



Quantitative Insights into Extension Advisory Services: Enhancing Rural Livelihoods through Evidence-based Analysis

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Authors' contributions

This work was carried out in collaboration among all authors. Author WT designed the study, performed the statistical and wrote the first draft of the manuscript. Author MND managed the analyses of the study. Authors HDD and CM managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Agricultural extension advisory services (EAS) aim to facilitate development of agriculture and rural sector through transfer of agricultural information and technology. However various literature were published in different forums on various challenges faced by the EAS agents in disseminating effective service to farmer. Hence, this study was taken to evaluate various factors of EAS impacting agriculture development to benefit farming community and for effective policy framing.

Study Design: Exploratory-diagnostic research design was employed in the study.

Place and Duration of Study: Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu. January 2012 to January 2024.

Methodology: A meta-analysis of selected EAS articles from international data base (Scopus) was carried out with an objective to identify the variables explaining EAS and analysing the relationship between the variables for policy making.

Results: On analysing the variables of EAS, four major factors of EAS were identified namely, EAS Purpose, EAS Strategies, EAS Process and EAS Product. The study also revealed that studies focusing on Agricultural and Rural credit were very few, which play a vital role in up scaling of farmers and agricultural sector. The study revealed the need for framing EAS policy for effective facilitation of Agricultural and Rural Credit for the development of agricultural and rural sector.

Conclusion: The study found that while the EAS process included agricultural and rural credit support, its focus was primarily on transferring agricultural information. However, the progress of the agricultural sector relies heavily on farmers' financial capacity to address modern challenges. Integrating EAS with improved credit access could help overcome barriers to scaling up agricultural and rural development. This underscores the need for policies that align EAS with credit facilitation to promote long-term sustainability for farmers.

Keywords: Agriculture and rural credit; EAS; literature review; meta-analysis.

1. INTRODUCTION

Today Extension Advisory Services (EAS) are regarded from a broad systems standpoint that focuses on an individual and organizational level to address the current challenges (Sulaiman & Devis, 2012). While in various countries, governments use extension system to meet national goals (van den Ban & Hawkins, 1996), other private sector and NGOs also perform a critical role in providing services. 'Agricultural Extension' services are provided for the farming community and rural people with the aim to facilitate easy access to knowledge and information that is needed to enhance their productivity and sustainability of their production systems and improve their livelihoods. The service is not limited to the transfer of knowledge generated by agricultural research but it has moved towards meeting the food security, conserving natural resources and developing human capacity and social capital in a country (NRI, 2014). Hence, Christoplos (2010) and GFRAS (2011) have defined Extension Advisory Services (EAS) as encompassing all activities that offers information and services to farmers and other stakeholders in the rural areas. There services aim to assist them in enhancing their

technical, organizational and managerial abilities and practices, ultimately leading to improved well-being. Agricultural extension and advisory services are crucial promoting technological, institutional, and socio-economic progress in numerous developing nations (Davis et al., 2016; Saravanan et al., 2018). It can be considered as vital tool in helping farmers to engage in development by changing the environment (Hoffman et al., 2009).

However when it comes to accessing quality extension and advisory services, Glendenning et al. (2010) observed that smallholders in many developing countries remain disadvantaged and women faced even greater challenges in accessing these services (FAO, 1995; Manfre et al., 2013). Spielman et al. (2012) observed that many EAS systems operate at a sub-par level due to inefficiencies, lack of capability of EAS agent, a poor enabling environment and an insufficient number of providers.

Despite the challenges faced in EAS throughout the country extension services have to be provided consistently (World Bank and IFPRI, 2010) for small holder and marginal farmers who produce approximately 80 per cent of the food in

many countries. EAS provide farmers with knowledge and link them to new technology that can be a powerful tool to help small and marginal farmers break the cycle of low productivity, vulnerability and poverty. EAS can be a critical force for change by providing them greater access to finance and market solutions (Kristin & Steven, 2018). Therefore the need to obtain efficiency of EAS becomes crucial for the advancement of farm and rural community in a continuous process at the individual, socio-economic and livelihood entity level and it can be achieved with detailed analysis on of all available literature related to agricultural extension advisory services and comprehend the trend to augment better policy decision.

It was noted that, very few studies were found on quantitative analysis of literature on EAS. Considering the above point in view, the present study was designed to review the literature on EAS in agriculture and highlight the findings through meta-analysis. The research objective was to conduct quantitative analysis of extension advisory services literature with the aim to (i) identify the variables explaining EAS in agriculture and (ii) analyse the relationship between those variables for policy making.

2. MATERIALS AND METHODS

The study was conducted during May 2023 to identify available literature in the Scopus database from January 2012 to January 2024. The following steps were followed:

1. An analysis of the present context of EAS
2. Identification of area of interest
3. Establishing level of analysis
4. Selection of articles on phases
5. Grouping of concepts based on theme
6. Coding of the identified analysis groups
7. Data analysis

The literature on extension advisory services were reviewed and meta-analysed to get an overview of the present scenario of the EAS in agriculture.

2.1 Meta-analysis

Glass (1976) coined the term Meta-analysis, which refers to the statistical analysis of outcomes obtained from individual readings, from large collection of literature in internet base for the purpose of assimilating the findings. Meta-analysis approach consists of an organized

application of an ensemble criteria defined by researcher, for classifying, computing and analysing the material content (Gurevitch et al., 2018). It is a quantitative, formal, sociological study design used to scientifically weigh the results of previous research and derive inferences on body of the research. This statistical tool is used to combine the multiple scientific studies with the objective for exploration and draw research implications. Meta-analysis also has the capacity to remove human error i.e. sampling error, errors of measurement and range of variation and thereafter cumulates the results across studies. Typically, but not necessarily, the study is based on randomized, controlled trials and may include a more precise estimate of the variables or constructs, than any individual study contributing to the pooled analysis. Hence, meta-analysis is referred as the central method for knowledge accumulation in different scientific fields (Aguinis et al., 2011; Kepes et al., 2013).

Therefore, Meta-analysis was opted for this study to identify the sources of variation in EAS and generalizability of variables to obtain effective identification or modification of EAS. The significance of this research is given by the possibility of correlating independent results obtained from the analysed studies. The data was processed using *IBM SPSS software functions –version 26* for factor analysis and Multiple Corresponding Analysis (MCA) was performed by subjecting the variables to the library 'Factoshiny' to generate MCA biplot using RStudio (v4.1.1).

2.2 Selection of Online Database

The international database 'Scopus' was purposively selected. Key words 'extension', 'advisory', 'services', 'agriculture' and 'assess' were considered in different combination in the 'advance search' field for reference identification.

To select the articles from the area of interest of research, one of the international Representative databases i.e. Scopus was chosen. Literature from January 2012 to January 2024 was accumulated and analysed to understand the EAS system in the country to get better insight for policy implication.

i) Selecting the areas of interest

Subject areas were chosen from each database, as shown in Table 1, which binds

directly or indirectly to our research question (assessment of extension advisory services) were analysed thoroughly for literature search.

Table 1. Selected areas of interest

Sl.no.	Areas of interest
1	Agriculture and Biological Sciences
2	Social Sciences
3	Environmental Sciences
4	Economics, Econometrics and Finance
5	Decision Sciences

2.3 Establishing Level of Analysis

After identifying the relevant areas of interest keyword was defined for determining the targeted articles and applied for the “abstract, title, key words” in the search criteria shown in Table 2.

At this stage, type of interested publication was chosen and the period of analysis was between the years January 2012 to January 2024 which resulted in 521 articles structure as shown in Table 3.

Table 2. Defining the structure of search criteria

Sl.no.	Scopus
1	‘Extension’ and
2	‘Advisory’ and
3	‘Services’ and
4	‘Agriculture’
5	(‘measure’ or ‘evaluate’ or ‘assess’ or ‘study’)

Table 3. The type of document available

Sl.no.	Type of document	No. of document
1	Article	399
2	Book chapter	44
3	Conference paper	41
4	Review paper	23
5	Note	6
6	Editorial	4
7	Book	2
8	Short summary	2
Total		521

2.4 Identification and Selection of References

By following the steps as shown in Table 4, references were identified and selected for the research study:

Table 4. Article selection for reference

Phase	Items	No. of articles displayed	No. of articles rejected	No. of articles selected for next step
Phase-I Identification	Total articles displayed	521	For further criteria applied	521
Phase-II screening	Articles in open access	182	339 were rejected from 521	182
	Articles considered with research criteria	161	21 were rejected from 182	161
Phase-III	Articles excluded by title	138	23 were rejected from 161	138
	Articles excluded by year (below 2012 were rejected)	132	6 were rejected from 161	132
Excluding Criteria	Articles not written in English	129	3 were rejected from 132	129
	Rejected by document type	114	15 were rejected from 129	114
	Rejected by publication stage	110	4 were rejected from 114	110
	Excluded by abstract	56	54 were rejected from 110	56
	Excluded by full paper	50	Out of 56, 50 were considered for the research	50

A total of 50 articles were selected for final study in analysing the concepts related to EAS in agriculture.

3. RESULTS AND DISCUSSION

The analysis performed was aimed at identifying the key concepts, measuring their frequency and the relations between them and obtaining results that can be generalized, regarding the extension advisory services. In this section the steps that have been taken to achieve the meta-analysis of studies in the field and the main results are detailed.

3.1 Distribution of EAS Articles Based on Countries

Bibliographic network analysis was drawn using VOSviewer (www.vosviewer.com). The nodes in Fig. 1 indicate the countries where articles on EAS is mostly found and the distance between the nodes approximately indicates the relatedness of nodes. Therefore it can be seen from Fig. 1 that most research on EAS was carried out in the United States and United

Kingdom. There has been scarcity of research in India.

3.2 Distribution of EAS Articles based on Journals

From the Fig. 2 it can be seen that EAS and its related articles were mostly distributed in Journal of Agricultural Education which is published by Taylor and Francis (United Kingdom) and Agricultural Extension Reforms of South Asia.

3.3 Identification of Variables Explaining Extension Advisory Services and Coding

During this stage the groups were established using key phrase describing in the concepts as listed in Table 5. The content of the articles were analysed and coded based on grounded theory.

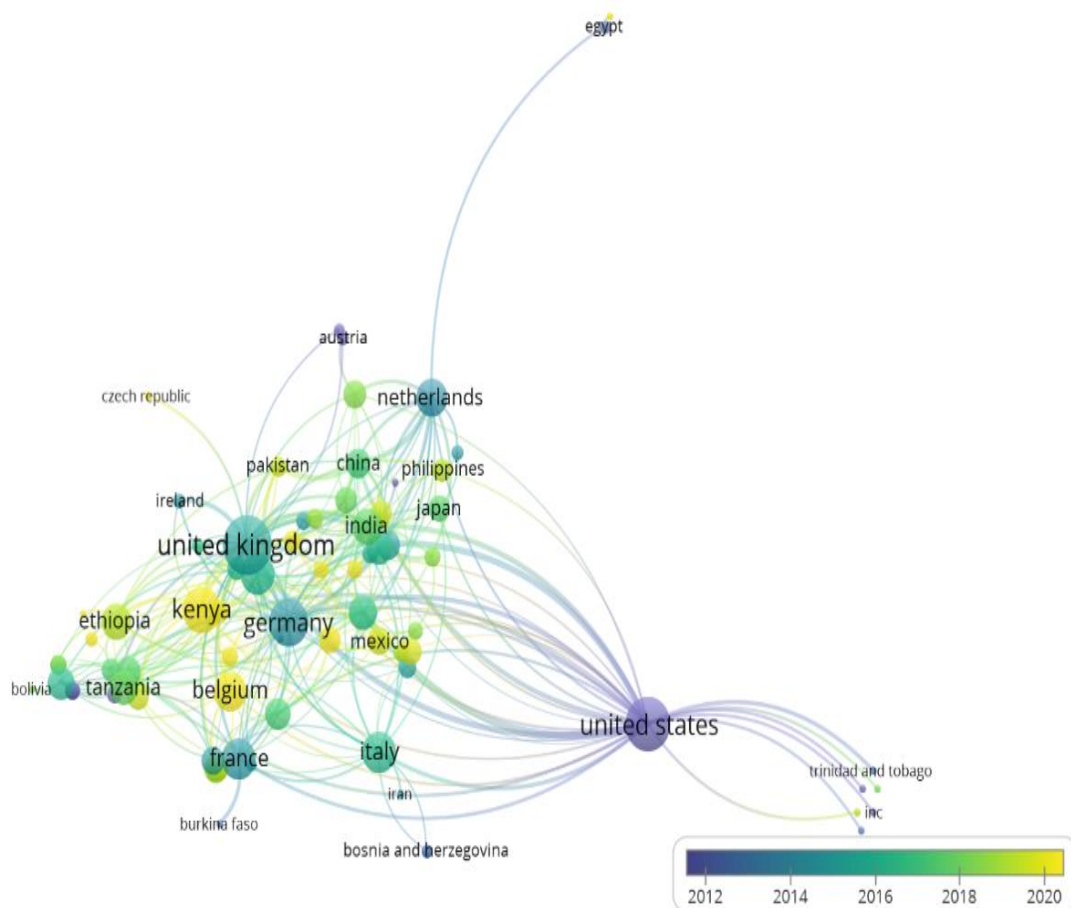


Fig. 1. EAS article distribution based on countries

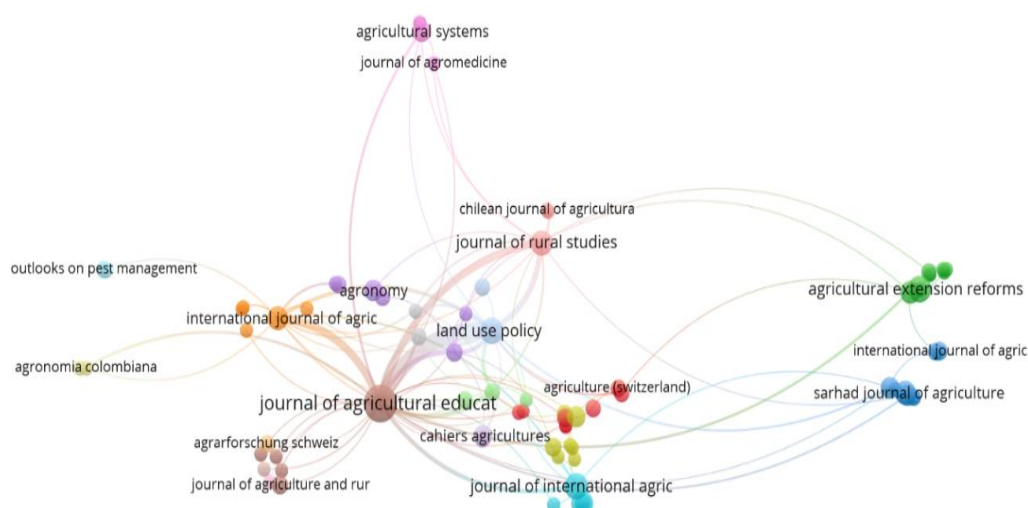


Fig. 2. EAS article distribution based on journals

Table 5. Analysis of groups

Group	Symbol	Group details
EAS Purpose	EP	The prime objective for EAS in agriculture.
EAS Strategies	EPs	Approach taken for extension advisory services.
EAS Process	EPc	Services in agriculture that can be regarded as process.
EAS Product	EPr	Services that build skills and brings behavioural changes or regarded as product.

Table 6. Coding of groups and key concepts

Group	Sl.No.	Main concepts	Code	No. of articles in which the concepts has been found (%)
EAS Purpose	1	Technology Transfer	EP 1	24 (48)
	2	Livelihood Development	EP 2	28 (56)
	3	Gender Sensitization	EP 3	15 (30)
	4	Climate Smart Agriculture	EP 4	19 (38)
	5	Entrepreneurship development	EP 5	23 (46)
EAS Strategies	6	Information and Communication Technology (ICT)	EPs 6	31 (62)
	7	Pluralistic Extension	EPs 7	25 (50)
	8	Digital Extension	EPs 8	26 (52)
EAS Process	9	Agricultural Information	EPc 9	28 (56)
	10	Capacity Development	EPc 10	19 (38)
	11	Rural Credit	EPc 11	18 (36)
EAS Product	12	Vocational Training	EPr 12	31 (62)
	13	Agricultural Innovation System	EPr 13	24 (48)
	14	Demonstration	EPr 14	21(42)

Thus a total of 14 sub-groups (concepts) were identified and grouped under four main groups (construct) as shown in Table 6. Now the concept of EAS can be viewed in 14 dimensions. All the concepts were coded using number 1 to 14 (Table 6).

3.4 Frequency and Percentage Analysis of the Key Concepts

The frequency and percentage analysis of literature on EAS according to key concepts were identified and tabulated in Table 6 for further

analysis. It is to be mentioned that there were more than one purpose or evaluation indicator present in each given article. From Table 6, it is clear that EAS had more focus on its purpose followed by Strategies, Product and Process.

Analysis of literature revealed that main purpose of EAS was on livelihood development (56.00%), followed by Technology Transfer (48.00%), Entrepreneurship Development (46.00%), Climate Smart Agriculture (38.00%) and Gender Sensitization (30.00%). The purpose of EAS has shifted and evolved with time as it is related to changes in development objectives which involves in achieving national food security, improving rural livelihood and maintaining natural resources (Abou, 2015).

Majority of the researchers have discussed on the strategies of EAS in their study where 62 per cent of the literature on EAS focused on ICT (Information and Communication Technology), this may be because ICT has and had the highest potential to disseminate agricultural related information quickly and cheaply that enables the farming stakeholders to strengthen resilience (Davis & Alex, 2020). ICT was followed by Digital development (52.00%) in agriculture sector and Pluralistic extension (50.00%) among all the agricultural and allied sector stakeholders.

As per the analysis of literature review, it is clear that 23 per cent of research articles focused on product of EAS in agriculture sector which provide Vocational Training (62.00%), Agricultural Innovation System (48.00%), and Demonstration (42.00%) among farming community that empowers one to self-sustain.

While in the areas such as Process of EAS, Capacity Development and Rural Credit concepts were studied only in 30 and 36 per cent of the article respectively.

3.5 Relationship between Qualitative Variables

Relationship between the variables was performed using Multiple Correspondence Analysis (MCA) in RStudio (v4.1.1). MCA gives the relationship between the coded variables and with each of the variables at different levels in the given dimensions, which is based on the factorial axes, the point contributing to the axis creation and the correlation point with an axis (Moschidis et al., 2022). The result of MCA is represented visually and analytically in dimension 1 and

dimension 2 (Fig. 3). Collective contribution of identified variables are represented in dimension 1 (20.74%) and dimension 2 (12.92%), which brings in total identified variables contributes in 33.66 per cent to the study. The distance between the variables dimension shows the relationship between the major variables (Clausen, 1998). Therefore this method aims to explore the associations and provide detail information on relationship among the variables. In order to ensure the reliability of MCA, it is desirable for the set point of Cronbach's alpha reliability coefficient to be close to 1. Researchers generally consider value of 0.7 or above to indicate sufficient consistency in the test (Hajjar, 2018 and Cronbach, 1951). Cronbach's alpha coefficient value is 0.780 for dimension 1 (Table 7), which indicates that the chosen scale is relevant and consistent.

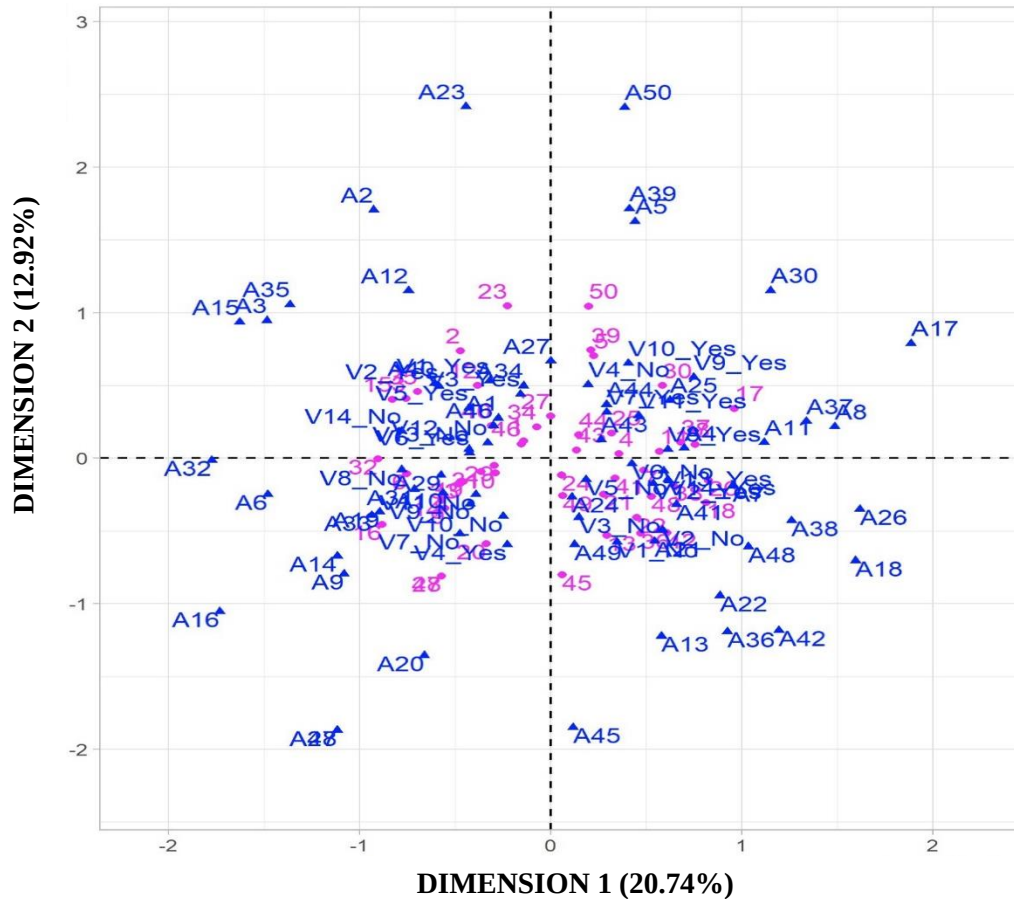
In the given MCA biplot (Fig. 3) the articles selected (50) for research study are represented by A1 to A50 in the plot and variables are represented as V1 to V14. V1to V14 represents the selected variables of EAS in agriculture from literature, where, V1= Digital Extension, V2= Pluralistic Extension, V3= Technology Transfer, V4= Agricultural Information System, V5= Gender sensitization, V6= Information and Communication Technology (ICT), V7=Vocational Training, V8=Agricultural Information, V8= Rural Credit, V10=Capacity Development, V11=Entrepreneurship Development, V12= Climate Smart Agriculture, V13= Demonstration and V14= Livelihood Development. It is visible from Fig. 3 that the one factorial axis explains 20.74 per cent of the variance and second factorial axis explains 12.92 per cent of the variance indicating there is not much difference, hence together two factorial axes explains 33.67 per cent of the total variance. The plot above shows the global pattern and relation within the data.

It can be further inferred from Fig. 4 that Agricultural Information (V8) and Vocational Training (V7) is highly correlated ($r=0.50^{***}$). Agricultural Extension Advisory Services involved the dissemination of knowledge, information, improved technology, and practices to farmers and farmer groups through training sessions and vocational trainings (Christoplos, 2010). Pluralistic Extension (V2) and ICT (V6) were also positively correlated ($r=0.40^{**}$), as both the variables aim to disseminate agricultural technology to the end user by decentralizing the decision-making structure involving all the

Table 7. Model summary of MCA

Dimension	Cronbach's Alpha	Variance accounted for		
		Total (Eigen value)	Inertia	% of Variance
1	0.780	4.658	0.207	20.744
2	0.465	2.337	0.129	12.927
Total		6.995	0.336	
Mean	0.645 ^a	3.497	0.271	16.835

a. Mean Cronbach's Alpha value is based on the mean Eigen Value


Fig. 3. CA Biplot

stakeholders (Abou, 2015). Rural Credit (V9) was also found to be positively correlated ($r=0.30^*$) with Capacity Development (V10), which can be supported by Satyasai & Tiwari (2021) where they proved that rural credit plays critical role in technology adoption and capacity building among the farming community. Meanwhile ICT (V6) was found to be negatively correlated with Demonstration (V13). This could be attributed to the increasing recognition of digital utilization in agricultural technology and information, which has led to a decline in traditional demonstrations of technological functioning. More emphasis is given for the digital transfer of information that

may include both audio and visual information services.

3.6 Limitation of the Present Study

The findings of this study was aimed to provide cognitive knowledge on existing EAS and identify gap in research studies taken in the field of EAS for agricultural and rural sector, Therefore the empirical study was not taken into consideration. The study also aimed to enhance policy framing of EAS by analysing the present scenario of EAS in securing the livelihood of farm population and rural sector rather than instinctively dealing with empirical data for EAS policy framing.

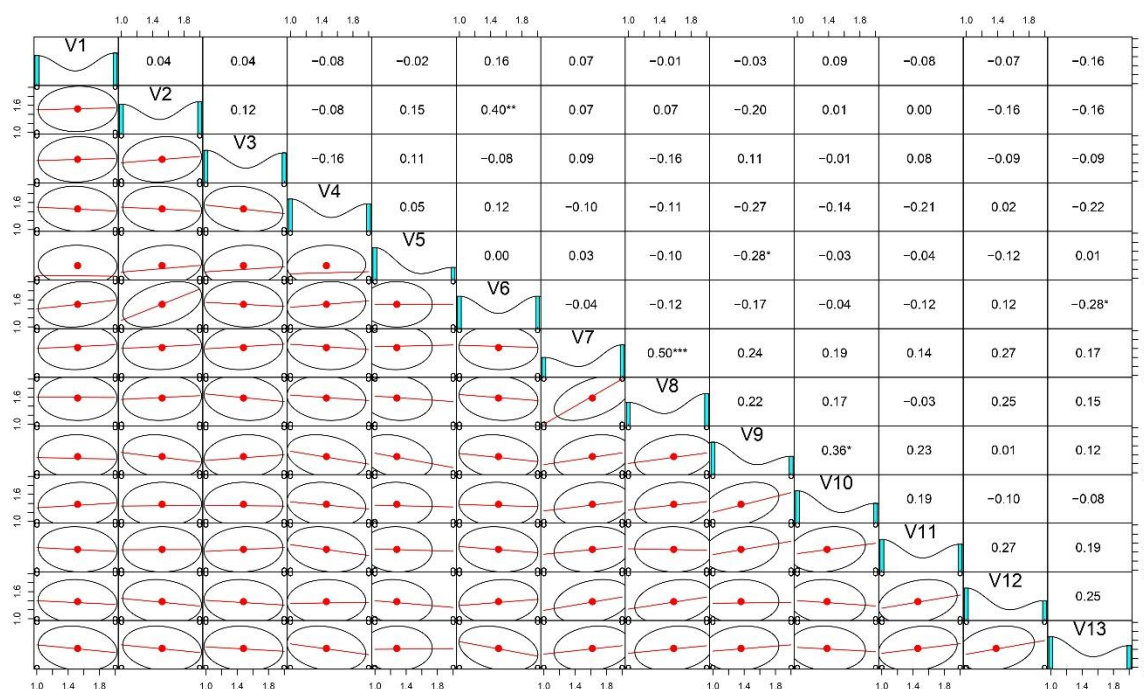


Fig. 4. Correlation between the identified variables

4. CONCLUSION

With the changing scenario in agricultural and allied sector analysis of EAS becomes essential. Therefore this paper involved exploratory conceptual analysis by using Meta-analysis statistical tool to provide basic understanding of evolving EAS in agricultural sectors and to conduct future research for better policy framing. The study proved that EAS had focused most on its strategy building that included pluralistic approach, ICT and digital approaches. The purpose of EAS has also been found to be upgraded along with changing dimensions of agricultural and allied sector. However to increase the farm income and to improve rural livelihoods, Agricultural Extension Systems are shifting their attention to the broader goal of improving rural livelihoods in nation. To achieve this goal, National Extension Advisory Service System need to enhance the technical, management, and marketing domains in all the identified dimensions of EAS from purpose, process, product and strategies for development of agricultural and allied sector.

The study revealed that although EAS process included agricultural and rural credit support to achieve the identified purposes in different dimensions of agricultural sectors, it was

observed that more emphasis was given in transfer of agricultural information only. However Mujumdar (2001) reported that advancement of agriculture sector is highly dependent on financial capacity of farmers to mitigate and adapt to the modern challenges faced today. This can be achieved by effective implementation of EAS that facilitates agricultural and rural credit to the farming community. For instance, Makate et al. (2019) observed that institutional credit and EAS are vital for transforming agriculture and rural sector. Simultaneous intervention of credit access and EAS can reduce the challenges faced in scaling up of agriculture and rural sector. Ajayi et al. (2018) also favoured and highlighted that weak EAS system in the field of agricultural and rural credit facilitation and weak policy implementation immensely hampers the scaling of agricultural technology adoption and development. Therefore it can be implied that integration of EAS with agricultural and rural credit for agricultural and rural development becomes essential (Anderson & Feder, 2007).

The study indicates that there is a weak integration between Extension Advisory Services (EAS) and agricultural rural credit facilitation. This highlights the need for policy development that could combine EAS with credit access in

agricultural and rural development to help farmers achieve long term sustainability.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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