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STUDY ON FARMERS' PERCEPTION ON CLIMATE CHANGE: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

Climate change and its impacts are being felt around the world. Farmer perception tends to influence their coping and adaptation strategies. This review aimed to examine the contributions of studies on farmer perceptions to climate change through a systematically review of the scientific literature. The search strategy was adapted to the Scopus database using the search terms "Farmers' perception" AND "climate change." The selection criteria were based on the Preferred Reporting Items for Systematic Review and Meta-analyses approach. The review was conducted based on 48 peer-reviewed articles, selected after evaluating each article against inclusion and exclusion criteria. Key findings from the data showed that participants were aware of the climate's changing in 81.25% of the articles reviewed. The review results also identified limitations highlighting the gaps in the existing literature regarding the aims and scope of the journals and the methods used in the articles.

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INTRODUCTION

Climate change refers to any change in climate over time, whether due to natural variability and/or as a result of human activity (IPCC, 2007). Climate change is a constraint to development, especially among smallholder farmers whose livelihoods depend on rain-fed agriculture (Tanner and Mitchell, 2009).

Climate change and its impacts are being felt all over the world. The overall temperature has been increasing; rainfall has become erratic; rising sea levels and extreme weather events have become more frequent and intense. Frequent droughts with longer periods and floods become hurdles for development success. Extreme weather events, which are both causes and consequently the reflection of climate change, induce an enormous adverse effect on populations worldwide (van der Geest *et al.*, 2018). According to Odewumi (2013), farmers' perception tends to influence their coping and

adaptation strategies, which ultimately determine the extent to which climate impacts agriculture.

There is growing evidence that extreme events, such as drought and floods, have been common occurrences, and these affect small-scale farmers in developing countries, who depend heavily on rainfed agriculture for their livelihoods (Belay *et al.*, 2017).

A study by Jacobi *et al.* (2013) indicated that small-scale farmers are affected by the negative impacts of global climate change, and that livelihood. Based on small-scale agriculture tend to be highly vulnerable to climate change as these farmers have limited coping options. A better understanding of farmers' concerns and the way how they perceive climate change is crucial and will assist in equipping farmers to take the correct adaptive measures (Ayanlade *et al.*, 2017). Perception significantly affects how farmers deal with climate-induced risks and opportunities (Debela *et al.*, 2015).

There are several studies have been done on farmers' perception of climate change adaptation strategies (Mahdi *et al.*, 2021; Akhtar *et al.*, 2019; Kais and Islam, 2019; Kunene, 2019; Mkonda *et al.*, 2018; Alam *et al.*, 2017) using different methodologies, approaches, theories, and conceptual frameworks. More evidence on the influence of farmers' perception of climate change is urgently needed for governments and donor organizations to identify effective interventions to achieve the correct coping and adaptation strategies, ultimately determining the extent to which climate impacts agriculture. Here we explore the contributions of studies on farmers' perception of climate change by systematically reviewing the scientific literature on the farmers' perception of climate change on small-scale producers in Africa and Asia. More specifically, we reviewed 48 papers to elicit the importance of farmers' perception to adapt to the impacts of climate change both in agricultural production and in their daily lives. The literature screening and eligibility criteria were found in detail in the Methodology section.

Research Gaps

There is a long tradition of scholarly work on adaptation strategies to climate change and a small but emerging body of systematic literature review on the influences of farmers' perception on adaptation to climate change (Fierros-González and López-Feldman, 2021; Madhuri and Sharma, 2020). Most of the researches done on adaptation strategies of climate change targeted primarily on scientific conceptualizations and empirical work concerning to natural influences, However, little attention has been given to the influence of farmers' choices and the cascading impacts on climate change adaptations. This review aims to explore the contributions of studies on farmers' perception of climate change by systematically reviewing the scientific literature. Any intervention that promotes the use of adaptation measures to climate change may account for location-specific factors that determine farmers' perception of climate change and adaptive responses thereof (Asrat and Simane, 2018). We first present a methodological approach for studying farmers' perception of climate change.

MATERIALS AND METHODS

We adopted a systematic literature review method to probe into existing scholarly articles on farmers

perception and climate change following our study purpose. The advantage of a systematic literature review is that it provides transparent and explicit protocols by which researchers search for and assess the field of studies relevant to a specific research topic; it has been widely used in environmental and climate change (Fierros-González and López-Feldman, 2021; Menghistu *et al.*, 2020; Yates *et al.*, 2021).

We have defined our method of systematic literature review with the following criteria in order to define our search boundaries as a protocol of the search strategy, as shown in Figure 1.

Research Approach and Design

The methodology of this research was based on a systematic literature review (SLR). SLR method was primarily used in medical studies (Cabassa *et al.*, 2017). To enhance theoretical and methodological inflexibilities while enforcing practical. Tranfield *et al.* (2003) initiated this method in managerial studies. SLR aids in compiling very inclusive empirical research that was based on multiple published literature (Tranfield *et al.*, 2003; Massaro *et al.*, 2016; Kraus *et al.*, 2020). In this regard, the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) principle has been used (Moher *et al.*, 2015).

Furthermore, the SLR method fulfills the purpose of providing a deeper understanding of research questions through an extensive collection of databases of peer-reviewed articles.

Search strategy

We developed a search strategy to identify relevant literature for this systematic search. This search strategy was tailored to the Scopus database using the search terms: "Farmers' perception" AND "climate change." All searches spanned from database inception until 2021 and included journal articles published in English only. As a result, a total of 523 papers were identified.

Selection criteria

The selection criteria were based on the PRISMA statement (Moher *et al.*, 2009). The search mainly focused on mapping existing literature on the farmers' perception and climate change in agriculture, environment, and psychology. All open access, Gold, Hybrid Gold, Bronze, and green types were included regarding the type of paper. As a result, about 287

papers were excluded (n=236). The search span was from the year 2010 to 2021. Four articles before 2010 were excluded from the search (n=232). The search then narrowed to the subject areas of environmental science, social science, agricultural and biological science, multidisciplinary, and psychology fields. These criteria excluded around 12 papers, and 220 papers were selected. Only the final published papers were included in the study. The search was mainly focused on papers from Africa and Asia. Thus, 34 articles from other countries were excluded. The following exclusion criterion limited the papers published in the English language only. At this stage, 475 research articles were excluded, and 48 records were extracted.

Quality Assessment

The study is based only on original research articles. For maintaining the quality of the review, all duplications were checked thoroughly. The abstracts of the articles were checked deeply to analyze and purify the articles to ensure the quality and relevance of academic literature included in the review process.

A careful evaluation of each research paper was carried out at a later stage. Furthermore, no additional articles were removed from the study after checking all the records. We selected 48 articles after assessing each article on the inclusion as mentioned above and exclusion criteria. Figure 1 shows the literature inclusion and exclusion at every stage.

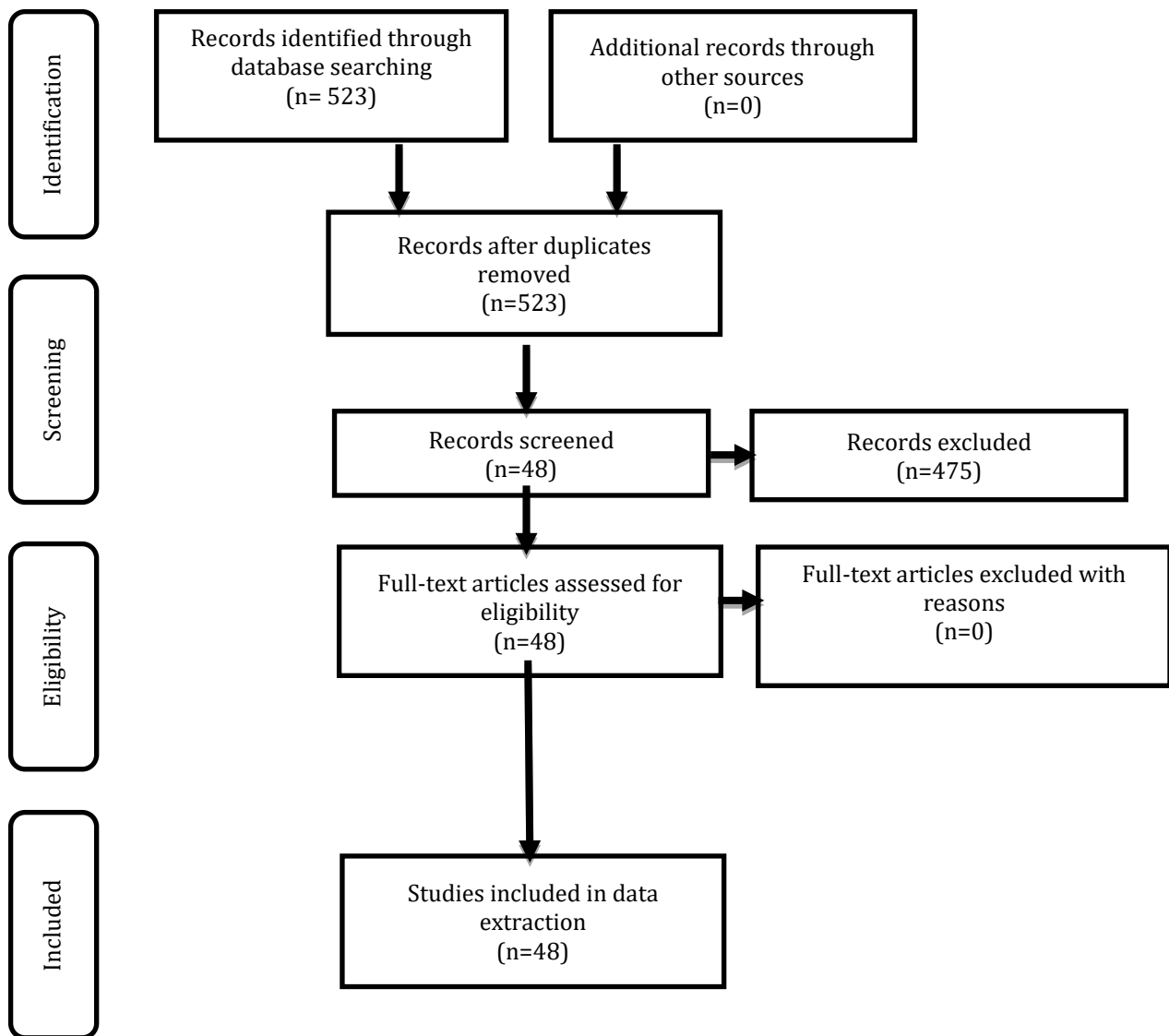


Figure 1. PRISMA flow diagram.

Data extraction

In the data extraction phase, 48 articles were selected and the characteristics extracted were:

1. Articles must be original papers. Published case studies.
2. The article must be in English language and from environmental science, social sciences, Agricultural and Biological science, Decision science, and Multidisciplinary fields.
3. Extracted articles are published between 2010 to 2021
4. The extracted papers were from Africa and Asia only.

RESULTS

Descriptive Analysis

The research was based on 48 peer-reviewed articles from the Scopus database. Scopus is Elsevier's database of abstract and citations launched in 2004. Scopus covers nearly 36,377 titles (22,794 active titles and 13,583 inactive titles) from approximately 11,678

publishers, including 34,346 peer-reviewed journals in first-level disciplinary fields: life sciences, social sciences, physical sciences and health sciences. It covers three types of sources: series of books, journals, and specialized journals. All journals covered by the Scopus database are reviewed annually for sufficiently high quality according to four types of digital measurement of each title; these are h-Index, CiteScore, SJR (SCImago Journal Rank) and SNIP (Source Normalized Impact per Paper). Searches in Scopus also incorporate searches of patent databases (Kulkarni et al., 2009).

Frequency of publications per year

A Majority (91%) of papers were published from 2017 to 2021 (Figure 2). The search span was for about 12 years, ranging from 2010 to 2021. However, there was no document published from 2010 up to 2013 regarding farmers' perception of climate change. The least number of papers were published in 2012 and from 2014 to 2016.

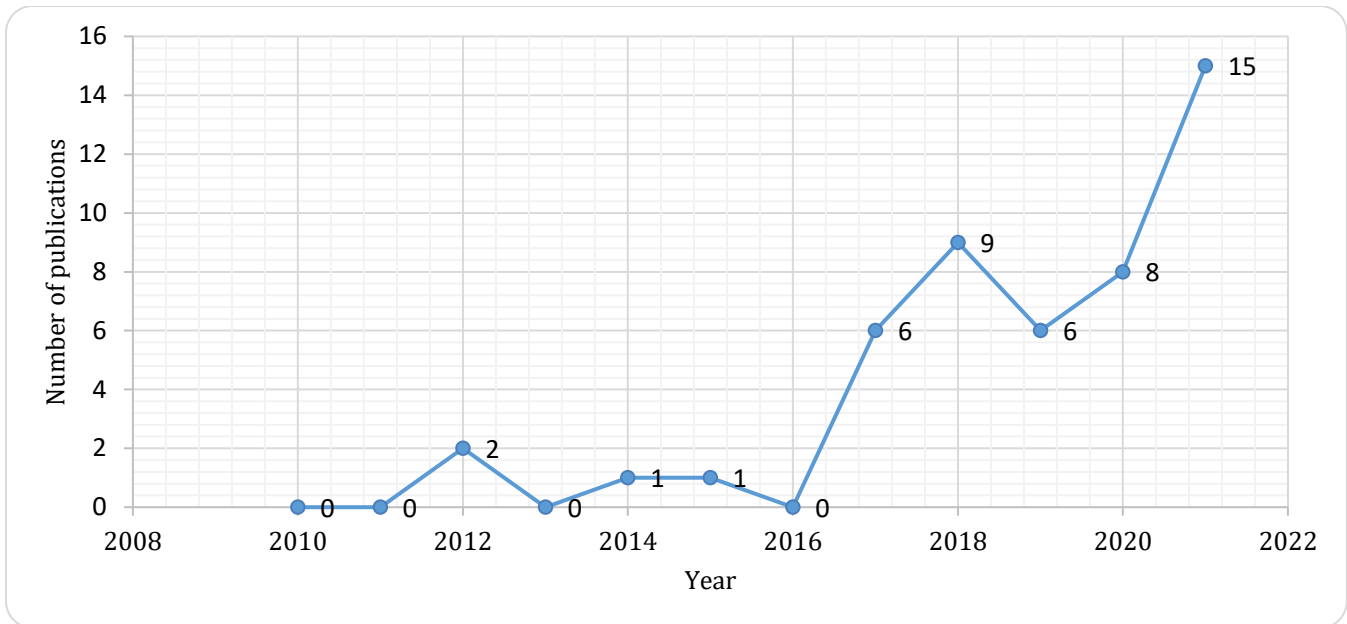


Figure 1. Year and number of publications in Scopus database.

Journal by Number of Papers Published

Totally 25 journals were used to extract documents in the database. However, almost 40% of papers were extracted only from three journals: International Journal of Climate Change Strategies and Management, Climate Risk Management, and Climatic Change. For detailed information, see Figure 3.

Publications by Region

The database coverage of this review focus on publications from African and Asian countries only. This is because climate change is expected to affect the livelihood of rural farmers in Africa and Asia, particularly the smallholder farmers, due to their overwhelming dependence on rain-fed agriculture.

Fourteen countries from Africa and six countries from Asia were included in this review process. On the other

hand, 33 (69%) of publications from Africa and 15 (31%) of publications from Asia were identified.

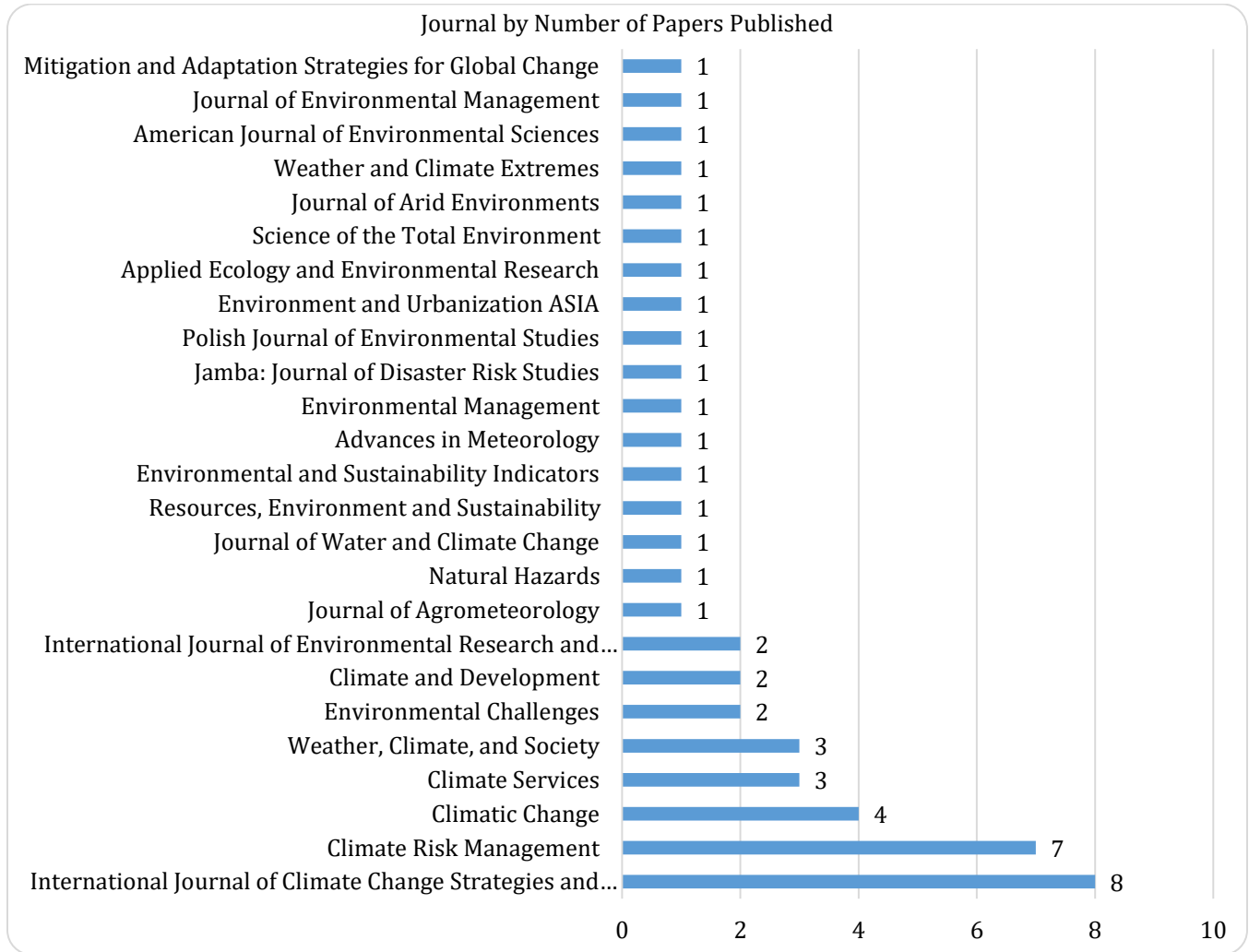


Figure 3. Journals by number of papers published.

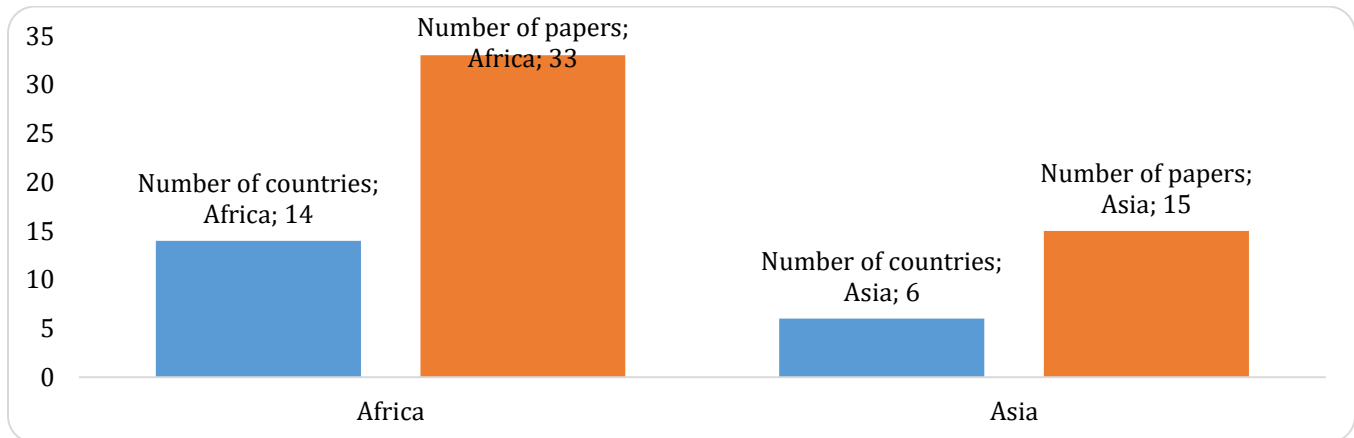


Figure 2. Publications by Region.

Among the African countries, most of the publications were from Ethiopia, and India is the first publishing

country from Asia in the area of farmers' perception of climate change.

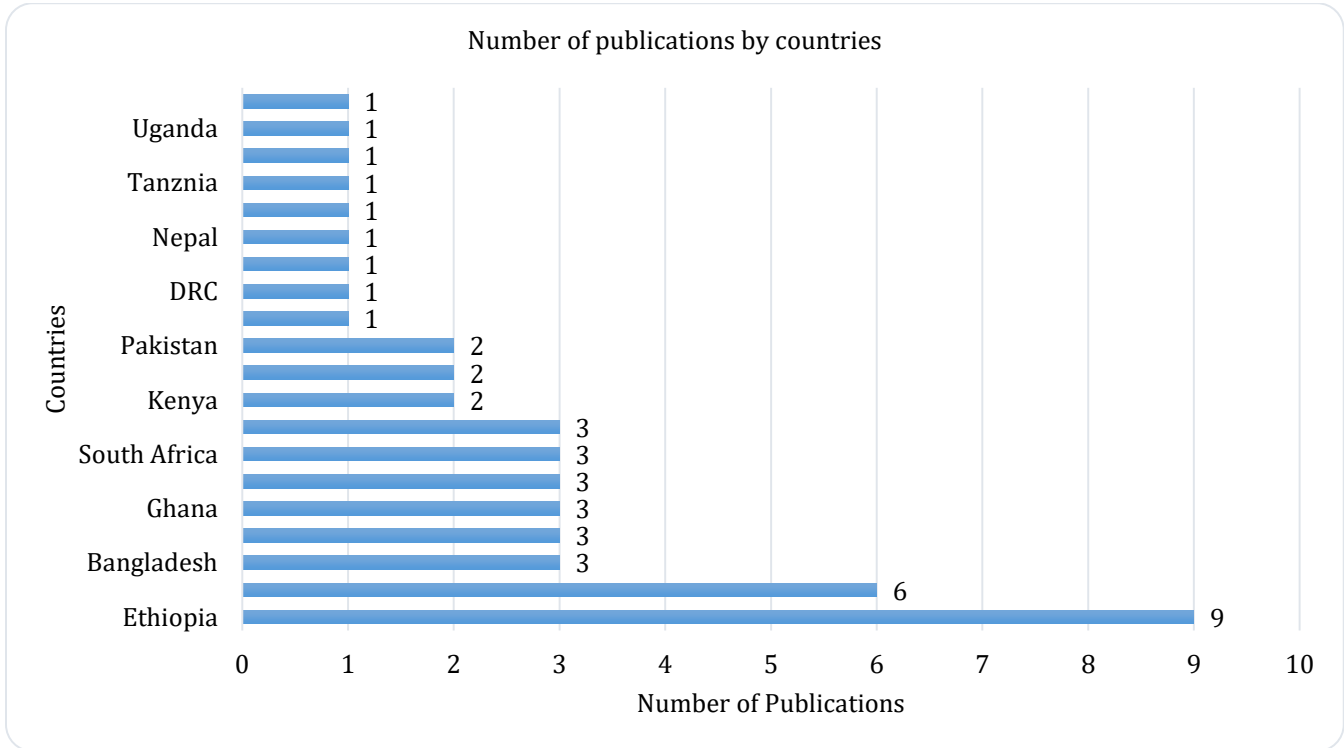


Figure 3. Publications by Country.

Publication by Subject Area

The search span covers five subject areas: Environmental science, Social science, Agricultural and biological science, Multidisciplinary, and Psychology fields. However, publications were identified in three

subject areas only. The highest (60%) is by Environmental science, which is around 29 papers, the second subject area covering 29%, is Multidisciplinary with 14 papers, and Agricultural and biological science subject area cover 11% or five papers.

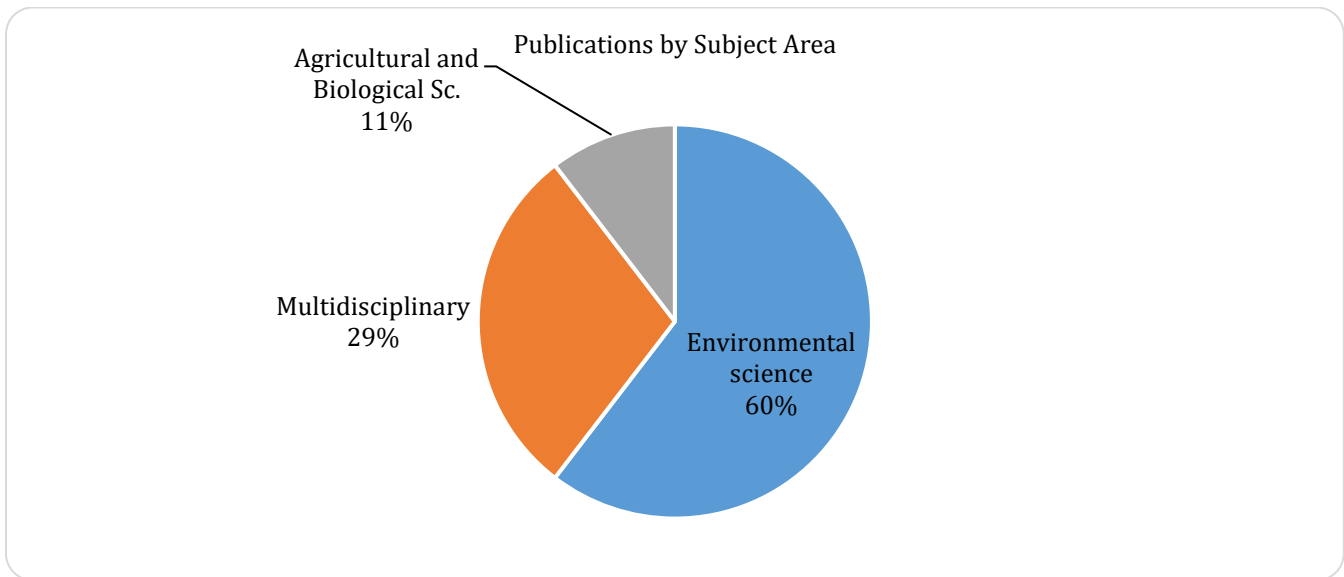


Figure 4. Publications by Subject Area.

Most Cited Title of Article and Journal

Out of the total 48 articles, 43 titles were cited from 1-131 times, and the rest five titles were not cited in any journals. For minimalism, we presented here the top 11 titles only. Accordingly, the most cited paper title was

published in 2017 in the Journal of Agrometeorology and cited 131 times. The second most cited paper was published in 2017 in Environmental Challenges and cited 120 times (Table 1).

Table 1. Most Cited Title of Article and Journal.

Year	Article Title	Number of Cited by	Journal
2017	Climate change perceptions and local adaptation strategies of hazard-prone rural households in Bangladesh	131	Journal of Agrometeorology
2017	Farmer's perception of climate change and responsive strategies in three selected provinces of South Africa	120	Environmental Challenges
2017	Knowledge and passive adaptation to climate change: An example from Indian farmers	95	Natural Hazards
2017	Comparing smallholder farmers' perception of climate change with meteorological data: A case study from southwestern Nigeria	79	Journal of Water and Climate Change
2012	Climate variability and change or multiple stressors? Farmer perceptions regarding threats to livelihoods in Zimbabwe and Zambia	61	Resources, Environment and Sustainability
2014	Sources of vulnerability to a variable and changing climate among smallholder households in Zimbabwe: A participatory analysis	47	Environmental Challenges
2017	Farmers' perceptions of climate variability and its adverse impacts on crop and livestock production in Ethiopia	44	Climate Services
2018	Rainfall variability and drought characteristics in two agro-climatic zones: An assessment of climate change challenges in Africa	43	Environmental and Sustainability Indicators
2018	Migration as adaptation strategy to cope with climate change: A study of farmers' migration in rural India	38	Climate Services
2019	Climate change perception: an analysis of climate change and risk perceptions among farmer types of Indian Western Himalayas	28	International Journal of Climate Change Strategies and Management
2018	Climate trends, risks and coping strategies in smallholder farming systems in Uganda	27	International Journal of Climate Change Strategies and Management

Regarding the number of citations by journals, Climate Risk Management, Weather and Climate Extremes, International Journal of Climate Change Strategies and Management are the first three journals where the highest number of publications were cited in.

Literature Classification

In this section, searched literature was classified mainly in the methodology used, types of statistical analysis used, and farmers' perception of climate change.

Methodology Used

The literature checked whether it is a quantitative, qualitative, or mixed in methodology. Quantitative analysis is known to be a deductive research methodology. Usually, researchers use this type of data analysis to find out the relationship between the independent and dependent variables.

The Qualitative method is also one of the methods that usually has been used in collecting data for research. Qualitative is primarily used as a data-gathering

technique (such as an interview) or data analysis method to categorize data that produces or uses non-numerical data (Saunders *et al.*, 2009).

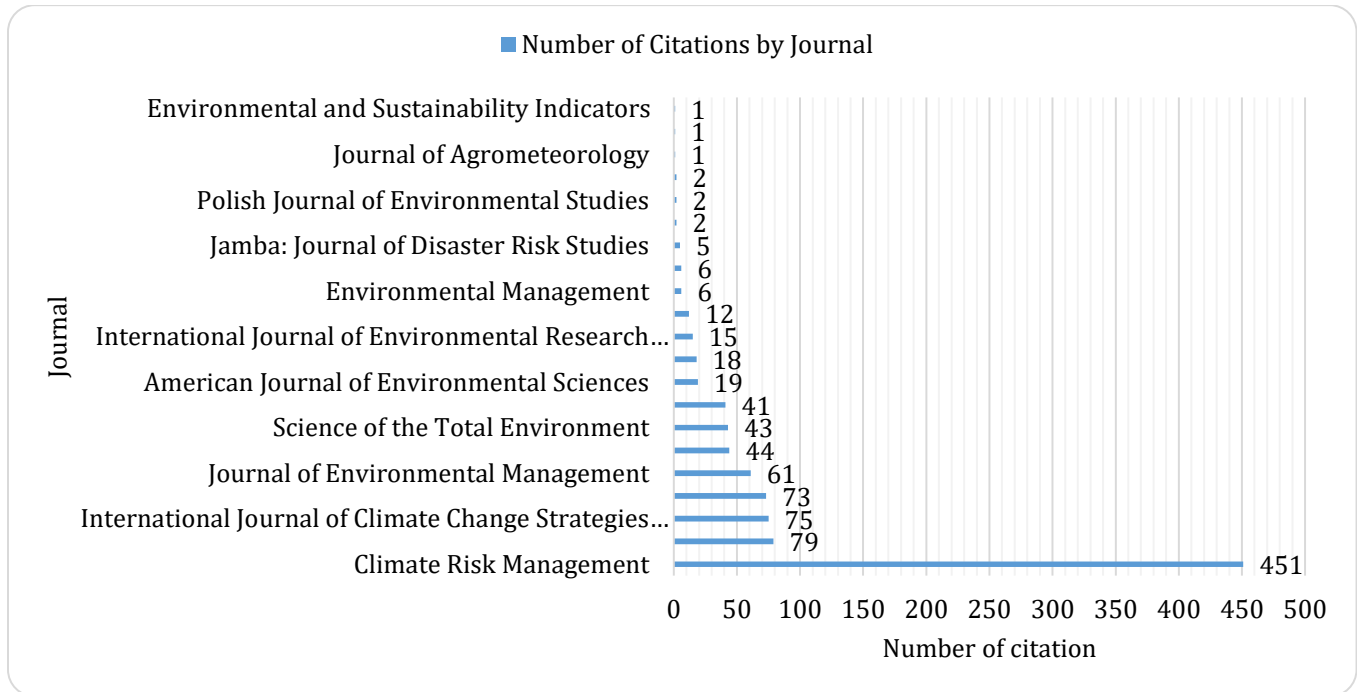


Figure 5. Number of Citation by Journals.

Some types of mixed methods found in this research are the combination of survey questionnaire with in-depth interview questions, survey questionnaire with semi-structured questions, and lastly, survey questionnaire with interviews. The Mixed method can be described as a combination of both research methods, quantitative and qualitative, where the research from basic, simultaneous patterns towards more complex and sequential forms (Saunders *et al.*, 2009). Simultaneously,

a mixed methodology study integrates multi-methods research, quantitative and qualitative data analysis techniques, and procedures.

In this review process, we found that 4 (8%) papers were used quantitative methodologies, 19 (40%) papers were used qualitative methodology, and 25 (52%) papers were used a mixed approach, which is both quantitative and qualitative approaches (See figure 8 below).

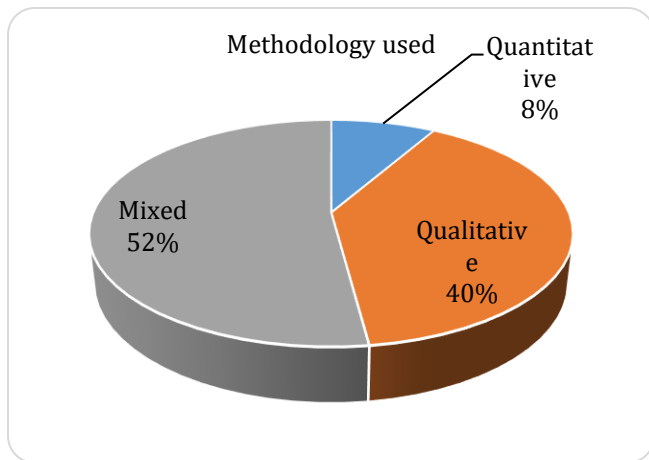


Figure 6. Methodology Used.

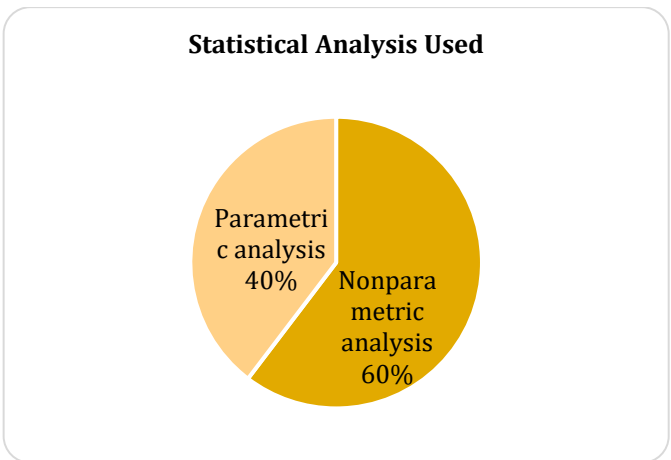


Figure 9: Statistical Analysis Used.

By Statistical Analysis Used

Parametric tests make assumptions about the parameters of the population distribution from which the sample is drawn. This is often the assumption that population data is normally distributed. Nonparametric tests are “distribution-free” and as such can be used for

non-Normal variables. In this review, 60% of papers were analyzed in nonparametric tests, while 40% were analyzed in parametric tests. There were 18 different nonparametric techniques of analysis employed. The majority of papers were used the Mann-Kendall trend test, Climate trend analysis, and Sen’s slope estimator.

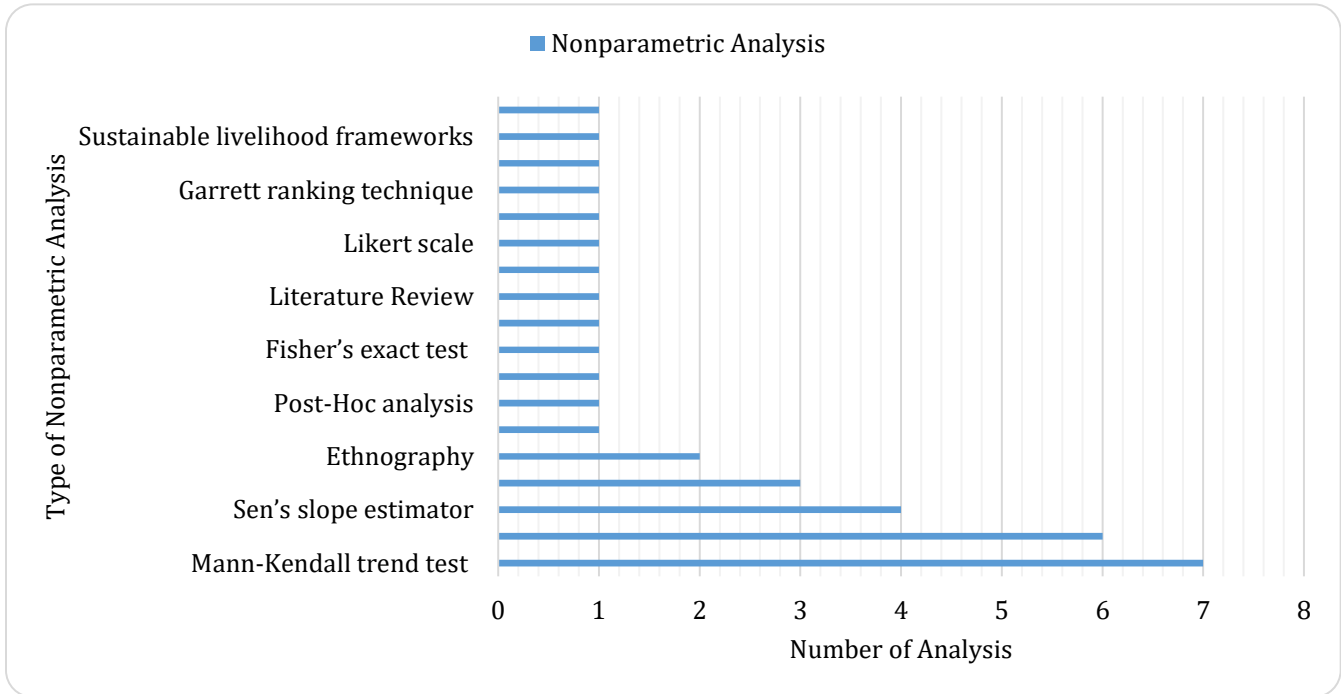


Figure 7. Types of Nonparametric Analysis.

Among the parametric test analysis, Multivariate analysis, Multinomial Logistic Regression (MNL), Linear

Regression (LR), Binary Logistic Regression (BLR), and ANOVA are the most used types of tests.

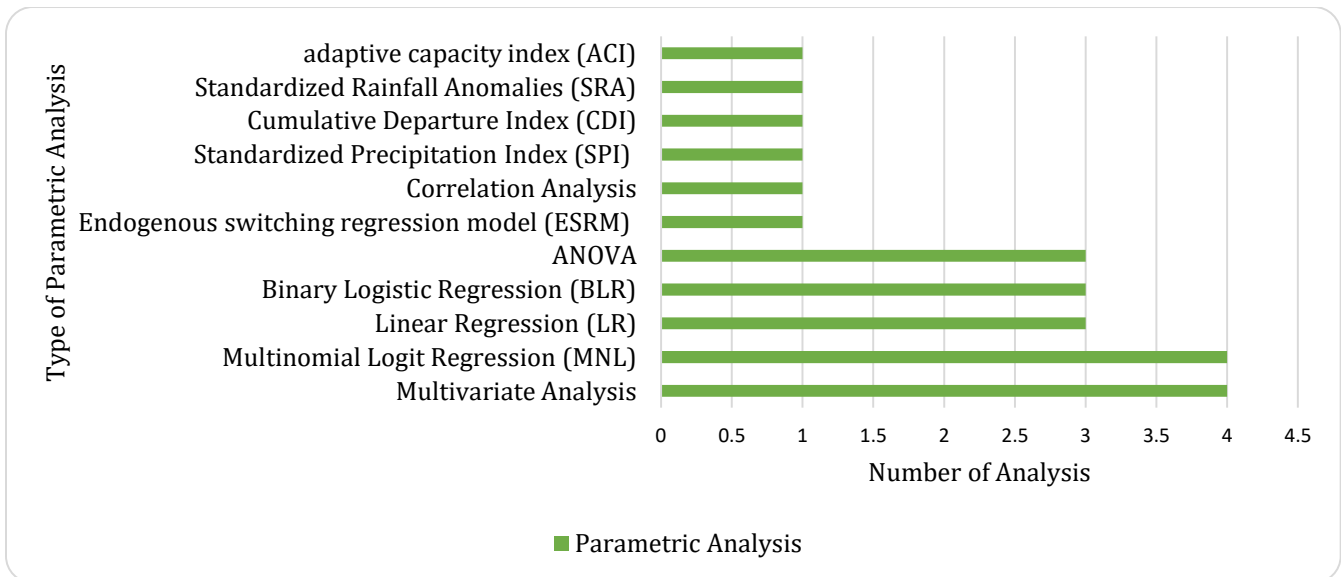


Figure 8. Types of Parametric Analysis.

Perception of farmers on climate change

Except for those publications where full texts were not found (9 papers), in all of the publications reviewed (39 papers), participants of the study were aware of the changing climate change (mainly rainfall and temperature) in one way or the other. They also adopted different adaptation and mitigation measures depending on their location and type of farming activities to

counter its ill effects of climate change. Adaptation to climate change which initially requires farmers’ perception that climate is changing prior to responding to the changes through adaptation measures (Asrat and Simane, 2018). Therefore, perception of climate change is an important precondition for individual adaptation responses, including farm-level adaptation (Bryan *et al.*, 2009; Gbetibouo *et al.*, 2010)

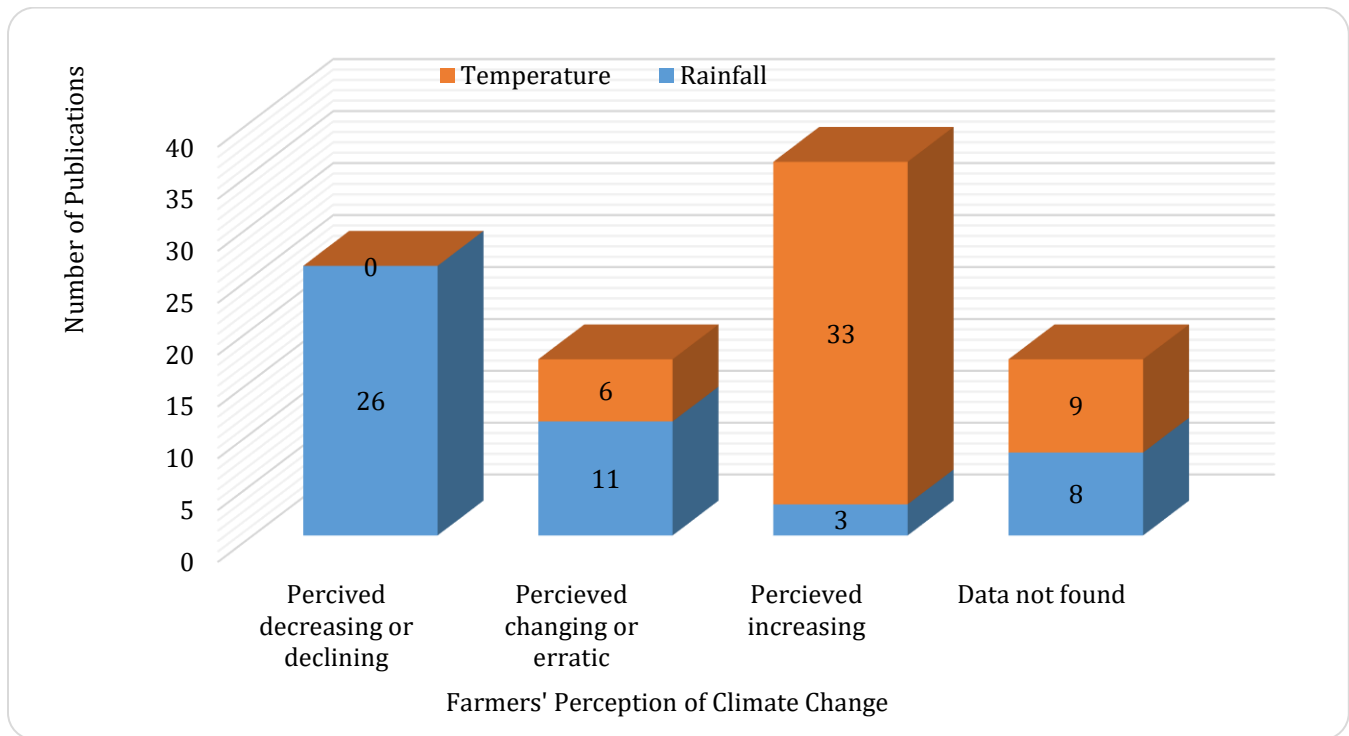


Figure 9. Farmers’ Perception of Climate change.

DISCUSSION

Research papers on farmers' perception of climate change were limited, but since 2017 it has been getting the attention of researchers. However, when it is compared to other topics of studies, it still needs consideration, particularly in Africa and Asia.

Even though some of journals have been dedicated to publishing climate associated topics. However, the review shows that, 40% of papers have been extracted only from three journals. Therefore, journals have to encourage researchers to submit topics like farmers’ perception concerning climate change. International Journal of Climate Change Strategies and Management is among the well-known open Access journals published by Emerald in Scopus from 2009 to present. Climate Risk Management journal is likewise an open

access and has coverage in Scopus since 2014 to present and published by Elsevier. Climatic Change journal is published by Springer Nature from 1977 to 2021.

The systematic literature review indicates that only a few journals publish articles on farmers’ perception of climate change. Therefore, some journals must revise their thematic areas or aims and scopes to accept more manuscripts focusing on environmental contents in general and farmers’ perception of climate change particularly. In the Scopus database, relatively to African countries, there are few Asian countries engaged in studying the topic of farmers’ perception towards climate change and adaptation strategies. This shows that, researchers in Asia need to focus on topics like farmers’ perception of climate change. Due to the

very nature of the topic, quantitative methodologies have been visible as insufficient in the papers reviewed. Most of the papers have been used qualitative and mixed approaches. The low number of citations is probably because of this case. Qualitative researchers emphasize the socially constructed nature of reality, the intimate relationship among the researcher and what's being studied and the situational constraints that shape the inquiry. Such researchers emphasize the value-laden nature of the inquiry. They are seeking for solutions to questions that stress how social experience is created and given meaning. Therefore, journals have to encourage qualitative studies as well.

CONCLUSION

The outcomes of the review discovered that study participants in 81.25% of the papers reviewed have been aware about the climate change in one way or the other. The review outcomes additionally recognized the limitations revealing the gaps in the existing journals concerning the aims and scopes of journals and methodologies used in the articles. Therefore, some journals must revise their thematic areas or aims and scopes to accept more manuscripts focusing on environmental contents in general and farmers' perception of climate change particularly.

We attempted to summarize the recommendations forwarded through the papers in to seven classes and accordingly, 33.3% of papers suggest the provision of regular and credible climate information and relevant adaptation strategies to the farmers; provision of climate-smart training; and improve smallholder farmers' access to agricultural extension services. Secondly, 31.3% of papers propose to take in to account the local or traditional farmers perceptions and knowledge to develop effective climate change adaptation strategies; and additionally advocate to consider the inclusion of indigenous people in the decision-making process. On the contrary, 6.3% of papers indicated the bad aspect of farmers perceptions that farmers may be negatively impacted the coping and adaption strategies through their religious beliefs and traditional norms and wrong perceptions about climate change. In the fourth class, 10.4% of articles have been encouraged the provision of financial support, supply of inputs and insurance to farmers to

address the present-day situation of climate change. In the fifth class, 6.3% of papers recognized the significance of incorporating gender perspectives into climate change interventions. On the other hand, 2.1% paper advises the necessity of a broader study on verifying farmer perceptions using historical climatic data across the country. Lastly, 10.4% of papers suggest different alternatives as a solution to manage up the impact of climate change.

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