measured by computing the Cronbach's alpha (α = 0.964).

The following section describes the independent variables used in this study along with the hypothesis formulation.

*Irrigation*

Irrigation refers to the process of artificially supplying water to crops and plants to support their growth, especially in areas where natural rainfall is insufficient or irregular. It plays a critical role in agriculture, helping to ensure that crops receive the necessary moisture to thrive and maximize yield. Sojka *et al.* (2002) defined irrigation broadly as the practice of applying additional water (beyond what is available from rainfall) to soil to enable or enhance plant growth and yield, and, in some cases, the quality of foliage or harvested plant parts. Irrigation modernization is increasingly recognized as a fundamental transformation in the management of water resources within agricultural areas (Renault and Makin, 1999). However, if today's water management practices continue, they could result in acute water crises in several parts of the world (Anas, 2016). Sustainable agricultural technologies (SATs) are hinged on sustainable resource utilization to meet the global food demands as such, irrigation is pivotal to producing more crops per drop of water per joule of energy per hectare of land used (Taguta *et al.,* 2022). Based on it, this study develops the following hypothesis:

$H_1$: There is a positive relationship between irrigation and sustainable agriculture.

*Climate change adaption*

Climate change adaptation refers to the process of making adjustments in systems, practices, and structures to minimize the negative impacts of climate change, while taking advantage of potential opportunities. Climate change is projected to have significant impacts on agriculture through direct and indirect effects on crops, soils, livestock and pests (Hatfield, 2020). Similarly, agricultural technologies have been successful in eradicating hunger from many parts of the world, but by the virtue of chemical means and usage, which has raised more concern for environment, health and future agriculture (Movilla-Pateiro *et al.,* 2021). While climate change (such as in temperature, precipitation, and frost timing) could lengthen the growing season or allow different crops to be grown in some regions, it will also make agricultural practices more difficult in others (Walsh *et al.,* 2020). Therefore, the modern agricultural sector needs more climate change adaption strategies for simultaneously improving crop productivity and mitigating climate change impacts (Bibi and Rahman, 2023). Based on it, this study develops the following hypothesis:

$H_2$: There is a positive relationship between climate change adaption and sustainable agriculture.

*Fertilizer*

Fertilizer is a substance added to soil or plants to supply essential nutrients that promote plant growth and improve crop yields. Fertilizers provide key nutrients that may be lacking in the soil, helping plants grow more vigorously and produce higher yields. Fertilizers are substances, either organic or synthetic, applied to soil or plants to supply essential nutrients like nitrogen, phosphorus, and potassium, thereby promoting healthy crop growth (Das *et al.,* 2023). According to Pan *et al.* (2021), soil nutrient balance is related to the interaction mechanism between soil fertilizer, soil water, climate change adaption, and plant capability. Amending agricultural soils with composted organic residues has been shown to improve water penetration, hydraulic conductivity, water retention, and aggregate stability (Mujdeci, 2017). Nutrient use efficiency is a critically important concept for evaluating crop production systems and can be greatly impacted by fertilizer management as well as soil- and plant-water relationships (Drechsel *et al.,* 2015). It is worth noting that regardless of the solution used to improve the NUE indicators, each action has a positive effect on the biogeochemical cycle of biogenic elements, and at the same time can help to protect the environment and reduce fertilization costs (Barłog *et al.,* 2022). Based on it, this study develops the following hypothesis:

$H_3$: There is a positive relationship between fertilizer and sustainable agriculture.

*Soil health*

Soil health refers to the condition of the soil in terms of its ability to function as a living system that supports plant life, sustains agricultural productivity, and supports ecosystems.

Healthy soil is rich in nutrients, has good structure and drainage, and supports a diverse community of microorganisms that contribute to soil fertility and plant growth. The soil health concept emerged from soil quality in the 1990s (Sojka and Upchurch, 1999).Soil health in agriculture is the ability of soil to support plant growth and other ecosystem services. It's important for sustainable agriculture and food security (Lehmann *et al.,* 2020). Healthy soils function to sustain soil biota and plant life, store and cycle water and nutrients, decompose organic matter, inactivate toxic compounds, suppress pathogens and protect water quality (Slavich, 2001). Based on it, this study develops the following hypothesis:

$H_4$: There is a positive relationship between soil health and sustainable agriculture.

*Hybrid crops*

Hybrid crops are the result of the controlled crossbreeding of two genetically different plants within the same species to produce offspring with specific desired traits. These traits can include higher yields, improved disease resistance, enhanced nutritional value, or better environmental adaptability. Genetically hybrid crops (GMOs) are defined as organisms (except for human beings) in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination (Verma *et al.,* 2011). Crops that have been genetically modified are more resilient to abiotic stresses, have a lower reliance on chemical insecticides, have higher effectiveness in mineral utilization by agricultural plants, have a lower post-harvest loss rate, and have a longer dietary cost of food (Yali, 2022). Furthermore, GM crops like drought-tolerant maize are being developed to address climate change adaption impacts, providing more stable food supplies in regions with water scarcity (Brookes and Barfoot, 2018). Economic studies have also highlighted the advantages of GM crops for farmers, with increased profitability due to reduced costs and higher productivity (Klümper and Qaim, 2014). Based on it, this study develops the following hypothesis:

$H_5$: There is a positive relationship between hybrid crops and sustainable agriculture.

## 3. Results and discussion

*Correlation analysis*

On analysis of data, correlation analysis has been undertaken first and for this purpose, Kendall's Tau correlation coefficients along with means and standard deviations have been computed, and the results are presented in Table 1.

Table 1

**Kendall's Tau correlation coefficients matrix**

This table presents Kendall's Tau coefficients between dependent and independent variables. The correlation coefficients are based on 150 observations. The dependent variable is SA (Sustainable agriculture). The independent variables are IR (Irrigation), CC (Climate change adaption), FE (Fertilizers), SH (Soil health) and HC (Hybrid crops).

| Variables | Mean | Std. Deviation | IR | CC | FE | SH | HC | SA |
|---|---|---|---|---|---|---|---|---|
| **IR** | 3.145 | 0.6885 | 1.000 | | | | | |
| **CC** | 3.168 | 0.6917 | 0.187** | 1.000 | | | | |
| **FE** | 3.189 | 0.7454 | 0.091 | 0.191** | 1.000 | | | |
| **SH** | 3.123 | 0.7867 | 0.187** | 0.188** | 0.212** | 1.000 | | |
| **HC** | 3.149 | 0.7419 | 0.262** | 0.225** | 0.197** | 0.231** | 1.000 | |
| **SA** | 3.177 | 0.7777 | 0.271** | 0.195** | 0.201** | 0.250** | 0.212** | 1.000 |

Notes: The asterisk signs (**) and (*) indicate that the results are significant at one percent and five percent level respectively.

Table 1 shows the Kendall's Tau correlation coefficients of dependent and independent variables. The study shows that irrigation is positively correlated to sustainable agriculture. It means that increase in irrigation facilities leads to increase in the sustainable agriculture. Similarly, there is a positive relationship exists between climate change adaption and sustainable agriculture. It means that effective climate change adaption leads to increase in sustainable agriculture. Likewise, fertilizers has a positive relationship with sustainable agriculture. It implies that efficient fertilizer leads to increase in sustainable agriculture. Furthermore, there is a positive relationship between soil health and sustainable agriculture. It indicates that improve soil health leads to increase in sustainable agriculture. Moreover, hybrid crops has a positive relationship with sustainable agriculture. It shows that increase in hybrid crops leads to increase in sustainable agriculture.

*Regression analysis*

Having indicated Kendall's Tau correlation coefficients, the regression analysis has been carried out and the results are presented in Table 2. More specifically, it presents the regression results of irrigation, climate change adaptation, fertilizer, soil health and hybrid crops on sustainable agriculture in Nepal.

Table 2

**Estimated regression results of irrigation, climate change adaption, fertilizers, soil health, and hybrid crops on sustainable agriculture in Nepal**

The results are based on 150 observations using linear regression model. The model is CP = $\beta_0 + \beta_1$ (IR) + $\beta_2$ (CC) + $\beta_3$ (FE) + $\beta_4$ (SH) + $\beta_5$ (HC) + e, where the dependent variable is SA (sustainable agriculture). The independent variables are IR (irrigation), CC (climate change adaption), FE (fertilizers), SH (soil health) and HC (hybrid crops).

| Model | Intercept | Regression coefficient of | | | | | Adj. R_bar$^2$ | SEE | F-value |
|---|---|---|---|---|---|---|---|---|---|
| | | IS | CC | FE | SH | HC | | | |
| 1 | 1.330 (5.208)** | 0.587 (7.408)** | | | | | 0.266 | 0.667 | 54.874 |
| 2 | 1.293 (5.083)** | | 0.595 (7.586)** | | | | 0.275 | 0.662 | 57.548 |
| 3 | 1.360 (5.781)** | | | 0.570 (7.929)** | | | 0.293 | 0.654 | 62.872 |
| 4 | 1.312 (6.293)** | | | | 0.597 (9.293)** | | 0.361 | 0.622 | 85.160 |
| 5 | 1.269 (5.578)** | | | | | 0.606 (8.621)** | 0.330 | 0.637 | 74.318 |
| 6 | 0.487 | 0.419 | 0.433 | | | | 0.389 | 0.608 | 48.342 |
| | (1.752) | (5.335)** | (5.547)** | | | | | | |
| 7 | 0.085 | 0.362 | 0.278 | 0.336 | | | 0.463 | 0.570 | 43.769 |
| | (0.310) | (4.855)** | (3.453)** | (4.613)** | | | | | |
| 8 | -0.011 | 0.292 | 0.208 | 0.222 | 0.289 | | 0.512 | 0.543 | 40.095 |
| | (0.041) | (3.983)** | (2.646)** | (2.958)** | (3.972)** | | | | |
| 9 | -0.057 | 0.242 | 0.171 | 0.191 | 0.251 | 0.171 | 0.524 | 0.537 | 33.757 |
| | (0.218) | (3.179)** | (2.140)* | (2.523)** | (3.395)** | (2.125)* | | | |

Notes:

i. Figures in parenthesis are t-values
ii. The asterisk signs (**) and (*) indicate that the results are significant at one percent and five percent level respectively.
iii. Sustainable agriculture is the dependent variable.

Table 2 shows that the beta coefficients for irrigation are positive with sustainable agriculture. It indicates that irrigation has a positive impact on sustainable agriculture. This finding is consistent with the findings Taguta *et al.* (2022). Similarly, the beta coefficients for climate change adaption are positive with sustainable agriculture. It indicates that climate change adaption has a positive impact on sustainable agriculture. This finding is similar to the findings of (Bibi and Rahman, 2023). Likewise, the beta coefficients for fertilizers are positive with sustainable agriculture. It indicates that the fertilizers has a positive impact on sustainable agriculture. This finding is similar to the findings of (Barłog *et al.,* 2022). Further, the beta coefficients for soil health are positive with sustainable agriculture. It indicates that soil health has a positive impact on sustainable agriculture. This finding is similar to the findings of Slavich (2001). Moreover, the beta coefficients for hybrid crops are positive with sustainable agriculture. It indicates that hybrid crops has a positive impact on sustainable agriculture. This finding is similar to the findings of Brookes and Barfoot (2018).

## 4. Summary and conclusion

Sustainable agriculture is an approach to farming that seeks to meet the current food and fiber needs of society while ensuring that the land, water, and other natural resources are conserved for future generations. It emphasizes practices that are environmentally sound, economically viable, and socially responsible. The goal is to create farming systems that can produce food and other agricultural products in a way that maintains the health of the environment and the well-being of farming communities over the long term. Agricultural technology (Agri-tech) plays a crucial role in promoting sustainable agriculture in Nepal by addressing the challenges faced by farmers and the agricultural sector. Nepal, with its diverse topography and climate, faces significant agricultural challenges, including limited access to resources, low productivity, climate change impacts, and a reliance on traditional farming methods. The integration of modern agricultural technologies can help enhance productivity, improve resource management, and make agriculture more resilient and sustainable in Nepal. However, for these technologies to be effectively adopted, there is a need for continued investment in infrastructure, training, financial support, and awareness-raising. With the right policies and support systems, Nepal can leverage agricultural technology to create a more sustainable and prosperous agricultural future.

This study provides insightful information regarding the role of agriculture technology for sustainable agriculture in Nepal. The study analyzes various significant variables that could impact sustainable agriculture in Nepal. These variables include how irrigation, climate change adaption, fertilizers, soil health and hybrid crops influence sustainable agriculture in Nepal.

This study attempts to examine the role of agriculture technology for sustainable agriculture in Nepal. The study is based on primary data with 150 observations.

The major conclusion of the study is that irrigation, climate change adaptation, fertilizer use, soil health, and hybrid crops have a positive impact on sustainable agriculture. The study also concludes that soil health is the most significant factor followed by hybrid crops and fertilizers that affect the role of agriculture technology for sustainable agriculture in Nepal.

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