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# Dimensions of rural web as factors influencing farmer's adoption of sustainable agricultural practices: A review

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**Abstract.** Agriculture is one of the main driving forces of rural development. Ensuring its sustainability in practice will provide economic, social and environmental benefits to the rural area. This will then contribute to sustainable rural development in general. Similarly, the processes of rural development are also the external influences that can facilitate the condition for sustainable practices to be carried out in ease of manner. The purpose of this paper is to analyse the importance of rural development processes as facilitating factors in farmer's decision-making on the adoption of Sustainable Agricultural Practices (SAP). Using the method of Protocol, Search, Appraisal, Synthesis, Analysis and Reporting (PSALSAR), this study has adapted six steps towards conducting a systematic literature review. A total of 50 empirical studies obtained from Scopus database were reviewed to determine the significant factors influencing the adoption of SAP. These factors were then coded into six dimensions of rural development processes which are endogeneity, novelty, market governance, institutional, social capital and sustainability. The finding of this paper has discovered that the institutional dimension contains the most factors influencing SAP adoption, followed up by social capital. The rural development dimension with the least significant factors from the empirical studies reviewed is the novelty dimension. This finding has highlighted the gap in the literature regarding factors influencing adoption. Future research should consider exploring the relationship between farmers' novelty practices with their decisions in adopting SAP.

## 1. Introduction

In many different countries, agriculture is the powerhouse of its economy. Natural resources have a significant role in accommodating agricultural production, and the unsustainable use of these resources will only create future negative impacts. Conventional agriculture has been linked to many environmental concerns and this creates the need for agriculture to be practised sustainably. Besides providing benefits to the conservation of the environment, sustainable agricultural practices (SAP) also significantly reduce household poverty [1]. Sustainably practising agriculture contributes to the well-being of the rural community, it's a means towards obtaining sustainable rural development. SAP is not a new concept, yet the rate of adoption all over the world has not been significantly satisfying.



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The studies of farmers' behaviour on adoption have evolved since its initial findings in the 1980s [2]-[3]-[4] and the robust literature has provided a countless amount of framework in understanding farmer's adoption. The need to understand these influencing factors is crucial to encourage more adoption of sustainable measures. The novelty of this review paper lies in the integration of an idea that rural development processes also play an important role in providing the external conditions that influence farmer's adoption. The purpose of this paper is to analyze the importance of rural development processes as facilitating factors in farmer's decision-making on the adoption of SAP.

## 2. Adoption of sustainable agriculture in the context of rural development

Addressing the environmental problems of intensive agriculture is an important feature of rural development. It is essential to link agriculture production with conservation to plan for the rural areas. Sustainable rural development can be defined as the economic, social and cultural improvement that protects the environment while contributing to the well-being of the rural community [5]. The modernization of agriculture which has resulted in environmental degradation has created an increase of awareness on the importance of conserving natural resources [6]. This has provided the need for sustainable agriculture to be one of the main agendas for rural development.

According to the concept of rural web, sustainable rural development consists of six dimensions of processes. The dimensions are endogeneity, novelty, market governance, institutional, social capital and sustainability [7]. Rural web is a conceptual model that represents the idea that for sustainable rural development to occur, it has to be supported by these six dimensions as its supporting resources. From the perspective of SAP adoption, these six dimensions have the potential of acting as influencing factors. Agricultural practices that are considered sustainable are mostly tailored towards the condition of its farmland. Most SAPs that are commonly practised and easily executed by farmers are conservational practices such as conservation tillage, crop rotation, composting, crop diversification, and intercropping. The different types of SAPs covered in this review are listed out in Table 1 below.

## 3. Materials and methods

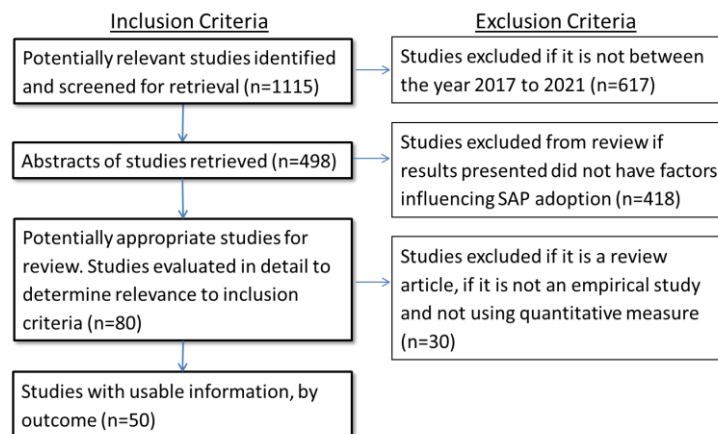
Using the PSALSAR method, this study has adapted six steps towards conducting a systematic literature review [8]. The six steps are protocol (define the research scope), search (define searching string and types of databases), appraisal (pre-defined literature inclusion and exclusion, and quality assessment criteria), synthesis (extract and categorized the data), and analysis (narrate the result and finally reach into conclusion), and reporting results (stating the procedure followed and communicating the result). The Scopus database was used to obtain the empirical studies for this review due to its large database of peer-reviewed literature. The screening process for the abstracts was performed using a tool called Abstrackr. Abstrackr is a system to facilitate screening for systematic reviews [9]. Once the papers were screened to fit the inclusion criteria, Google Scholar was then used as a secondary database to perform citation tracking.

**Table 1.** Overview of selected empirical papers on factors of SAP adoption.

Author(s)	Study Area	Sample Size	Type of SAP	Statistical Model Used
Abdulai et al. [10]	Zambia	408	Crop rotation, cover crops	Factor analytic model
Adnan et al. [11]	Malaysia	74	Green Fertilizer Technology	Structural equation model
Adusumilli and Wang [12]	Unites States	500	Best Management Practices	Probit model
Agholor and Nkosi [13]	South Africa	100	Water Conservation Practices	Logit model
Amare and Simane [14]	Ethiopia	442	Water and Soil Conservation Measures	Logit model
Arunrat et al. [15]	Thailand	661	Irrigation system, crop rotation	Logit model
Aryal et al. [16]	India	1267	Climate Smart Agriculture	Probit model

Badu-Gyan et al. [17]	Ghana	295	Organic farming	Logit model
Bavorová et al. [18]	Russia	110	Reduced tillage practices	Logit model
Branca and Perelli [19]	Ethiopia	2218	Climate Smart Agriculture	Fractional regression
Canales et al. [20]	United States	290	Soil Conservation Practices	Logit model
Debie [21]	Ethiopia	155	Compost and crop rotation	Logit model
Dhehibi et al. [22]	Tunisia	250	Water and Soil Conservation Measures	Logit model
Etsay et al. [23]	Ethiopia	230	Sustainable Land Management	Logit and probit model
Faridi et al. [24]	Iran	538	Water and Soil Conservation Measures	Structural equation model
Han et al. [25]	China	385	Conservation tillage	Logit model
Hou and Hou [26]	China	442	Low-carbon agriculture	Structural equation model
Jabbar et al. [27]	Pakistan	612	Sustainable Intensification Practices	Probit model
Jha et al. [28]	Tanzania	701	Water Conservation Practices	Logit model
Ji et al. [29]	China	266	Conservation tillage	Probit model
Kanyenji et al. [30]	Kenya	334	Soil Carbon Enhancing Practices	Probit model
Karidjo et al. [31]	Niger	149	Soil and Water Control Technology	Logit model
Kotu et al. [32]	Ghana	1284	Sustainable Intensification Practices	Probit model
Kpadonou et al. [33]	Burkina Faso	440	Water and Soil Conservation Measures	Probit model
Kurgat et al. [34]	Kenya	685	Sustainable Intensification Practices	Probit model
Lawin and Tamini [35]	Benin	2800	Agri-environmental practices	Endogenous treatment effects model
Makate et al. [36]	Zimbabwe and Malawi	1173	Climate Smart Agriculture	Regression with inverse probability weighting
Mekuriaw et al. [37]	Ethiopia	269	Water and Soil Conservation Measures	Logit model
Miheretu and Yimer [38]	Ethiopia	176	Sustainable Land Management	Logit model
Muchai et al. [39]	Kenya	291	Zai pit technology	Logit model
Mujeyi et al. [40]	Zimbabwe	386	Climate Smart Agriculture	Logit model
Muriu-Ng'ang'a et al. [41]	Kenya	351	Rain water harvesting	Logit model
Mutua-Mutuku et al. [42]	Kenya	248	Soil Fertility And Water Management	Tobit model
Ndagijimana et al. [43]	Burundi	160	Sustainable Land Management	Logit model
Ng'ang'a et al. [44]	Kenya	45	Sustainable Land Management	Probit model
Nguyen and Nguyen [45]	Vietnam	318	Organic farming	Exploratory factor analysis
Nigussie et al. [46]	Ethiopia	300	Sustainable Land Management	Probit model
Ntshangase et al. [47]	South Africa	185	Conservation Agriculture	Logit model
Olawuyi [48]	Nigeria	350	Conservation Agriculture	Heterogeneous treatment effects model
Paul et al. [49]	Guadeloupe	520	Compost	Logit model
Sileshi et al. [50]	Ethiopia	408	Water and Soil Conservation Measures	Probit model
Suwanmaneepong et al. [51]	Thailand	108	Organic farming	Logit model
Tinh et al. [52]	Vietnam	294	Good Agricultural Practices	Structural equation model
Tran et al. [53]	Vietnam	579	Climate Smart Agriculture	regression model
Tsige et al. [54]	Ethiopia	344	Conservation Agriculture	Logit model
Tu et al. [55]	Vietnam	202	Eco-friendly practices	Logit model
Zakaria et al. [56]	Ghana	300	Climate Smart Agriculture	regression model
Zeng et al. [57]	China	550	Sustainable Agricultural Technologies	Probit model
Zeweld et al. [58]	Ethiopia	350	Sustainable Land Management	Probit model
Zhang et al. [59]	China	924	Eco-friendly practices	Logit model

A total of 50 empirical studies from the year 2017 to 2021 carried out in different countries were included as research materials for this review. The inclusion and exclusion criteria for article screening is explained in detail in Figure 1 below. These studies were reviewed to determine the significant factors influencing SAP adoption. These factors were then coded into six dimensions of rural development processes by using NVivo 12 software. The dimensions of rural development are endogeneity, novelty, market governance, institutional, social capital and sustainability [7].

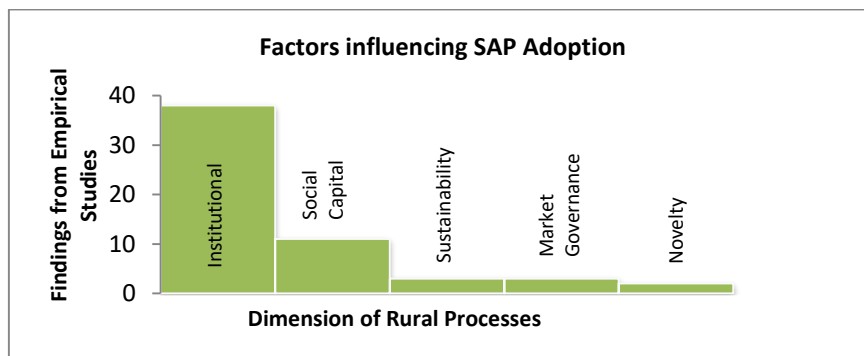


**Figure 1.** Inclusion and exclusion criteria for the article screening process.

#### 4. Factors influencing adoption of SAP

##### 4.1. Institutional and social capital

According to the empirical studies reviewed in this paper, the institutional dimension contains the most factors that influence the adoption of SAP as portrayed in Figure 2 below. The institutional dimension refers to the constellations that solve coordination problems and support cooperation among rural dwellers. Factors in this dimension that influences the adoption of SAP are access to public programs, access to credit and subsidies, frequent extension delivery system, training provided by local institutions, and membership within an agricultural cooperative. Institutional networks play a big role in directly and indirectly spreading the information regarding SAP to farmers. It can be described well through frequent visits from the extension agents, active participation of farmers in organizations, training and workshops, and group membership [10]-[13]-[14]-[18]-[19]-[21]-[22]-[25]-[26]-[37]-[56]. These are highly influential towards technology diffusion as it supports the dissemination of information regarding SAP. As for the dimension of social capital, it refers to the norms and networks which enables people to act collectively for a common purpose. Factors such as active involvement in social networking, involvement in collective action, relationship and communication with other farmers were found to be influential towards the adoption of SAP. This is because connections between farmers in social spheres act as sources of information for farmers to get introduced to practices that are sustainable [14]-[15]-[27]-[28]-[45]-[48]. This is especially useful towards introducing information on sustainable practices that were not familiar to the farmers.



**Figure 2.** Factors influencing SAP adoption according to empirical studies reviewed.

#### 4.2. Sustainability, market governance, endogeneity and novelty

According to the rural web conceptual model, the sustainability dimension refers to the multifunctionality of agriculture. This can be explained through the act of diversifying the income of farmers through practices that go alongside the agricultural produce. Factors such as off-farm income and diversification of activities were found to be influential in farmers' adoption of SAP [31]-[37]-[44]. As for market governance, this dimension refers to the capacity to control and strengthen existing markets. Factors such as market access and market integration were found to be influential towards the adoption of SAP [16]-[32]-[34]. With regards to the endogeneity dimension, it refers to the element of local context that affects rural economic activities. Factors such as the distance of farmland from home and the environmental condition of the farm were found to be influential towards the adoption of SAP among farmers. The environmental condition of the plot of farming land significantly affects adoption as arid or semi-arid agro-ecological zones adopt more climate-smart intense technology packages [19]. As for the novelty dimension, it refers to the re-patterning of resource use and the capacity to make new territorial connections that strengthen the local setting [60]. This dimension seeks to highlight new practices and insights that are carried out on the farm. However, findings from the review of literature have not been exploring the connection between novelty practices with the adoption of SAP. Table 2 below shows the SAP adoption factors found from the empirical studies that can be categorized under dimensions of sustainable rural development.

**Table 2.** SAP adoption factors related to dimensions of rural development.

Dimensions	Related SAP adoption factors
Institutional	Access to public programs, credit and subsidies, frequent extension delivery system, training provided by local institutions, membership within an agricultural cooperative
Social Capital	Active involvement in social networking, involvement in collective action, relationship and communication with other farmers
Sustainability	Off-farm income, diversification of activities
Market Governance	Market access, market integration
Endogeneity	Farm distance from home, environmental condition of farm location

## 5. Conclusions

Based on the finding of this paper, the adoption of sustainable agricultural practices conducted in most literature has proven that the factors mostly can be categorized into the dimensions of sustainable rural development. However, the sustainability, market governance, endogeneity dimensions were least associated with influential factors. Factors related to the novelty dimension were not recorded in any

findings from the reviewed studies. Therefore, the analysis done has highlighted the gap in the literature regarding factors influencing adoption. There is a need to address the connection between these dimensions with farmers' decision to adopt sustainable practices to acquire a comprehensive representation of the whole situation. Future research should consider exploring the relationship of novelty practices and agricultural multifunctionality with the adoption of sustainable agricultural practices.

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