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THE USE OF Q-METHODOLOGY IN EXPLORING FARMERS' PERSPECTIVES IN THE CONTEXT OF CLIMATE CHANGE

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Abstract: This paper aimed to examine the literature to determine the extent to which Q-methodology has been employed in empirical studies in order to measure farmers' perspectives in various contexts of climate change. The analysis revealed a surprisingly limited application of Q-methodology in this area. A search of the SCOPUS database, using the advanced search string TITLE-ABS-KEY ("Q-method*" OR "Q-sort*" OR "Q-stud*" OR "Q-technique" AND "farmer*" OR "agricultur*" AND "clima*"), identified 21 published articles that met the specified criteria. All these papers were published over the last decade, indicating an upward trend in the number of publications over the years. The analysis of these studies demonstrates that Q-methodology can be effectively applied in research aimed at uncovering and comprehending farmers' perceptions regarding climate change mitigation and adaptation to its risks. Despite its evident potential, this method remains underutilized and merits greater attention from scholars and practitioners. To the best of the authors' knowledge, no such review has been conducted previously. Hence, this paper makes a substantial contribution and serves as both an incentive and a valuable starting point for researchers considering the use of Q-methodology in empirical studies concerning farmers' subjectivity in the context of climate change.

Key words: Q-methodology, farmers, climate change, scoping review.

Introduction

The interplay between climate change and agriculture has spurred scientific interest in examining the subjectivity of farmers, as their decisions and implemented practices can impact climate change outcomes. To investigate this subjectivity, researchers employ various approaches and employ a wide array of methods, instruments, and scales. One of these methods is the Q-methodology, which is both a qualitative and statistical protocol (Seghezzo et al., 2023). This methodology facilitates the exploration of many different views and attitudes of

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individuals. Through factor analysis, the Q-methodology enables the identification of existing perspectives on specific topics, exploring individual subjectivity and offering insights into the behavior of these individuals and how they perceive their social and environmental environments (Barry and Proops, 1999). Particularly, Q-methodology seeks to reveal common understandings and shared worldviews, particularly regarding topics that are the subject to debate and contestation (Eden et al., 2005).

The Q-methodology categorizes participants into groups based on similar value orientations, using written statements or photographs. The process of Q-sorting and subsequent interviews allows for the analysis of individual beliefs, interests, and attitudes, ultimately revealing distinct value systems and perspectives on a given topic (Cheng et al., 2019). Unlike surveys, where researchers create statements for respondents to evaluate, the Q-methodology relies on statements originating from the participants themselves. These statements may stem from a variety of sources, including prior interviews, media, information campaigns, governmental and non-governmental organizations, and public documents. Consequently, Q-methodology captures the existing perspectives and worldviews of diverse individuals within specific contexts (Western et al., 2017). This approach allows respondents to define their own attitudes rather than categorizing the statements produced by the researcher (Bumbudsanpharoke et al., 2009). All of the above components constitute what Western et al. (2017) defined as "a pattern of subjective views held by a certain group of people". These views include central ideas, meanings, attributes, and compromises related to a particular topic. Even though it employs complex mathematical (factor) analysis, the Q-methodology is essentially a research tool that does not demand mathematical expertise to interpret the results, which makes it an exceptionally accessible method (Shemmings, 2006). Moreover, the process of sorting statements in Q-methodology is intriguing and resembles a card game, which fosters an interactive and engaging approach to involving research subjects (Eden et al., 2005). This interactive element contributes to a higher response rate (Davies and Hodge, 2007). Additionally, Q-methodology is very cost-effective as it requires modest sample sizes (Barry and Proops, 1999).

The primary criticisms of the Q-methodology center on its reliability (some authors suggest that respondents may not provide consistent answers in repeated surveys) and potential researcher bias when interpreting the results (Cross, 2005). Advocates of the Q-methodology counter these criticisms by claiming that, like other measurement scales, it relies on the honesty and cooperation of respondents, which are not and cannot be guaranteed. Moreover, the bias of the researcher in interpreting the results is not unique to this method but can be encountered in other research approaches as well.

While certain limitations of the Q-methodology cannot be ignored, it is a method applied across diverse research contexts, fields, and with various

participant groups (Western et al., 2017; Peters and Fontaine, 2020). Being qualitative in nature and centred on subjectivity, the Q-methodology finds its most extensive application in the social sciences (Mathur and Skelcher, 2007). However, it has been employed in numerous studies comprising various domains, including medical and health sciences (Baker et al., 2006), engineering (Niemeyer et al., 2005), the IT sector (Hazari, 2005), business and management (Angelopulo, 2009), psychology (Shemmings, 2006), arts (Thumvichit, 2022), mathematics (Nahm et al., 2002), as well as agriculture and related biological sciences (Brodt et al., 2006).

The success of using the Q-methodology is directly related to the interest of the participants. Therefore, the selection of participants is of particular importance in this method. Previous research included various participants, such as different professionals, experts in specific fields, political decision-makers, scientists, students, children, parents, and others (Dziopa and Ahern, 2011).

Recently, the Q-methodology has seen growing utilization in the field of agriculture. It is no longer limited solely to exploring the perspectives of farmers (Zobeidi et al., 2016; Norris et al., 2021; Mataruse et al., 2022; Reichenspurner et al., 2023). Instead, it has been employed to study the attitudes of advisors (Schulze and Matzdorf, 2023), policymakers in agribusiness (Turhan, 2016; Cruz et al., 2021), landowners (Carmenta et al., 2017), members of governmental and non-governmental organizations (Hall and Wreford, 2012; Rittelmeyer, 2020; Adams and Carodenuto, 2023), members of agricultural and local associations (Armatas et al., 2017), local managers (Carmenta et al., 2017), researchers, experts in various fields (Kopytko and Pruneddu, 2018; Steeves and Filqueira, 2019; Hinzmann et al., 2021), and other relevant actors.

Q-methodology proves highly effective in measuring subjectivity within diverse contexts, including the realm of climate change. This topic is becoming increasingly important for research, and the results derived from such measurements may be of significant societal importance.

According to Xiao and Watson (2019), advancing knowledge relies on a comprehensive understanding of existing achievements. Therefore, before embarking on new research, a literature review of prior scientific publications is necessary. To the best of the authors' knowledge, there is no stand-alone overview of the scientific literature focused on the application of Q-methodology to farmers, particularly within the context of climate change. Therefore, this paper sets out to provide such an overview, which will serve as a cornerstone for academic research.

An overview of the relevant literature serves as a means to understand the existing knowledge, assess the quality and validity of prior research, and reveal certain weaknesses, inconsistencies, and contradictions (Paré et al., 2015). Furthermore, it allows for identifying research gaps, exploring new research directions, testing specific research hypotheses, and/or developing new theories. A literature review should be valid, reliable, and reproducible (Xiao and Watson,

2019). To meet these criteria, it must be conducted systematically. In this paper, a systematic review is defined as "a review of a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyze data from the studies that are included in the review" (Moher et al., 2009).

Literature reviews can be categorized into four distinct types, depending on whether their objective is describing, testing, extending, or critisizing a body of existing literature (Xiao and Watson, 2019). Given that the primary aim of this study is to describe the application of the Q-methodology in empirical studies for measuring farmers' subjectivity in various climate change contexts, a scoping review is employed. This type of review should provide a comprehensive overview of what has been accomplished in a specific area by extracting relevant data from each piece of the literature. A scoping review does not seek to extend the existing literature, but rather offers an overview of the state of the literature at the time when the review was published (Xiao and Watson, 2019). Such an approach does not diminish its value, especially considering the growing multidisciplinarity of research and the (hyper) production of scientific work, which can lengthen and complicate the reviewing process. The primary advantage of a scoping literature review lies in its comprehensiveness and its independence from the type of literature sources (quantitative, qualitative, etc.). Its key contributions include providing an overview of the scope of the research field, highlighting conceptual limitations, summarizing existing achievements, presenting various types of scientific evidence, and identifying research gaps (Munn et al., 2018; Xiao and Watson, 2019). However, a notable disadvantage of this type of review is neglecting the quality of the papers included in the review (Peters et al., 2015).

Previous literature reviews have explored various applications of Q-methodology in different domains. For instance, Dziopa and Ahern (2011) and Churruca et al. (2021) have analyzed its use in health sciences, while Zabala et al. (2018) delved into its application in conservation biology. In the field of education, Lundberg et al. (2020) have provided an overview, and Sneegas et al. (2021) have focused on its application in environmental sustainability, among others. However, as previously noted, there is no comprehensive review of studies employing Q-methodology among farmers in the context of climate change in the available literature. This article aims to address this gap by providing a review of existing publications. Our goal is to find out whether there are enough studies to justify a future systematic review and to identify future research avenues.

The structure of this article is as follows: The subsequent section outlines the methodology employed in this study. The obtained results are then presented and discussed, featuring a brief analysis of each of the papers included in this review. The final section draws conclusions, highlights the main limitations of the study and makes recommendations for future research.

Material and Methods

We conducted a scoping review of the literature following the instructions outlined in PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) (Tricco et al., 2018). This approach is recommended for writing review papers of this type (McGowan et al., 2020; Pollock et al., 2021). PRISMA-ScR, like other PRISMA extensions, was developed in response to the need to adapt the PRISMA guidelines (Moher et al., 2009) to accommodate the growing output of review papers across diverse topic areas that employ different methods (McGowan et al., 2020). This guideline offers three unique advantages: 1) it insists on the formulation of clear research questions, 2) it identifies criteria for the inclusion/exclusion of specific publications from the review, and 3) it aims to explore large bodies of scientific literature within a limited timeframe (Sierra-Correa and Cantera Kintz, 2015).

We conducted the literature search using the Scopus database, the largest and most widely used repository of peer-reviewed scientific publications (de Moya-Anegón et al., 2007; Aghaei Chadegani et al., 2013). While databases such as Web of Science, PubMed, Google Scholar, Science Direct, MEDLINE, CINAHL, JSTOR, and various others are used to access scientific publications in specific scientific fields, comparative analyses have shown the advantages of the Scopus database. Scopus offers a more extensive collection of scientific papers across a wider range of disciplines. Additionally, the Scopus search engine is faster than the search engines of the other databases (Falagas et al., 2007; Aghaei Chadegani et al., 2013). The popularity of the Scopus database can be attributed, in part, to its user-friendly platform and the array of search tools it offers (Burnham, 2006; Tober, 2011).

This review was based on a search conducted on July 3, 2023. The central research question was: Whether and how has Q-methodology been employed to explore farmers' perspectives in the context of climate change? Recognizing that Q-methodology can be referred to in various ways in the literature, such as Q-method, Q-sort, Q-study, and Q-technique (Dziopa and Ahern, 2011; Dieteren et al., 2023), an advanced search using relevant keywords included all its synonyms (in English: Q-method*[†], Q-sort, Q-stud*, and Q-technique). Given the objective of scoping studies where Q-methodology was applied to farmers, we included the term 'farmer*' in the search string. To avoid overlooking participants engaged in agriculture but described using terms other than "farmer" (e.g., agricultural workers, agriculturalist, agriculturist), we included the additional search criterion "agricultur*". The last key term we selected was based on the criterion of climate

[†]The Boolean operator *refers to the shortest possible keyword, i.e., it replaces all possible suffixes that can be found in a certain expression, such as Q-method* = Q-method; Q-methods; Q-methodology, etc.

change. To allow for its variations, we reduced the term to its very basic form "clima*". Therefore, the search string used in the Scopus database was as follows:

TITLE-ABS-KEY ("Q-method*" OR "Q-sort*" OR "Q-stud*" OR "Q-technique" AND "farmer*" OR "agricultur*" AND "clima*").

Surprisingly, despite the relatively wide application of Q-methodology, the search yielded only a few (n=24) scientific publications that met the specified criteria, requiring the publications to contain the search keys in the title, abstract, or keywords (Figure 1). Subsequently, the search focused on papers published or approved for publication after peer review, which was one of the reasons for choosing the Scopus database. We included papers from all scientific fields and disciplines that were written in English. A specific time frame was not set since it could not limit this research because Q-methodology has been in use since 1935 (Dieteren et al., 2023), and the Scopus database refers to publications from before that period. Spatial limitations were not set either. The criteria used to include articles for further analysis were twofold: 1) Q-methodology was applied to the population of farmers (though not exclusively), and 2) the research objectives and results could be contextualized in the context of climate change, contributing to our understanding of farmers' subjectivity concerning various topics related to climate change.

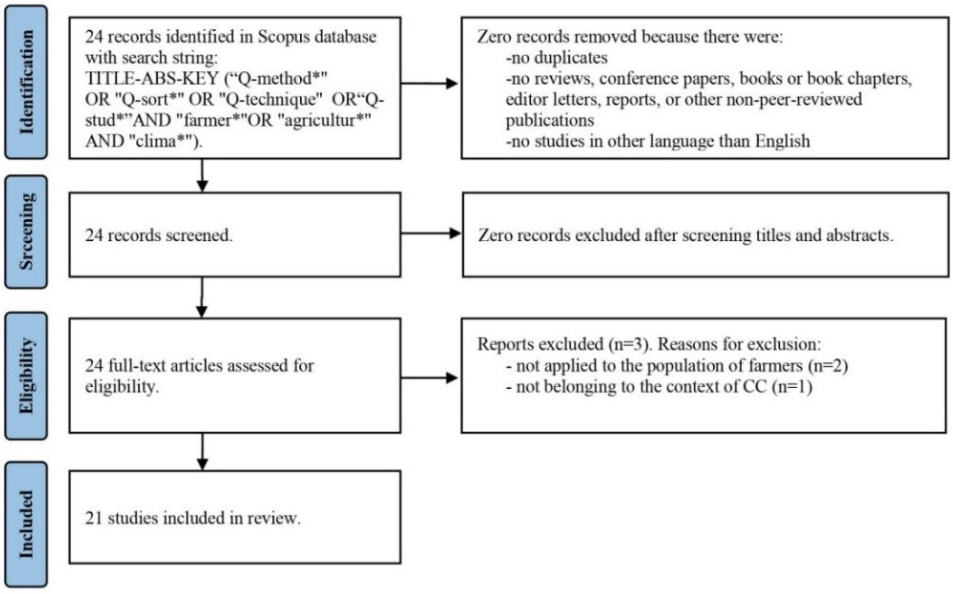

Figure 1. A flowchart of the selection process of publications for the scoping review following the PRISMA-ScR instructions.

After a review of the full papers, three were excluded from further analysis. Two of these did not apply Q-methodology to a population of farmers, while one study was not conducted in the context of climate change. A total of 21 scientific papers were included in the in-depth analysis.

Results and Discussion

The search conducted in the SCOPUS database revealed an upward trend in the application of Q-methodology in general, thus confirming the conclusions of Dieteren et al. (2023). Figure 2 illustrates the number of publications referenced in the Scopus database using the search string TITLE-ABS-KEY ("Q-method*" OR "Q-sort*" OR "Q-stud*" OR "Q-technique"). The cumulative number of publications meeting the search criteria was 5.093.

There is a similar trend in the application of Q-methodology for measuring the subjectivity of farmers. When the search string is extended to TITLE-ABS-KEY ("Q-method*" OR "Q-sort*" OR "Q-stud*" OR "Q-technique" AND "farmer*" OR "agricultur*"), the cumulative number of publications found totaled 166.

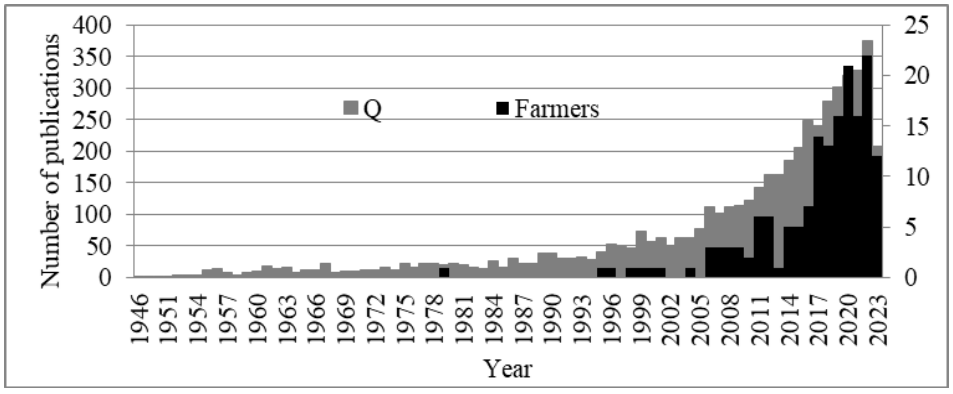

Figure 2. Number of referenced publications per year.

More than half (53%) of the total number of publications that applied Q-methodology were referenced within the last decade. Furthermore, 79% of the total number of publications that applied this method to the population of farmers were referenced in the last 10 years. This increase implies that the Q-methodology is gaining considerable importance in research.

Following the procedure outlined in the Methodology section, we identified 21 scientific articles that met the given criteria – namely, the use of the Q-methodology to explore farmers' perspectives in the context of climate change TITLE-ABS-KEY ("Q-method*" OR "Q-sort*" OR "Q-stud*" OR "Q-technique" AND "farmer*" OR "agricultur*" AND "climate*"). The earliest referenced paper

was published in 2012. Figure 3 shows the number of these articles per year, revealing a clear growing trend.

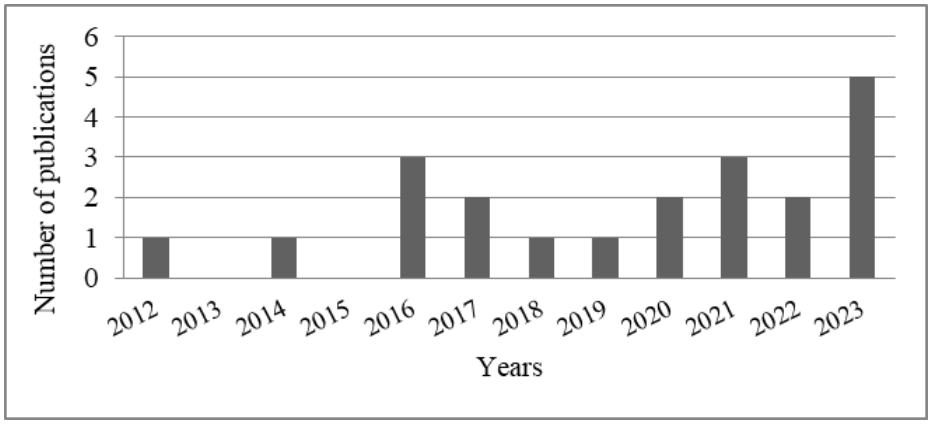

Figure 3. Number of publications selected for this review referenced per year.

Figure 4 presents the spatial distribution of the study areas. The papers included in this review encompassed all continents. The majority of these papers were based on research conducted in Europe, including two papers each from Germany and the Netherlands, and one paper each from Great Britain, Ukraine, and Sweden. Given that the nature of the selected methodology does not imply a representative or simple random sample, the participants in these studies were mainly from smaller regions, districts, or provinces.

Figure 4. Study areas of selected publications.

Table 1 offers a brief overview of each study included in this review. The topics investigated in these studies are diverse, yet all of them directly or indirectly can be connected to climate change. In addition, each study has made a certain contribution to climate change mitigation and/or adaptation.

The Q-methodology was applied to samples of farmers in just six observed studies (references in Table 1: #2, 10, 12, 13, 14, and 21). In the remaining studies, other stakeholders were also involved, including members of non-governmental organizations (#1, 3, and 17), researchers (#1, 6, 7, and 19), members of government communities, managers, and policy makers (#1, 3, 5, 7, 15, 17, and 20), experts in different fields (#8 and 9), local residents (#11 and 18), and other participants (#4 and 16).

Table 1. Brief description of the studies included in the scoping review.

No.	Reference	Themes/conclusions/contribution
1	Adams and Carodenuto, 2023	Stakeholders' perceptions of government measures aimed at reducing the poverty of cocoa farmers in Ghana were examined. Key attitudes are identified. Stakeholders believe that the introduced measures are indiscriminate, that they accelerate deforestation, and do not contribute to the desired poverty reduction.
2	Al-Maruf et al., 2022	The factors affecting the migration of farmers in Bangladesh from the countryside to the city were examined. Among the six identified dimensions, there are also climate-induced extremes (seasonal floods, above-average rainfall, heat waves, droughts, and river erosion).
3	Armatas et al., 2017	The analysis of the vulnerability of different users of the ecosystem services provided by the Wyoming National Forest (USA) watershed identified 4 distinct discourses. The paper explains the differences in those discourses, related to the concern for climate change and its negative impacts.
4	Buckwell et al., 2023	Discourses on the conservation of tropical forests in the equatorial region of Congo and initiatives for their conservation were identified. The collective perspectives of the community were established. The study concludes that social forms of compensation (such as educational and health institutions and services, strengthening moral responsibility for forest conservation, and reducing the gap within the population) are more acceptable than monetary ones.
5	Carmenta et al., 2017	Indonesian stakeholders' perceptions of peatland fire management initiatives. Given the significant role that peatlands play in storing CO_2, their exploitation by burning and drying for the sake of raising plantations requires urgent interventions. The authors emphasize the complexity and necessity of a multi-stakeholder approach to the solution of this problem.
6	Cruz et al., 2021	The authors examined the extent to which information about climate change is available to grassland-based livestock stakeholders in Uruguay. They found 4 different types of the use of climate information and proposed specific activities aimed at better adaptation.

Continuation Table 1. Brief description of the studies included in the scoping review.

7	Hall and Wreford, 2012	An analysis on the attitudes of stakeholders in the United Kingdom towards adaptation to climate change in the livestock sector was conducted. Depending on the attitudes, 4 groups of livestock farmers were defined, and it was determined that in three of the four groups, the adaptive capacity of farmers is not adequate and that it is necessary to provide appropriate market conditions, additional information, and financial support.
8	Hinzmann et al., 2021	Differences in views on subsoil amelioration, as a measure of adaptation to climate change in two regions in Germany, were examined. A typology of farmers was performed based on their willingness to accept ameliorative measures. The fundamental limitations of the application of such measures were identified and suggestions were made for overcoming them.
9	Kopytko and Pruneddu, 2018	The authors examined the attitudes of farmers in Ukraine towards crop rotation as a measure of adaptation to climate change. They identified the views on which there is a consensus and the disagreements that exist, and subsequently proposed measures for policy making.
10	Lairez et al. 2020	In this study, Q-methodology was applied as an additional method to gain an in-depth understanding of the differences in attitudes of farmers in Laos regarding soil fertility.
11	Lynch et al., 2014	Different perspectives were examined to define optimal strategies for policy innovation aimed at conserving Australia's Murray–Darling Basin, which faces severe droughts and extreme floods. The potential for a dialogue, which should result in solutions acceptable to all participants, was identified, even if it is rather modest.
12	Mataruse et al., 2022	The subject of this research is small farmers' perception of the natural and anthropogenic causes of deforestation and forest degradation in Zimbabwe. The study concludes that along with climate change, the destruction of forests is also caused by insect infestation, diseases, unavoidable external events, the lack of alternative sources of fuel, and the failure of existing institutional agreements. As a result, they recommend certain measures to create effective strategies for forest conservation.
13	Norris et al., 2021	The authors examine the views of Dutch farmers on climate mitigation plans and policies on agricultural peatlands. They conclude that support policy must change and focus on measures that go beyond compensation payments, by providing more information on funding sources, as well as potential business models for the use of peatlands with elevated water levels.
14	Reichenspurner et al., 2023	The study examines the perception of farmers in the Netherlands regarding agri-environmental climate measures. The survey shows that farmers agree that collective agroecological schemes are better than individual ones in the fight against climate change. However, farmers would like to see more flexibility and better integration of their knowledge and experience into scheme design.
No.	Reference	Themes/conclusions/contribution
15	Rittelmeyer, 2020	The paper reveals discourses among stakeholders regarding flood risk and flood management in the Sacramento-San Joaquin Delta (California, USA). The results indicate that decades of mistrust among stakeholders will continue to be a major challenge and that only a changed approach to understanding the different perspectives will enable the necessary communication on adaptation strategies.

Continuation Table 1. Brief description of the studies included in the scoping review.

16	Röös et al., 2023	The authors shed light on different perspectives regarding the sustainability of the food system in Sweden. The identified differences in priorities can be the main obstacle to the transformation of the food system, while the focus on healthy diets and increased production of fruits and vegetables represents the common priority of all participants and can be a good starting point for change.
17	Schulze and Matzdorf, 2023	The research aims to determine differences in the perception of contractual agri-environmental climate measures in Germany. The authors conclude that the differences between the perspectives of policy designers and farmers, who implement those policies, do not account for the institutional mismatch. It is recommended that policymakers gain a deeper understanding of the target group and consider its views when creating specific programs.
18	Sherren et al., 2016	In this study, the authors examined the preferences of interested actors in the coastal area of Nova Scotia (Acadian dykelands of Nova Scotia, Canada) regarding dyke maintenance measures and wetland restoration. They concluded that their views are polarized and that proposals to change the landscape must be focused on flood mitigation rather than cost savings.
19	Steeves and Filqueira, 2019	The focus of the work is to discover the perspectives of different Canadian stakeholders in shellfish production and aquaculture regarding measures of adaptation to climate change. The study concludes that, in order to improve the sustainability of the aquaculture industry by creating plans and decision-making, a higher level of integration and understanding among farmers and managers is necessary. Researchers should play a mediating role in knowledge transfer.
20	Turhan, 2016	The author examined the value orientations of political decision-makers in Turkey regarding climate change adaptation strategies. He identified four different discourses regarding the desirable direction of the development of the Turkish adaptation policy: productivist, eco-localist, techno-modernist, and authoritarian. He made suggestions for overcoming the differences and clearly defining priorities.
21	Zobeidi et al., 2016	Analyzing the discourse of Iranian farmers on climate change, the authors identified three groups of farmers depending on their attitudes towards climate change. Understanding the differences in the attitudes of these different groups can contribute to the development of more appropriate strategies for their adaptation to climate change.

The main steps in the implementation of the Q-methodology are the creation of the list of selected statements (so-called Q-set), the identification of the participants (P-set), the data collection, and their analysis and interpretation (Alderson et al., 2018).

Q-methodology starts from numerous statements that should reflect the diversity of possible attitudes towards a certain topic, often referred to as the concourse. There are various sources from which such statements can be collected (Alderson et al., 2018). In most studies examined in this review, the concourse was created from theoretical sources. This involved extracting dozens of statements pertinent to the specific topic from relevant literature, political documents, reports, news, and political announcements. Experts were consulted during this process. In

some studies, the concourse was created through interviews, workshops, and focus groups. There are also studies where the concourse was fashioned using a combination of theoretical and empirical approaches. In their systematic review of 613 scientific publications employing Q-methodology, Dieteren et al. (2023) observe a similar set of sources used for concourse creation.

In the following phase, statements or assertions to form the Q-set are chosen from the overall collection. This set comprises statements that participants will arrange based on their level of agreement with each statement. From the papers reviewed in this article, the authors have included 24 to 55 statements in the Q-set (Table 2). This is in line with numerous other studies utilizing Q-methodology (Dziopa and Ahern, 2011; Dieteren et al., 2023), where Q-sets normally contain from 20 to 100 statements. However, it is worth noting that a smaller number of statements makes the sorting process easier and more time-efficient (Barbosa et al., 1998).

Regarding sample size (P-set), Q-methodology has modest requirements. Barry and Proops (1999) demonstrated that even a sample of 12 participants can yield statistically significant results, particularly in terms of revealing implicit discourses (Barry and Proops, 1999). Some scholars recommend that the ratio of the number of participants and statements should be approximate, while others suggest that the P-set should include at least half the size of the Q-set (Dziopa and Ahern, 2011). In the systematic analysis conducted by Dieteren et al. (2023), it was observed that the number of participants in the analysed studies ranged from 3 to 302 participants. However, most of these studies typically included from 20 to 50 participants (Dieteren et al., 2023). As indicated in Table 2, the number of participants in the studies included in this review ranged from 15 to 254 individuals, with an average sample size of 65 participants. In nine of these papers, the size of the P-set exceeded that of the Q-set. While it is a more common practice that the number of participants is smaller or approximately equal to the number of items comprising the Q-set, there are review papers that also document research where the P-set surpasses the Q-set (Dieteren et al., 2023).

Only nine reviewed studies explicitly stated the type of sample used, and in each of these studies, a purposive sample was applied. The strength of purposive sampling lies in its capacity to select cases and individuals with a wealth of information about the topic under investigation (Baker et al., 2006). Hence, such a sample is desirable in any research employing Q-methodology.

The data collection process involves participants ranking (sorting) the provided statements based on their level of agreement in predefined Q-grids. These Q-grids most often have the form of a normal distribution or similar. This quasi-normal geometric form of the Q-sort was chosen due to the understanding that in any set of subjective self-reported statements, there are likely to be only a few with which participants strongly agree or strongly disagree. Those extremes (polar

opposites in the continuum of an individual's personal feelings) and middle positions of the distribution (representing less strong feelings, neutrality, or ambivalence) serve to interpret the results (Barbosa et al., 1998). The range of the scale used to gauge the degree of agreement primarily depends on the Q-grid and the number of statements involved. In the reviewed publications, the answer options typically span from -4 to +4 (found in 11 papers). However, there are instances where a five-point scale was used (ranging from -2 to +2, in one paper), a seven-point scale (ranging from -3 to +3, in three papers), and an eleven-point scale (ranging from -5 to +5, in three papers).

In all the studies observed, where this information was provided, the researchers applied principal component analysis (PCA) and utilized varimax rotation for the extracted factors. Applying these statistical procedures, three to four factors that met the necessary statistical criteria were extracted (Table 2). The extracted factors accounted for 56.80% of the variance. The highest percentage of variance explained was 72.97%, while the lowest was 41.00% (Table 2).

Table 2. Basic (technical) data about studies included in the scoping review.

No.	Reference	P-set	Q-set	Number of factors	% of variance
1	Adams and Carodenuto, 2023	32	36	3	53.00
2	Al-Maruf et al., 2022	254	30	6	72.97
3	Armatas et al., 2017	96	34	3	48.00
4	Buckwell et al., 2023	130	37	3	48.00
5	Carmenta et al., 2017	221	30 (40)*	4 (5)*	47.00 (39.00)*
6	Cruz et al., 2021	19	25	4	70.00
7	Hall and Wreford, 2012	22	24	4	58.00
8	Hinzmann et al., 2021	86	27	3	62.00
9	Kopytko and Pruneddu, 2018	10	27	3	53.00
10	Lairez et al., 2020	19	47	3	n. a.**
11	Lynch et al., 2014	37	27	4	64.00
12	Mataruse et al., 2022	42	25	5	48.00
13	Norris et al., 2021	15	37	3	61.30
14	Reichenspurner et al., 2023	15	37	3	66.31
15	Rittelmeyer, 2020	33	35	4	59.00
16	Röös et al., 2023	36	55	5	58.70
No.	Reference	P-set	Q-set	Number of factors	% of variance
17	Schulze and Matzdorf, 2023	25	38	3	57.00
18	Sherren et al., 2016	183	34	4	41.00
19	Steeves and Filqueira, 2019	20	40	3	68.00
20	Turhan, 2016	29	30	4	63.00
21	Zobeidi et al., 2016	46	42	3	56.00

*Q-methodology was applied twice on the same sample; the values in parentheses refer to the second application; **Not available.

Conclusion

Considering the importance of researching the contribution of agriculture to climate change, the possibility of mitigating the negative impacts of climate change on agriculture, and adapting the sector to them on one hand, and regarding the applicability of Q-methodology for such research on the other hand, the available literature lacks a scoping review of papers applying Q-methodology to the population of agricultural producers in the context of climate change. The performed search resulted in a surprisingly small number of papers (n=21) that met the given search criteria. However, since this review aims to highlight the possibility of using this promising methodology in research, the authors believe that its outcome does not limit the value of this work. Its contribution is evident in being the first review of its kind, to the best of the authors' knowledge, and in its potential to be a good initial reference for future researchers who decide to use Q-methodology in their research.

The results of the review demonstrate that the Q-methodology can indeed be successfully applied in this type of research. Although the number of researchers opting for this methodology has been small so far, its application has been gaining momentum over the last decade. This review may act as a stimulus for researchers to apply it. Our paper gives a brief description of each study reviewed in this research. These papers not only recommend and justify the use of Q-methodology but also provide guidance for crafting research plans. They provide theoretical context and insight into the gaps that future research needs to close.

As all research papers, this one also comes with certain limitations. While we carefully selected our literature review method and strictly followed relevant guidelines, it is necessary to acknowledge that the described search may not have covered all scientific publications where Q-methodology was applied to agricultural producers in the context of climate change, but its application was not evident from the title, abstract, or keywords. Researchers should consider this when defining paper titles, writing abstracts, and selecting keywords.

In future review papers, there are several possible directions for an improved approach. One such approach involves searching the database using terms such as "Q-methodology" (and related terms) and "farmers" (and related terms). This should be followed by a comprehensive reading of all selected papers to identify studies conducted in the context of climate change. Another method builds upon the first, incorporating additional filtering criteria by adding terms related to specific activities, practices, problems, policies, measures, and more. Although both approaches are complex and very time-consuming, they minimize the risk of overlooking significant publications, particularly if the first approach is applied. Additionally, future reviews may include "grey literature" in this area for a more comprehensive analysis.

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PRIMENA Q-METODOLOGIJE MEĐU POLJOPRIVREDNIM PROIZVOĐAČIMA U KONTEKSTU KLIMATSKH PROMENA: SISTEMATSKI PREGLED

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R e z i m e

Cilj ovog rada je da pruži sistematski pregled literature u kojoj je primenjena Q-metodologija među poljoprivrednim proizvođačima u kontekstu klimatskih promena. Analiza je pokazala neočekivano skromnu primenu Q-metodologije među poljoprivrednim proizvođačima u kontekstu klimatskih promena. Pretragom baze podataka SCOPUS, kao jedne od najvećih baza apstrakata i citata akademskih časopisa, za ključne termine: poljoprivrednici, klimatske promene i Q-metodologija u naslovu, apstraktu i ključnim rečima naučnih radova, identifikovan je samo 21 rad. Svi radovi su publikovani u poslednjoj deceniji, ukazujući na rastući trend publikovanja tokom godina. Detaljan opis i analiza ovih radova ukazuju da Q-metodologija ima i može i u budućnosti imati uspešnu primenu među poljoprivrednim proizvođačima u različitim istraživanjima koja doprinose otkrivanju i razumevanju stavova i pogleda poljoprivrednih proizvođača u različitim istraživačkim problemima koja doprinose borbi protiv klimatskih promena i ublažavanju njihovih negativnih posledica. Koliko je autorima poznato, ovakav pregled nije do sada sproveden i zbog toga predstavlja značajan doprinos i polaznu tačku istraživačima koji planiraju primenu Q-metodologije u svojim studijama koje se tiču subjektivnosti poljoprivrednika u oblasti klimatskih promena.

Ključne reči: Q-metodologija, poljoprivrednici, klimatske promene, sistematski pregled literature.

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