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# Bibliometric analysis and systematic review of compliance with agricultural certification standards: evidence from Africa and Asia

Dixon Oppong  and Richard Kwasi Bannor 

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## ABSTRACT

Agricultural certification standards establish critical sustainability principles which can deepen environmental and social responsibility within agri-food systems and increase compliant producers' competitiveness. However, African and Asian farmers' produce is rejected at the international markets due to non-compliance with certification schemes amid food safety and environmental and labour infractions. Meanwhile, there is a sparsity of a coherent review of the knowledge landscape related to certification standards compliance and its drivers' even though top-level insights are needed. Therefore, this study performs a comprehensive systematic review and bibliometric analysis of existing literature to provide insights into publication trends, critical articles, and research sponsorship contributors. It was revealed that, specific certification schemes and value chains are under-represented, with Germany being the most influential contributor to agricultural certification compliance-related studies. While the effect of most factors are mixed in the existing literature, wealth, female household membership, years of certification, subsidy, social influence, government and donor support show positive effects. The study recommends increased international research partnerships to propel the development of the compliance knowledge area, which appears to be suffering maturation challenges, plus progressive research on compliance within the underrepresented contexts. Policy responses to upgrade producers' financial capacity or lessen compliance cost are suggested.

## ARTICLE HISTORY

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## KEYWORDS

Certification standards; compliance; smallholder farmers; bibliometric analysis; Africa; Asia


## Introduction

The ever-booming world population and increasing prosperity levels continue to propel food demand worldwide. Food needs are projected to reach unprecedented levels in 2050 (Elferink and Schierhorn 2016; FAO 2018; UN 2019) and it is expected to influence food security significantly. Consequently, continuous efforts at domestic, regional, and international levels to boost food availability, fulfil the increasing demand, and curb hunger, have resulted in the intensification of agricultural production systems. The consequences have been substantial environmental costs from overstretched natural resources (Townsend 2015; FAO 2021) and human welfare and livelihood implications, including labour irregularities such as child labour and forced labour (Rasmussen et al. 2018; Lin 2021). Besides these environmental crises and labour violations, food safety challenges have also rocked the

agri-food system. The health implications of these challenges arising from biological and chemical contamination, coupled with the availability of technologies to detect levels of contamination, have heightened consumer alertness and preference for safer food (Humphrey 2017; WHO 2018, 2020; Tetra Pak Index 2020; Adeyeye 2022; Alaboudi 2022; FAO 2022). These changes in consumer behaviour and the overwhelming evidence pointing to the imminent collapse of the agri-food systems, have transformed food trade and occasioned a shift towards sustainable agriculture (Piñeiro et al. 2020; FAO 2021).

The global response to the concerns on food safety, environmental risks and social irresponsibility in the agri-food sector culminated in significant interventions on certification and labelling. These initiatives often rooted in international conventions, are usually fronted by the business sector, civil society or

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national governments (Dankers et al. 2003), and are implemented as verifiable voluntary or mandatory certification standards (Potts et al. 2010). The general consensus is that these standards' sustainability criteria can preserve the ecosystem, minimize climate impacts, and improve food sufficiency (Tayleur et al. 2017, 2018; Wheaton and Kulshreshtha 2017). Based on projections for 2050, the highest population growth is expected in Africa and Asia, where arable land per capita is currently three-quarters of an acre and one-third of an acre, respectively. Assuming arable land area remains the same, the projected population increases would continue to drive down per capita arable land area until it reaches half of an acre and less than a quarter of an acre for Africa and Asia, respectively, in 2050. This implies sustained pressure on the limited natural resources, making sustainability and certification standards more critical for Africa and Asia than any other continent.

There are currently about twelve internationally recognized agricultural commodity certification schemes (Meier et al. 2020; ITC 2021) and a number of regional or national-level schemes that operate as domesticated versions of the international standards. While these schemes vary in their focus and apply specific criteria and indicators, significant overlaps exist in their environmental, economic and social sustainability demands. Producers must voluntarily commit to adopting sustainable agricultural practices by complying with specific principles and documentation criteria before being awarded certificates or standard labels (Milder et al. 2015; Traldi 2021). There have been concerns that certification standards could widen the inequality gap between compliant and non-compliant producers in developing countries. Nevertheless, a growing body of evidence supports successful market integration of smallholder farmers in Africa and Asia through third-party schemes (Chiputwa et al. 2015; Qiao et al. 2016; Tran and Goto 2019).

In recent times, Africa and Asia's dominance in the list of top countries with the most certified producers (ITC 2018; Meier et al. 2020) indicates continuous adoption of certification standards. However, the level of agri-food border rejections involving exports going from Africa and Asia to Europe and North America (Jaud et al. 2013; UNIDO 2015; Bovay 2016; J. Buzby et al. 2008; J. C. Buzby and Regmi 2009) suggests some

compliance gaps that require immediate attention (Wilson and Abiola 2003; Ledger et al. 2006). Compliance has become an important topic in the sustainability and certification standards research domain, as governments and donors invest in producer capacity to solve certification challenges. As a result, factors found to drive farmers' compliance behaviour have been explored in many studies focused on various certification standards in Africa and Asia (Okello and Swinton 2007; Asfaw et al. 2009; Pongvinyoo et al. 2014; Akinwale et al. 2019; Karalliyadda and Kazunari 2020; Rodthong et al. 2020; Kassem et al. 2021)

In comparison, there are some reviews summarizing the literature on producer participation in certification schemes and their socioeconomic effectiveness (Kuit and Waarts 2014; Wongprawmas et al. 2015b; DeFries et al. 2017; Oya et al. 2018; Traldi 2021). However, a comprehensive review on certification standards compliance is lacking. Given the lack of coherent information and the generally fragmented literature related to farmers' compliance with certification standards, it is necessary to evaluate the present state of scholarship in the field and consolidate the driving forces behind the best compliance practices. Accordingly, this contribution provides insights into the evolution of the literature on certification standards compliance and further explores the factors behind agricultural producers' compliance decisions. Thus, this review intends to find solutions to the questions below;

- (1) What is the knowledge structure of existing literature on certification standards compliance?
- (2) What factors influence the compliance behaviours of <sup>1</sup>cash crop farmers in Africa and Asia, and what are the barriers and facilitators that drive the implementation of certification standards?

Specifically, this study explores three primary objectives through a bibliometric analysis and systematic content review: (a) to examine the intellectual structure of certification standards compliance, (b) to establish the influential factors of farmers' compliance with certification standards, and (c) to ascertain existing research gaps and propose future directions.

## Methods

### Selection of relevant studies

Literature reviews and bibliometric analyses report exhaustively on research patterns, new insights and potential research gaps based on a thorough assessment of knowledge from existing literature of scientific quality (Aria et al. 2020). They involve retrieving literature, assessing the quality of studies and establishing protocols for evidence-gathering through a robust selection process that is transparent, replicable and can produce evidence-based conclusions (Briner and Denyer 2012; Koutsos et al. 2019). Accordingly, this paper follows the widely-used PRISMA framework to identify and analyze empirical studies focused on agricultural certification standards compliance among cash crop producers in Africa and Asia and visualize the interrelatedness of the research domain's collaboration networks (Moher et al. 2010). Specifically, the data collection and selection procedure is based on the following steps; (1) identification of potentially relevant records, (2) screening of relevant articles (3) eligibility assessment, and (4) data coding and extraction of relevant information.

The first step involves the identification of scholarly materials via a database search. To systematically select potential peer-reviewed articles for screening, this review adopts the Scopus database, one of the largest abstract and citation repositories providing enriched bibliographic data from thousands of reputable journals (Baas et al. 2020). The choice of the Scopus database is informed by its offer of high-quality scientific papers from the renowned publishers. The search strategy was developed around five keyword blocks namely; (1) certification (e.g. certified, sustainability, quality standards, quality labelling, etc.); (2) type of sustainability standard (e.g. GlobalGAP, Rainforest Alliance, Fairtrade, Organic, UTZ, RSOP, RTRS, 4C, Better Cotton, Bonsucro, etc.); (3) farmer-related (e.g. smallholder, producer, farmer, horticulture, etc); (4) crop-related (e.g. cocoa, coffee, cotton, oil palm, tea, shea, sugarcane, soy, etc.); (5) country-related (i.e. keyword block for countries in Africa and Asia). Using Boolean operators and wildcards (i.e. 'OR', 'AND', '\*', '^', etc.), an all-inclusive search technique was applied to create the final queries to capture articles that investigated the concept under review. The search queries involved a combination of structured keywords under the five keyword blocks and was conducted across

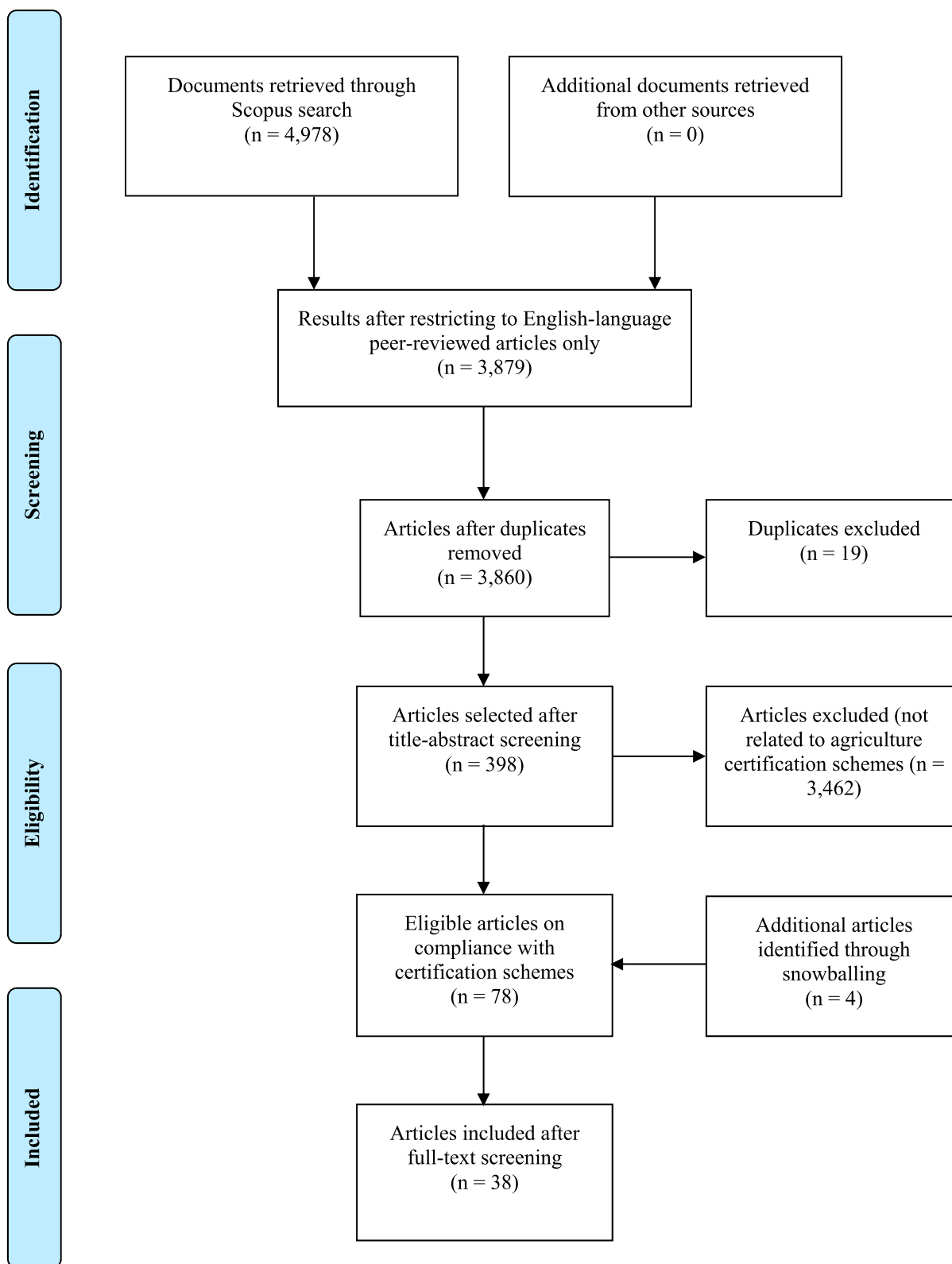
the title, abstract and keyword fields. With no restrictions on the publication period and the number of articles to include (Valentine et al. 2010), the final article retrieval process was performed on February 5, 2022. The final query was a drawdown of 4,978 publication records which was further cut down to 3,879 peer-reviewed English-language articles, found to be potentially connected to the searched topics.

At the second stage, the remaining dataset was imported into the Zotero citation management software, where 19 duplicates were removed followed by a manual evaluation of titles and abstracts which resulted in a sample of 398 records related to the agricultural certification domain. It was realized at this stage that while some scholars used compliance and adoption interchangeably, others characterized compliance with different phrases. As a result, the authors needed to update the selection criteria to include articles measuring compliance through (a) intensity or level of implementation or application of standards; (b) intensity of adoption of standards; and (c) level of continued participation in certification. The full inclusion and exclusion criteria used is presented in Table 1. Applying these criteria produced 78 eligible studies related to agricultural certification standards compliance.

At the third stage, a full text assessment was conducted for eligibility and to eliminate publications that did not refer to the determinants, facilitators or barriers of compliance. After this screening, 44 more records were disqualified, leaving a final sample of 34 studies which are included in the current literature review and bibliometric analyses. Additionally, four more publications were included following a snowball screening of the reference lists of the included articles

**Table 1.** Criteria for article inclusion.

Inclusion criteria
<ul style="list-style-type: none"> <li>• Focus on farmers' compliance with certification, intensity of adoption, level of implementation, level of continued participation</li> <li>• Focus on cash crop smallholder farmers</li> <li>• Peer-reviewed articles with full content available</li> <li>• Articles published in English language</li> <li>• Articles that include original results of primary studies</li> </ul>
Exclusion criteria
<ul style="list-style-type: none"> <li>• Articles that do not discuss at least one factor influencing compliance with certification standards</li> <li>• Articles not exploring cash crop farmers (e.g. veterinary, aquaculture, etc.)</li> <li>• Articles that do not present original results of empirical data (reviews, opinions, etc)</li> <li>• Conference proceedings, reports, student dissertations, book chapters, editorials, government and company publications</li> </ul>



**Figure 1.** The PRISMA framework for article inclusion (Moher et al. 2010).

as provided by Serenko (2013). In the end, 38 articles were selected, which form the basis of the current contribution (see Figure 1).

At the final stage, each article in the final sample was coded to extract critical information to synthesize the current state of scholarship on factors influencing cash

crop farmers' compliance with certification standards in Africa and Asia.

### **Methods for bibliometric analysis and content analysis for literature review**

In bibliometric studies, researchers rely on visualizing detailed citation information to draw insights into specific aspects of a research area. VOSviewer software was subsequently used to construct visuals of bibliometric networks such as authors, journals, countries, institutions and funders based on citation and co-authorship information. Several authors have adopted the VOSviewer software to identify emerging trends in scientific research (Cavalcante et al. 2021; Cen et al. 2021; Cheng et al. 2021; Qin et al. 2022; Tamala et al. 2022). In this paper, bibliometric indicators are presented for only active collaborations as captured from the dataset of the 38 studies identified on determinants of certification standards compliance. The methodological approach for the bibliometric analysis includes statistics and visualizations on year of publication, authors, journals, countries and citation analyses.

To establish the factors that drive certification standards compliance, a content analysis of each of the 38 included articles is performed to provide the basis for the literature review. Information is extracted on both quantitative and non-significant associations established between the dependent variable and the factors under study, plus a qualitative synthesis of the facilitators and barriers to compliance.

### **Results of bibliometric analyses of publications on farm certification compliance**

This section presents a bibliometric investigation of the 38 selected publications related to cash crop farmers' compliance with certification standards focusing on the year publication, country of origin, authors, source journals, institutions, sponsors and keywords.

#### **Yearly distribution of publication output**

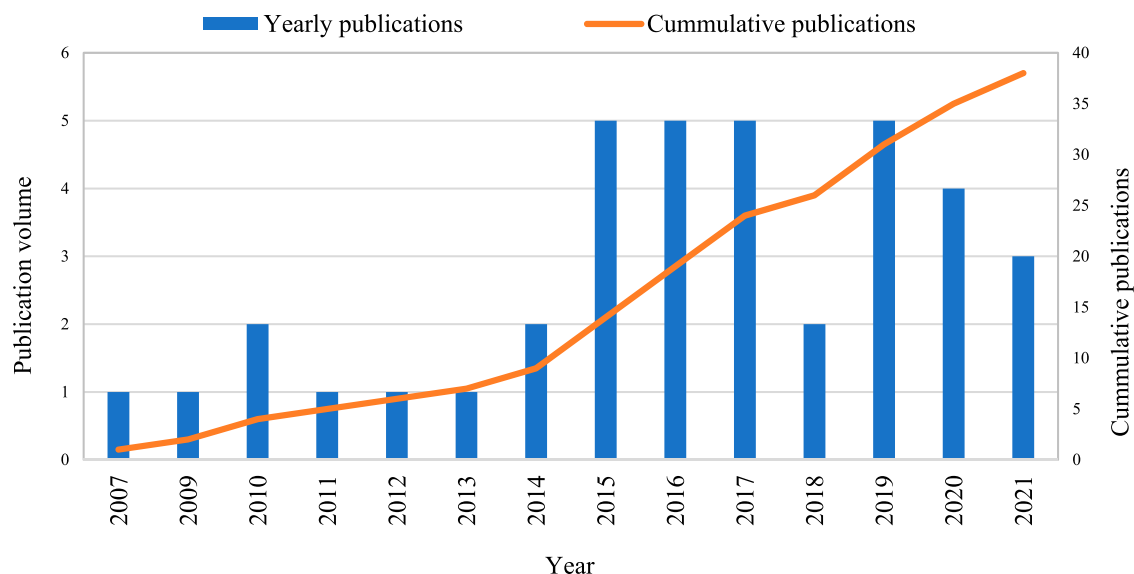
The number of published articles year-on-year indicates the trends in a particular research domain. An analysis of the trends can also provide a clue on future trends. Noticeably, scholars started paying attention to the drivers of farm certification compliance in Africa

and Asia only around 2007. Though the volume of available publications has risen from only one in the beginning to 38 as at the end of 2021 (see Figure 2), academic interest in the subject matter remained relatively low for seven years as the release of publications stagnated between one and two articles per year, with a marked publication drought in the year 2008. Between 2015 and 2021, there was generally a slight increase in the average rate of article release despite some fluctuations in quantities in 2018 and 2020. During this period, a maximum of 5 articles were published yearly. The trend suggests that in the future, many more scholars may join and contribute to the advancement of the research domain, which is slowly receiving attention from the scientific community. However, it must be noted that, the fourteen-year aggregate of 38 publications and the recent fluctuations in the number of articles published yearly appear to signal maturation problems within the certification standards compliance-related research area.

### **Active countries and partnerships in certification standards compliance research**

The contribution of various countries to the topic is represented in Table 2, and the international collaborations between these major countries are mapped out in the visualization depicted in Figure 3. The 38 articles on drivers of certification standards compliance originated from 19 countries from five geographical regions (i.e. Asia, Africa, North America, Europe and Oceania). Germany and Kenya published the highest number of articles (9 publications each, 30.5% of total articles), followed by Thailand with 6 publications (10.17%), while Ghana and the United States, who share the third spot, contributed 5 articles (8.47%) each. Indonesia published 4 articles (6.78%), while Netherlands and Malaysia published 3 articles (5.08%) each. Furthermore, four countries contributed two publications to the ongoing discussions on drivers of certification standards compliance, while seven countries published one article each.

Interestingly, the total number of contributions from these 19 countries is up to 59, higher than the 38 publications released in real-time. This implies that there were some cooperation efforts between some countries. Figure 3 presents the direction of these collaborations and identifies the most productive countries by the node's size representing each country in



**Figure 2.** Publication volume from 2007 to 2021.

**Table 2.** Top 10 countries that published articles on certification standards compliance.

No.	Country	No. of articles	% articles	Citations	Av. citations per article	% Citation	Total Link Strength
1	Germany	9	15.25	423	47	31.64	43
2	Kenya	9	15.25	247	27	18.47	34
3	Thailand	6	10.17	47	8	3.52	12
4	United States	5	8.47	188	38	14.06	25
5	Ghana	5	8.47	32	6	2.39	7
6	Indonesia	4	6.78	114	29	8.53	23
7	Netherlands	3	5.08	109	36	8.15	18
8	Malaysia	3	5.08	13	4	0.97	5
9	France	2	3.39	44	22	3.29	8
10	Australia	2	3.39	11	6	0.82	11

the network, while the size of the connecting links represents the strength of each collaborative network. The results indicate that Kenya has the widest network of partners, intensely collaborating with 15 countries, followed by Germany (14 countries), United States (9 countries) and Vietnam (8 countries). Ghana, Egypt and Saudi Arabia partnered with 7 countries each, while Netherlands, Thailand, Indonesia and Australia connected with researchers in 6 different countries. Apart from researchers based in France who also commissioned studies with scholars from 5 different countries, other countries in the network fostered partnerships with researchers in at least one to four different countries.

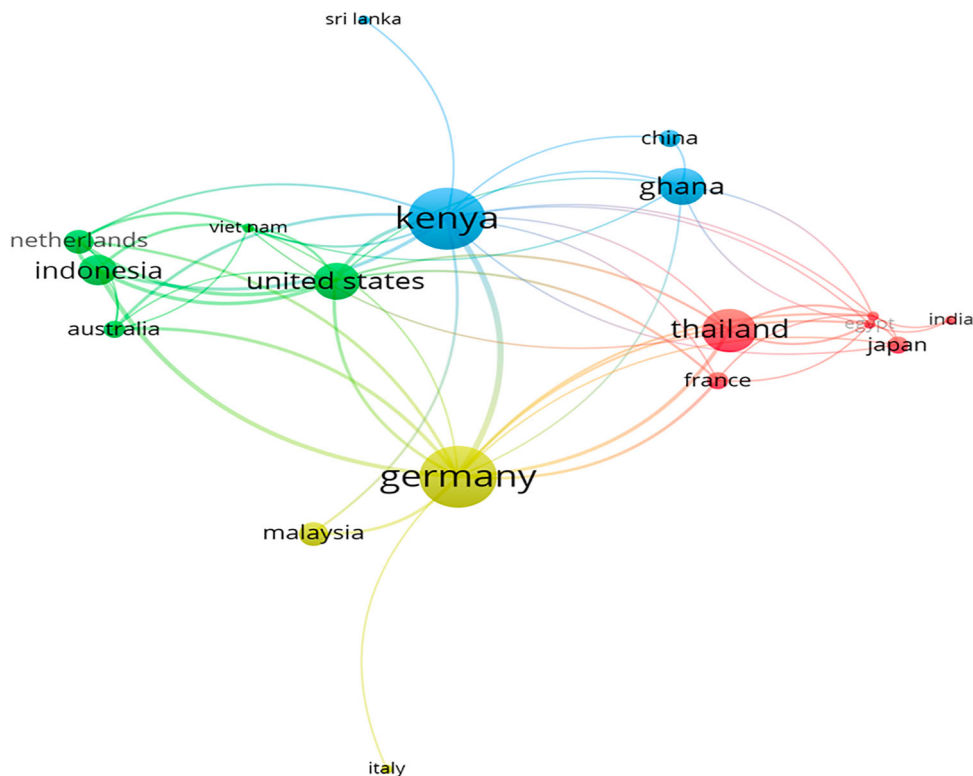
A further clustering of countries implies that collaborative activities between these countries are more robust among entities that share the same cluster colour. Expectedly, Kenya, Germany, Thailand, the United States and Ghana are the most visible nodes in the network and share thick links between them. However, the other entities are not in the same cluster,

as clearly shown by their category colours apart from Kenya and Ghana. This implies that, to a certain degree, geographical location may affect the research interests of entities in different geographical regions. This speaks to the continued existence of temporal barriers that researchers worldwide need to break down to fast-track the growth of research on sustainability standards.

Overall, Germany was the most potent contributor to research related to certification standards compliance, having its publications cited by 423 (31.64%) other articles globally. Kenya is the second most influential with 18.47% of total citations, followed by the United States (14.06%), Indonesia (8.53%) and Netherlands (8.15%).

#### **Active institutions contributing to certification standards compliance research**

Fifty-two institutions contributed to research on certification standards compliance in Africa and Asia.



**Figure 3.** Network visualization of the international cooperation towards research on certification standards compliance.

**Table 3.** Top 10 institutions contributing to farm certification compliance research.

Rank	Organization/Institution	No. of Publications	% Documents	Total Citations	Av. Citation per article	Total link strength
1	Egerton University, Kenya	5	6.94	31	6.2	22
2	Centre for International Forestry Research (CIFOR), Indonesia	3	4.17	104	34.7	26
3	Leibniz Universität Hannover, Germany	3	4.17	75	25.0	32
4	Ministry of Trade and Industry, Ghana	3	4.17	23	7.7	5
5	Georg-August-Universität Göttingen, Germany	2	2.78	116	58.0	11
6	Utrecht University, Netherlands	2	2.78	98	49.0	20
7	University of Nairobi, Kenya	2	2.78	82	41.0	12
8	Michigan State University, United States	2	2.78	70	35.0	3
9	Asian Institute of Technology, Thailand	2	2.78	29	14.5	11
10	University of Ghana, Ghana	2	2.78	22	11.0	5

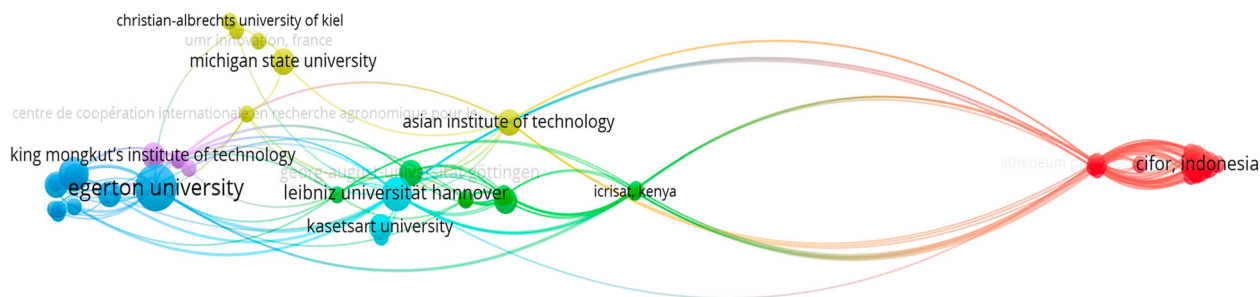
Together, the top ten active institutions were responsible for more than one-third (36.11%) of all the publications on the topic (Table 3). The list of top ten institutions was jointly dominated by Kenyan, Ghanaian and German institutions, with the Egerton University in Kenya ranking as the most productive institution with 5 (6.94%) articles. Three institutions, namely, Centre for International Forestry Research (CIFOR), Indonesia; Leibniz Universität Hannover, Germany and Ministry of Trade and Industry, Ghana, individually contributed three papers each, while the remaining six institutions on the list published two documents each. In terms of popularity and influence within the research community, Germany's Georg-August-Universität, Göttingen reigned

supreme, receiving the highest in total citations, which translated into 58 citations per document by CIFOR, Indonesia, Utrecht University, Netherlands and University of Nairobi, Kenya. It must be mentioned that this paper's findings on international collaborations are partly affirmed by the agility of the German, Kenyan, Dutch and Indonesian institutions, as well as their interconnectivity as indicated by the strength of the links between them (Figure 4).

#### **Funding of research on farm certification compliance**

Overall, 16 (42.10%) publications related to agricultural certification standards compliance, were funded.





**Figure 4.** Network visualization of institutions contributing to certification standards compliance research.

The *German Academic Exchange Service, DAAD* and *United States Agency for International Development, USAID* were jointly the most active funding agencies, followed by *Priority Academic Program Development, PAPD, China*. In terms of country contributions to the funding of this research domain, German institutions were the most prominent sponsors, funding 6 articles, followed by the United States (4 articles), China (2 articles) and Thailand (2 articles). Five other countries individually sponsored the publication of one research article each. The United Kingdom (UK), Netherlands, France, Malaysia and Saudi Arabia. It can be observed from Table 4 that the 14 organizations appear to have contributed funding for 19 publications which exceed the volume of publications funded. This implies that some of the publications were jointly funded by two or more institutions in different countries, indicating some collaborative work.

### **Influential journals contributing to certification standards compliance research**

The thirty-eight articles included in the dataset for this study were published in 33 different source journals. In all, 29 journals (87.9%) published only one paper on certification standards compliance; 3 journals (9.1%) published two articles; while only one journal published the maximum of 3 publications on the topic. Table 5 lists all the publications' sources and the number of articles released by each journal on the research area under review. The wide distribution of articles published across journals in the agriculture, environment, business, economics, policy, technology and behavioural disciplines seems to suggest the interdisciplinary nature of the certification and sustainability research domains, which focus primarily on adopting and compliance with new technology. It also indicates the interest shown by a diversity of

**Table 4.** Institutions and organizations that funded certification compliance research.

Funding institutions	Country	No. of articles	References
German Academic Exchange Service, DAAD	Germany	3	(Holzapfel and Wollni 2014; Kariuki and Loy 2016; Kibet et al. 2018)
Stiftung Fiat Panis	Germany	1	(Holzapfel and Wollni 2014)
Federal Ministry of Education and Research, BMBF	Germany	1	(Krause et al. 2016)
Federal Ministry for Economic Cooperation and Development, BMZ	Germany	1	(Brandt et al. 2015)
United States Agency for International Development, USAID	USA	3	(Jelsma et al. 2017; Schoneveld et al. 2019; Apriani et al. 2020)
Michigan State University	USA	1	(Ansah et al. 2020)
Priority Academic Program Development of Jiangsu Higher Education Institutions, PAPD	China	2	(Gichuki et al. 2019, 2020)
King Saud University	Saudi Arabia	1	(Kassem et al. 2021)
Thailand Research Fund, TRF	Thailand	1	(Kuldilok 2021)
Asian Institute of Technology, AIT	Thailand	1	(Rodthong et al. 2020)
Consortium of International Agricultural Research Centers, CGIAR	France	1	(Schoneveld et al. 2019)
Department for International Development, DFID	UK	1	(Jelsma et al. 2017)
Wageningen University	Netherlands	1	(Hutabarat et al. 2019)
Universiti Putra Malaysia	Malaysia	1	(Tey et al. 2015)

**Table 5.** Sources of publications related to compliance with certification standards.

No.	Journal	ISSN	No. of articles	Subject category of journal
1	Agribusiness	7424477	3	Agricultural Economics & Policy
2	International Journal of Agricultural Technology	1686-9141	2	Agricultural and Biological Sciences
3	Land Use Policy	2648377	2	Environmental Sciences
4	Journal of Environment and Development	10704965	2	Environmental Sciences
5	Food Policy	3069192	1	Agricultural and Biological Sciences
6	Agroecology and Sustainable Food Systems	21683565	1	Agricultural and Biological Sciences
7	British Food Journal	0007070X	1	Agricultural and Biological Sciences
8	Review of Agricultural Economics	10587195	1	Agricultural and Biological Sciences
9	Journal of Agribusiness in Developing and Emerging Economies	20440839	1	Agricultural and Biological Sciences
10	Journal of Agricultural Sciences – Sri Lanka	13919318	1	Agricultural and Biological Sciences
11	Saudi Journal of Biological Sciences	1319562X	1	Agricultural and Biological Sciences
12	Horticulturae	23117524	1	Agricultural and Biological Sciences
13	Journal of Agriculture and Environment for International Development	22402802	1	Agricultural and Biological Sciences
14	Journal of Agricultural and Environmental Ethics	11877863	1	Agricultural and Biological Sciences
15	Indian Journal of Agricultural Sciences	195022	1	Agricultural and Biological Sciences
16	Agriculture	2077-0472	1	Agricultural and Biological Sciences
17	International Journal of Agricultural Management and Development	2159-5860	1	Agricultural Management and Development
18	Emerald Emerging Markets Case Studies	20450621	1	Business and International Management
19	Journal of International Food and Agribusiness Marketing	8974438	1	Business, Management and Accounting: Marketing
20	Applied Ecology and Environmental Research	15891623	1	Ecology, Evolution, Behavior and Systematics
21	Journal of Behavioral and Experimental Finance	22146350	1	Economics, Econometrics and Finance
22	Journal of Economics and Behavioral Studies	2220-6140	1	Economics, Finance and Behavioral Studies
23	Environmental Management	0364152X	1	Environmental Sciences
24	Global Environmental Change	9593780	1	Environmental Sciences
25	International Journal of Sustainable Development	9601406	1	Environmental Sciences
26	Technological Forecasting and Social Change	401625	1	Management of Technology and Innovation
27	International Journal of Modern Trends in Social Sciences	2600-8777	1	Social Sciences
28	Quarterly Journal of International Agriculture	498599	1	Social Sciences
29	Kasetsart Journal of Social Sciences	24523151	1	Social Sciences
30	Journal of Development Studies	220388	1	Social Sciences
31	Economic Geography	130095	1	Social Sciences
32	International Journal of Academic Research in Business and Social Sciences	2222-6990	1	Social Sciences, Business and Education
33	American Journal of Rural Development	2333-4762	1	Social Welfare and Rural Development

research communities to play some role in advancing the research domain. Though not surprising, it must be noted that journals with a focus on agriculture and rural development discipline have paid more attention to this subject matter than any other discipline. This explains why the journals *Agribusiness*, *Land Use Policy*, *International Journal of Agricultural Technology* and *Journal of Environment and Development* are the most significant sources of scholarly articles on farmers' compliance with certification standards.

#### **Active authors in certification standards compliance research**

The advancement of any research domain hinges on the interest shown by scholars and their contributions to the body of knowledge. In all, 109 researchers contributed to the 38 articles on certification standards compliance. Among these, the top 15 productive

researchers either authored or co-authored at least two articles which account for 24.80% of all articles, while each of the remaining authors contributed to the publication of an article. Though not very active, Ouma S. (125 citations per article) received much more recognition for his work than others, while Annor B.P. ranks first as the most prolific author with 3 articles. Six of the top ten active authors have gained appreciable attention for their work. They are Wollni M. (116 and 58 citations per article), followed by Jelsma I and Schonveld G.C., who jointly share the second most influential position with 49 citations per article, while Asfaw S., Mithöfer D., and Waibel H. share the next position with 45 citations per article. Apart from Ouma S. whose work was a solo effort, all the other authors on both the top active and top influential lists co-authored with one or more other authors. Table 6 lists the top 10 active authors followed by the top 10 influential authors.

**Table 6.** Top 10 authors by productivity and influence.

Rank	Active authors	No. of publications	Citations	Av. citations per article	Total link strength
1	Annor B.P.	3	23	8	10
2	Wollni M.	2	116	58	26
3	Jelsma I.	2	98	49	29
4	Schoneveld G.C.	2	98	49	29
5	Asfaw S.	2	89	45	33
6	Mithöfer D.	2	89	45	33
7	Waibel H.	2	89	45	33
8	Grote U.	2	10	5	34
9	Lippe R.S.	2	10	5	34
10	Kuwornu J.K.M.	2	9	5	6

Rank	Influential authors	No. of publications	Citations	Av. citations per article	Total link strength
1	Ouma S.	1	125	125	8
2	Wollni M.	2	116	58	26
3	Jelsma I.	2	98	49	29
4	Schoneveld G.C.	2	98	49	29
5	Asfaw S.	2	89	45	33
6	Mithöfer D.	2	89	45	33
7	Waibel H.	2	89	45	33
8	Kersting S.	1	86	86	19
9	Brandi C.	1	78	78	27
10	Cabani T.	1	78	78	27

### Most cited documents in certification standards compliance research

Different techniques have been employed to estimate the significance of a research paper. The most popular method in recent times is citation analysis, which determines the influence of an article by computing its popularity through the number of times that paper has been quoted in the work of other authors (Ding and Cronin 2011). The frequency of citations is a significant metric that informs the quality of the contributions in the publication. Within the local citations network, the node's size gives an indication of the direction of citation, with smaller node publications citing publications at the bigger nodes. A citation analysis of publications on certification standards compliance reveals 758 global citations, averaging 19.95 citations per article, with 29 publications citing at least one other publication within the current database. Table 7 and Figure 5 show the most cited papers and the citation network based on the most extensive set of the 29 related documents.

Overall, the most popular paper in the network, Ouma (2010) (125 citations), is a journal article published in *Economic Geography* in 2010 titled 'Global standards, local realities: Private agri-food governance and the restructuring of the Kenyan horticulture industry'. This paper studies the link between voluntary standards and its influence in agri-food markets

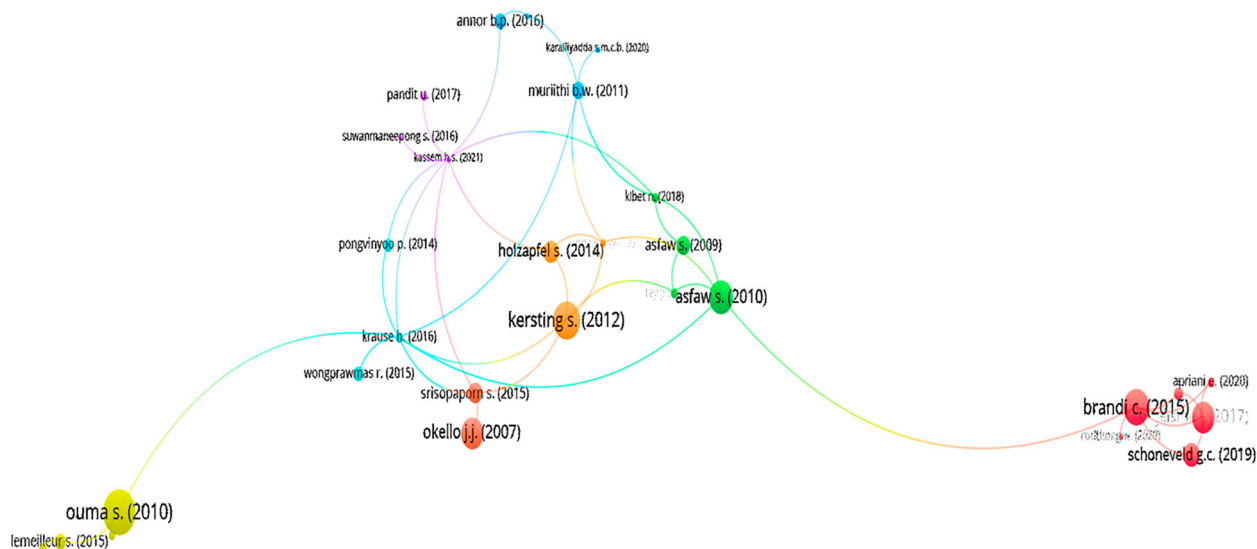
and discusses the impact of EurepGAP/GlobalGAP on the Kenyan horticulture industry. It further throws light on the exporter-producer supply chain relationships while exposing the barriers and opportunities in their efforts to comply with standards (Ouma 2010). The second most cited paper is Kersting and Wollni (2012), with 86 citations. This paper analyzing the circumstances behind GlobalGAP-certified producers' compliance behaviours was conducted in Thailand and published in *Food Policy*. The findings showed that producers are better able to implement standards when they are well educated, experienced and have access to adequate information, quality farming technology and support services. In third place is a paper by (Brandi et al. 2015) expounding on the compliance challenges of smallholder oil palm producers working under the RSPO certification scheme. It is important to highlight that the pioneering papers of Asfaw et al. (2009, 2010) and Okello and Swinton (2007) also appear in the top. Besides global attention, the articles by Brandi et al. (2015), Kersting and Wollni (2012), Asfaw et al. (2010), and other early scholars have also provided much guidance to other researchers investigating factors driving certification standards compliance, specifically in Africa and Asia, having been cited at least five times by other researchers within the local network. For instance, a recent paper by Kassem et al. (2021) cites at least eight previous publications in the network. Clearly, the total mismatch between the global and local citation metrics seems to affirm that apart from Africa and Asia, researchers on other continents are also paying attention to certification standards compliance research and drawing lessons from empirical studies conducted in the two regions.

### Review of publications related to agricultural certification standards compliance

Before presenting the evidence on the determinants of compliance, it is relevant to give brief background information on the commodities, certification systems, and settings explored in existing literature. The selected publications employed quantitative (57.89%), qualitative (23.68%) and mixed-method (18.42%) approaches to gather available evidence on certification standards compliance. Though these publications originated from 19 countries across 5 regions, they are largely skewed towards certain value chains and certification schemes, and focus primarily on

**Table 7.** Top 10 most cited papers on farm certification compliance.

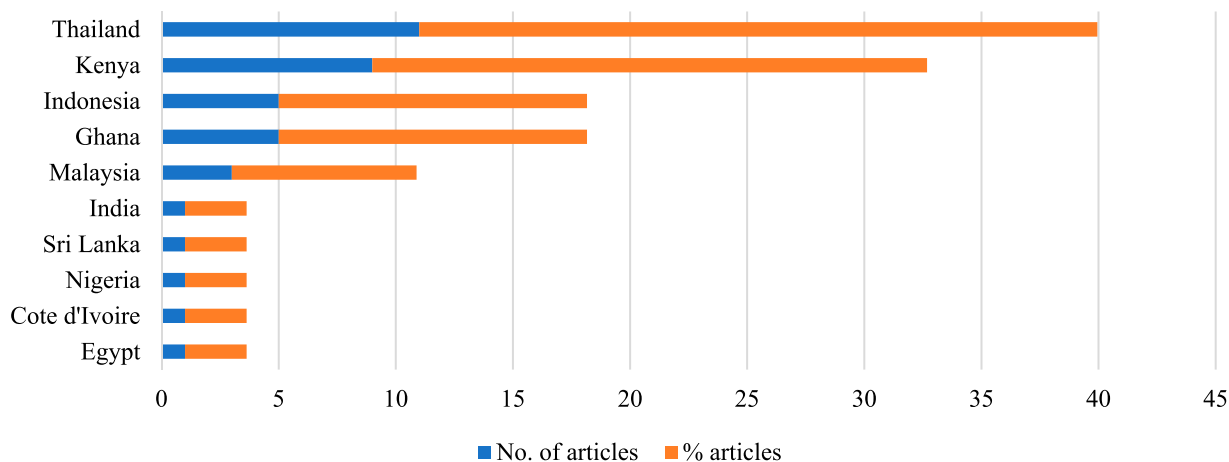
Rank	Title of publication	Year	Journal	Local citations	Global citations	References
1	"Global Standards, Local Realities-Private Agrifood Governance and the Restructuring of the Kenyan Horticulture Industry"	2010	Economic Geography	3	125	(Ouma 2010)
2	"New institutional arrangements and standard adoption – Evidence from small-scale fruit and vegetable farmers in Thailand"	2012	Food Policy	5	86	(Kersting and Wollni 2012)
3	"Sustainability Standards for Palm Oil-Challenges for Smallholder Certification Under the RSPO"	2015	Journal of Environment and Development	6	78	(Brandi et al. 2015)
4	"What Impact Are EU Supermarket Standards Having on Developing Countries' Export of High-Value Horticultural Products? Evidence From Kenya"	2010	Journal of International Food and Agribusiness Marketing	5	65	(Asfaw et al. 2010)
5	"Unpacking Indonesia's independent oil palm smallholders-An actor-disaggregated approach to identifying environmental and social performance challenges"	2017	Land Use Policy	4	64	(Jelsma et al. 2017)
6	"Compliance with International Food Safety Standards in Kenya's Green Bean Industry-Comparison of a Small – and a Large-scale Farm Producing for Export"	2007	Review of Agricultural Economics	1	63	(Okello and Swinton 2007)
7	"Certification, good agricultural practice and smallholder heterogeneity-Differentiated pathways for resolving compliance gaps in the Indonesian oil palm sector"	2019	Global Environmental Change	2	34	(Schoneveld et al. 2019)
8	"Is GlobalGAP Certification of Small-Scale Farmers Sustainable? Evidence from Thailand"	2014	Journal of Development Studies	3	30	(Holzapfel and Wollni 2014)
9	"Adoption and continued participation in a public Good Agricultural Practices programme-The case of rice farmers in the Central Plains of Thailand"	2015	Technological Forecasting and Social Change	4	27	(Srisopaporn et al. 2015)
10	"Investment in compliance with GlobalGAP standards-Does it pay off for small-scale producers in Kenya?"	2009	Quarterly Journal of International Agriculture	2	24	(Asfaw et al. 2009)



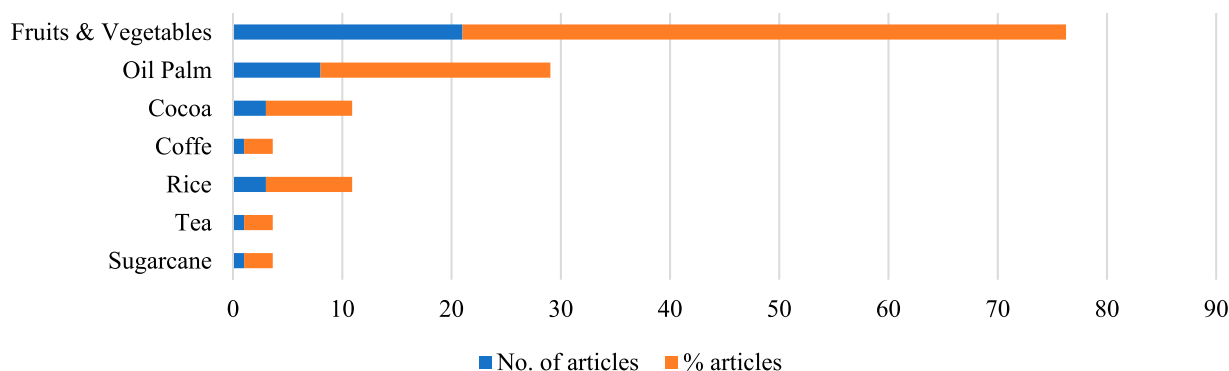
**Figure 5.** Citation network of publications related to certification standards compliance.

five African countries and five countries in the Asian region, as illustrated in Figure 6. More than half (55.26%) of the studies explored the fruits and vegetable value chains, followed by oil palm (21.05%), while rice (7.89%), cocoa (7.89%), coffee (2.63%), tea (2.63%) and sugarcane (2.63%), received little attention (see Figure 7). Overall, three-quarters (73.17%) of

publications investigated factors influencing compliance within international certification contexts, while 11 studies (26.83%) focused on national-level schemes. As shown in Figure 8, the publication bias is more conspicuous regarding the internationally recognized standards. The existing studies focused on a limited number of certification schemes, with just one scheme,



**Figure 6.** Focus countries of certification standards compliance research.

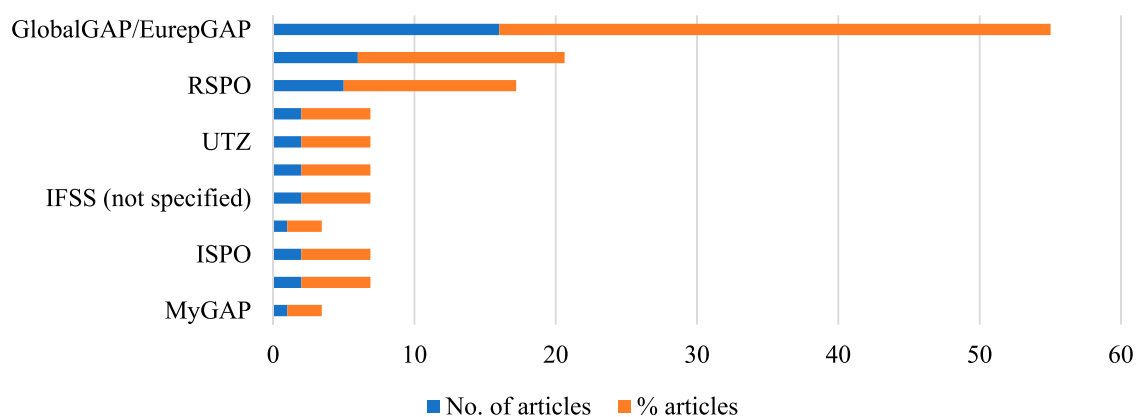


**Figure 7.** Distribution of publications by commodity crop.

GlobalGAP, accounting for more than one-third of the literature (39.02%), although Africa and Asia have more certified farmers than others for most of the recognized certification systems (ITC 2018, 2021).

Further, five articles were published on RSPO, while Rainforest Alliance, UTZ and Organic were evaluated in two articles. The dominance of GlobalGAP may partly explain why fruits and vegetables have

been more widely studied than other commodities like oil palm, cocoa, coffee, rice and tea. There was only one publication on the compliance to Fairtrade standards within the observation period. Asia’s sub-regional version of GlobalGAP, Q-GAP (6 articles) dominated publications assessing drivers of compliance with national-level schemes, followed by the domesticated RSPO versions of Indonesia (ISPO) and



**Figure 8.** Distribution of publications by type of certification scheme evaluated.

Malaysia (MSPO), which were covered by 2 articles each. There was no available publication evaluating compliance within any Africa-based national-level certification standards. It should also be noted that the distribution on type of certification scheme sums up to 41, and exceeds the number of articles included in this review. This is because one study explored three different certification schemes. The results on the distribution by certification schemes and the keyword analysis conducted in the bibliometric section jointly affirm the contribution and importance of GlobalGAP and RSPO to the literature on certification standards compliance.

### ***Factors influencing farmers compliance with certification standards***

This section outlines the key findings of the systematic content review, synchronizing results from both quantitative investigations and the qualitative synthesis of the barriers and facilitators of compliance. Additional insights are drawn from the qualitative studies to enhance our understanding and contextualize the quantitative effects of the determinants of compliance. The full range of influential factors, barriers and facilitators of compliance are presented in Tables 8–12. The focus is more directed towards factors that are observed to drive compliance within most of the certification systems covered by existing studies. The literature evaluated in this review assessed variations in compliance across a wide range of individual and institutional characteristics categorized into three broad themes, namely; (1) demographic and physical capital factors; (2) economic capital factors; and (3) social capital and institutional support factors. Generally, evidence in available literature are mixed in terms of the overall influence of the various factors moderating compliance. Positive and negative relationships have been reported across different schemes, commodities and settings, and there are even cases where the influence of certain factors is statistically insignificant. The key factors that emerged as potential drivers of agricultural certification standards compliance in Africa and Asia are discussed in the next section.

#### ***Demographic and physical capital factors***

A substantiable number of existing studies explored the link between compliance and producer characteristics and physical capital factors. It was observed that

the number of female household members (Asfaw et al. 2010; Kersting and Wollni 2012), number of years of certified production (Gichuki et al. 2020), number of farm enterprises (Muriithi et al. 2011; Annor et al. 2016), and asset value (Krause et al. 2016; Kibet et al. 2018; Apriani et al. 2020; Kuldilok 2021) positively influence compliance decisions. However, a large proportion of studies reported mixed results with regards to the influence of age, education, gender, household size, experience, age of plantation, land ownership, and farm size (Asfaw et al. 2009, 2010; Muriithi et al. 2011; Holzapfel and Wollni 2014; Srisopaporn et al. 2015; Annor et al. 2016; Kariuki and Loy 2016; Krause et al. 2016; Ni et al. 2016; Suwanmaneepong et al. 2016; Fakkhong and Suwanmaneepong 2017; Lippe and Grote 2017; Pandit et al. 2017; Kibet et al. 2018; Akinwale et al. 2019; Gichuki et al. 2019, 2020; Schoneveld et al. 2019; Apriani et al. 2020; Rodthong et al. 2020; Kassem et al. 2021; Kuldilok 2021; Mansor et al. 2021).

While Annor et al. (2016) uncovered an inverse link between compliance and age, Apriani et al. (2020) demonstrated that age was positively associated with farmers' intention to comply with certification standards. Higher education was widely reported to improve compliance (Asfaw et al. 2009, 2010; Holzapfel and Wollni 2014; Fakkhong and Suwanmaneepong 2017; Pandit et al. 2017; Mansor et al. 2021). Kersting and Wollni (2012) observed better compliance among young educated GlobalGAP-certified Thai farmers. In Kenya, Gichuki et al. (2019) revealed differences in age and education levels between compliant and non-compliant snap bean farmers, and showed that compliant farmers averaging 46.48 years were older and more educated than non-compliant farmers. Akinwale et al. (2019) found greater UTZ compliance among old uneducated cocoa farmers in Nigeria in a different setting and certification context. While the positive effects of age was observed among UTZ and RSPO-certified producers of long-term crops, literature that reported the inverse relationship evaluated GlobalGAP compliance among producers of short-term crops, which appear to be more attractive to younger farmers. Within these contexts, it is quite convenient to assume that younger producers comply more with standards because of their innovativeness, risk-neutrality and openness to adapt to new practices that produce greater short-term benefits. Certification is usually tied to expected market

**Table 8.** Determinants of certification standards compliance – physical capital factors.

Variable	Impact	References	Certification scheme
Age	+	(Akinwale et al. 2019; Gichuki et al. 2019; Apriani et al. 2020)	RSPO, UTZ, GlobalGAP
	–	(Kersting and Wollni 2012; Annor et al. 2016)	GlobalGAP
Education	NS	(Asfaw et al. 2009, 2010; Holzapfel and Wollni 2014; Krause et al. 2016; Ni et al. 2016; Suwanmaneepong et al. 2016; Fakkhong and Suwanmaneepong 2017; Pandit et al. 2017; Gichuki et al. 2020; Rodthong et al. 2020; Kassem et al. 2021; Mansor et al. 2021)	GlobalGAP, RSPO, Q-GAP, MSPO
	+	(Asfaw et al. 2009, 2010; Kersting and Wollni 2012; Holzapfel and Wollni 2014; Fakkhong and Suwanmaneepong 2017; Pandit et al. 2017; Gichuki et al. 2019; Kassem et al. 2021; Mansor et al. 2021)	GlobalGAP, Q-GAP, MSPO
Gender	–	(Akinwale et al. 2019)	UTZ
	NS	(Muriithi et al. 2011; Srisopaporn et al. 2015; Annor et al. 2016; Kariuki and Loy 2016; Krause et al. 2016; Ni et al. 2016; Suwanmaneepong et al. 2016; Lippe and Grote 2017; Kibet et al. 2018; Apriani et al. 2020; Gichuki et al. 2020; Rodthong et al. 2020)	RSPO, GlobalGAP, Q-GAP, IFSS, MSPO
Farming Experience	–	(Kuldilok 2021)	Organic
	NS	(Asfaw et al. 2010; Muriithi et al. 2011; Krause et al. 2016; Rodthong et al. 2020)	RSPO, Q-GAP, GlobalGAP
Years Certified	+	(Suwanmaneepong et al. 2016; Kassem et al. 2021)	Q-GAP, GlobalGAP
	NS	(Muriithi et al. 2011; Kersting and Wollni 2012; Srisopaporn et al. 2015; Annor et al. 2016; Krause et al. 2016; Fakkhong and Suwanmaneepong 2017; Lippe and Grote 2017; Kibet et al. 2018; Apriani et al. 2020; Kuldilok 2021)	Organic, RSPO, GlobalGAP, Q-GAP
Females in Household	+	(Gichuki et al. 2020)	GlobalGAP
	+	(Asfaw et al. 2010; Kersting and Wollni 2012)	GlobalGAP
Household Size	+	(Muriithi et al. 2011)	GlobalGAP
	–	(Akinwale et al. 2019; Kersting and Wollni 2012; Asfaw et al. 2010)	UTZ, GlobalGAP
Farm Size	NS	(Kibet et al. 2018; Suwanmaneepong et al. 2016; Annor et al. 2016; Krause et al. 2016; Srisopaporn et al. 2015; Holzapfel and Wollni 2014)	GlobalGAP, Q-GAP
	+	(Muriithi et al. 2011; Kersting and Wollni 2012; Holzapfel and Wollni 2014; Kariuki and Loy 2016; Krause et al. 2016; Lippe and Grote 2017; Kibet et al. 2018; Apriani et al. 2020; Rodthong et al. 2020)	RSPO, GlobalGAP, IFSS
Age of Plantation	–	(Akinwale et al. 2019; Gichuki et al. 2020)	UTZ, GlobalGAP
	NS	(Suwanmaneepong et al. 2016; Fakkhong and Suwanmaneepong 2017; Gichuki et al. 2019; Schoneveld et al. 2019; Kassem et al. 2021; Kuldilok 2021; Mansor et al. 2021)	Organic, Q-GAP, MSPO, GlobalGAP, ISPO
Farm enterprises	–	(Apriani et al. 2020; Rodthong et al. 2020; Mansor et al. 2021)	MSPO, RSPO
	NS	(Akinwale et al. 2019; Schoneveld et al. 2019)	UTZ, ISPO
Land Ownership	+	(Muriithi et al. 2011; Annor et al. 2016)	GlobalGAP
	+	(Fakkhong and Suwanmaneepong 2017; Pandit et al. 2017; Kuldilok 2021)	GlobalGAP, Organic, Q-GAP
Assets	–	(Srisopaporn et al. 2015)	Q-GAP
	NS	(Suwanmaneepong et al. 2016; Schoneveld et al. 2019; Rodthong et al. 2020)	RSPO, Q-GAP, ISPO
Assets	+	(Asfaw et al. 2009, 2010; Kersting and Wollni 2012; Krause et al. 2016; Kibet et al. 2018; Apriani et al. 2020; Gichuki et al. 2020; Kuldilok 2021)	GlobalGAP, Organic, RSPO, Q-GAP

Note: NS means statistically not significant

outcomes and therefore it is more cost-effective to certify only when the farm starts fruiting. Given that cocoa and oil palm are medium to long-term crops mostly dominated by older and wealthy farmers compared to short-term crops, the positive relationship may mean that by the time the crop reaches fruiting stage, the producer would have improved existing infrastructure and acquired the experience and knowledge needed to handle challenges of compliance. Apart from Akinwale et al. (2019) who affirmed that older UTZ-certified cocoa farmers were very knowledgeable and well-experienced, similar trends were reported for GlobalGAP and Q-GAP farmers in Egypt and

Thailand, respectively (Suwanmaneepong et al. 2016; Kassem et al. 2021).

In some communities, household size is an important indicator of the number of farm hands available to support the household head in implementing certification standards and practices. The importance of household size was affirmed by Muriithi et al. (2011), who observed an increasing probability of compliance among farmers with more dependants. Likewise, Kersting and Wollni (2012) and Asfaw et al. (2010) reported that farmers overseeing households with more females were more likely to implement sustainability standards. However, the same authors and

**Table 9.** Determinants of certification standards compliance – economic capital factors.

Variable	Impact	References	Certification scheme
Farm Income	+	(Holzapfel and Wollni 2014; Krause et al. 2016; Ni et al. 2016; Gichuki et al. 2019, 2020; Kassem et al. 2021)	GlobalGAP, MSPO, Q-GAP
	NS	(Lippe and Grote 2017; Kibet et al. 2018)	GlobalGAP
Off-Farm Income	+	(Annor et al. 2016; Gichuki et al. 2020; Kassem et al. 2021)	GlobalGAP
	–	(Asfaw et al. 2009, 2010; Muriithi et al. 2011; Kersting and Wollni 2012)	GlobalGAP
	NS	(Srisopaporn et al. 2015; Rodthong et al. 2020)	RSPO, Q-GAP
Agronomic benefits	+	(Akinwale et al. 2019; Gichuki et al. 2019; Kassem et al. 2021)	UTZ, GlobalGAP
	–	(Gichuki et al. 2020)	GlobalGAP
	NS	(Lippe and Grote 2017; Apriani et al. 2020; Rodthong et al. 2020)	RSPO, GlobalGAP
Subsidy	+	(Gichuki et al. 2020)	GlobalGAP
Investment in PPEs	+	(Kariuki and Loy 2016)	IFSS
Family Labour	+	(Rodthong et al. 2020)	RSPO
	NS	(Asfaw et al. 2009; Srisopaporn et al. 2015; Suwanmaneepong et al. 2016; Lippe and Grote 2017; Kassem et al. 2021; Kuldilok 2021)	GlobalGAP, Organic, Q-GAP
Hired Labour	NS	(Fakkhong and Suwanmaneepong 2017; Rodthong et al. 2020)	RSPO, Q-GAP
Compliance Costs	–	(Lippe and Grote 2017)	GlobalGAP
	NS	(Ni et al. 2016; Akinwale et al. 2019)	UTZ, MSPO
Production Cost	+	(Kibet et al. 2018)	GlobalGAP
	NS	(Annor et al. 2016; Gichuki et al. 2019)	GlobalGAP
HH Expenditure	–	(Kibet et al. 2018)	GlobalGAP
Debt	–	(Rodthong et al. 2020; Kuldilok 2021)	Organic, RSPO
Aversion to Loss	–	(Kibet et al. 2018)	GlobalGAP
Aversion to Risk	+	(Kibet et al. 2018)	GlobalGAP

Note: NS means statistically not significant

Akinwale et al. (2019) also revealed that larger household sizes reduce the possibility of household heads complying with certification standards and practices. This may be attributed to increased household expenditure which decreases investments into compliance activities and facilities.

There appears to be overwhelming evidence supporting the influence of farm size on farmers' decision to comply with certification standards, with owners of large farms showing greater willingness to apply certification standards (Muriithi et al. 2011; Kersting and Wollni 2012; Kariuki and Loy 2016; Krause et al. 2016; Lippe and Grote 2017; Kibet et al. 2018; Apriani et al. 2020; Rodthong et al. 2020). That notwithstanding, few other authors have published dissenting results to demonstrate that larger farm sizes discourage compliance due to complexities involved in farm maintenance (Akinwale et al. 2019), and also in cases where the producer is financially less-endowed (Gichuki et al. 2020). For example, Kuldilok (2021) found decreasing levels of organic practice among micro (60.9%), small (56.8%), medium (50.8%) and large-scale (39.3%) farms enterprises. Additionally, evidence from the qualitative synthesis reveals that smaller farm sizes could either act as a barrier or facilitator to compliance, even within the same certification schemes but different commodities (Pandit et al. 2017; Annor 2018). For some commodities, the reasons have been linked to economy of scale and increased net

profits, while for others, the minimal workload associated with smaller farms is responsible for compliance.

Further, certification standards compliance was also reported to be linked to farmers' physical capital factors such as land, asset ownership and number of farm enterprises, which partly indicate farmers' ability to take risks or meet financial obligations. The evidence on the positive influence of land ownership supports the role of agricultural assets (i.e. tractors, harvesters, irrigation equipment, etc.), which was reported to improve compliance activities (Asfaw et al. 2010; Kersting and Wollni 2012; Krause et al. 2016; Fakkhong and Suwanmaneepong 2017; Pandit et al. 2017; Kibet et al. 2018; Apriani et al. 2020; Gichuki et al. 2020; Kuldilok 2021). Beside physical assets, Muriithi et al. (2011) reported that farmers' capacity to comply increase as the number of farm enterprises increase. For instance, in Ghana, a 14% increase in the probability of compliance was reported among GlobalGAP-certified pineapple producers following the addition of a single farm enterprise (Annor et al. 2016).

Though the age of plantation appears not significant within the context of UTZ implementation (Akinwale et al. 2019), its negative influence on farmers' compliance with oil palm certification standards cannot be ignored (Apriani et al. 2020; Rodthong et al. 2020; (Schoneveld et al. 2019)). Among certified producers in Malaysia, Mansor et al. (2021) explained that



**Table 10.** Determinants of certification standards compliance – social capital and institutional support factors.

Variable	Impact	References	Certification scheme
Group Membership	+	(Asfaw et al. 2009, 2010; Muriithi et al. 2011; Kersting and Wollni 2012; Krause et al. 2016; Fakkhong and Suwanmaneepong 2017; Gichuki et al. 2020; Kassem et al. 2021)	GlobalGAP, Q-GAP
Status in Group	NS	(Lippe and Grote 2017; Kibet et al. 2018)	GlobalGAP
Social Recognition	+	(Apriani et al. 2020)	RSPO
Contract Farming	+	(Pandit et al. 2017; Apriani et al. 2020)	GlobalGAP, RSPO
Training	+	(Asfaw et al. 2009, 2010; Gichuki et al. 2020)	GlobalGAP
	–	(Kibet et al. 2018)	GlobalGAP
Knowledge on standards	+	(Asfaw et al. 2009, 2010; Muriithi et al. 2011; Kersting and Wollni 2012; Srisopaporn et al. 2015; Suwanmaneepong et al. 2016; Rodthong et al. 2020; Kuldilok 2021)	GlobalGAP, RSPO, Q-GAP, Organic
	NS	(Holzapfel and Wollni 2014; Fakkhong and Suwanmaneepong 2017; Kibet et al. 2018; Apriani et al. 2020; Gichuki et al. 2020)	RSPO, GlobalGAP, Q-GAP
Ease of Compliance	+	(Asfaw et al. 2009; Akinwale et al. 2019)	GlobalGAP, UTZ
	NS	(Krause et al. 2016; Ni et al. 2016)	Q-GAP, MSPO
Mobile Phone/ Mass Media	+	(Rodthong et al. 2020)	RSPO
Market Information	+	(Asfaw et al. 2009, 2010; Pandit et al. 2017)	GlobalGAP
Market Access/certified buyer	+	(Annor et al. 2016; Rodthong et al. 2020; Kuldilok 2021)	Organic, RSPO, GlobalGAP
Seasons with Buyer, Number of Sellers	+	(Kersting and Wollni 2012; Holzapfel and Wollni 2014; Gichuki et al. 2020)	GlobalGAP
	–	(Asfaw et al. 2010)	GlobalGAP
Price Incentives	NS	(Kariuki and Loy 2016; Lippe and Grote 2017; Apriani et al. 2020)	IFSS, GlobalGAP, RSPO
	+	(Kariuki and Loy 2016)	IFSS
Extension Services	+	(Apriani et al. 2020)	RSPO
	–	(Kariuki and Loy 2016)	IFSS
Donor Support	NS	(Muriithi et al. 2011; Lippe and Grote 2017)	GlobalGAP
	+	(Annor et al. 2016; Kariuki and Loy 2016; Akinwale et al. 2019; Rodthong et al. 2020)	RSPO, UTZ, IFSS, GlobalGAP
Government Support	NS	(Asfaw et al. 2009, 2010; Kersting and Wollni 2012)	GlobalGAP
	+	(Kersting and Wollni 2012; Holzapfel and Wollni 2014)	GlobalGAP
Access to Irrigation	+	(Srisopaporn et al. 2015; Ni et al. 2016)	Q-GAP, MSPO
	+	(Asfaw et al. 2009; Kersting and Wollni 2012)	GlobalGAP
Access to credit	NS	(Asfaw et al. 2010; Kariuki and Loy 2016)	IFSS, GlobalGAP
	+	(Asfaw et al. 2009; Kassem et al. 2021)	GlobalGAP
Distance to Capital	NS	(Asfaw et al. 2010; Annor et al. 2016; Apriani et al. 2020; Gichuki et al. 2020)	RSPO, GlobalGAP
	–	(Kersting and Wollni 2012)	GlobalGAP
Distance to Input Seller	NS	(Krause et al. 2016; Schoneveld et al. 2019)	ISPO, Q-GAP
	–	(Asfaw et al. 2010)	GlobalGAP
Distance to Market	+	(Muriithi et al. 2011)	GlobalGAP
	NS	(Kibet et al. 2018; Gichuki et al. 2020)	GlobalGAP

Note: NS means statistically not significant.

53.3% of those who complied with standards had palm plantations under five years old, while the rest had plantations older than 6 years. Given that the oil palm tree fruits from third year and peaks progressively with age (Poku 2002), the possible explanation to this trend may be that, relatively, farmers with older plantations were getting good yields and did not expect to improve agronomic benefits by complying with sustainability practices.

Lastly, a few studies attempted to evaluate the relationship between compliance and marital status (Kibet et al. 2018), farm location (Rodthong et al. 2020), number of males in a household (Kersting and Wollni 2012), reported no statistically significant result. Although a number of studies in the Asia region highlight the prevalence of producer absenteeism (Ni et al. 2016; Jelsma et al. 2017; Schoneveld et al. 2019;

Karalliyadda and Kazunari 2020), only one examined its impact on producer compliance behaviour and reported no significant association (Mansor et al. 2021).

### **Economic factors**

The expenses incurred on production and compliance measures have been frequently noted to affect farmers' ability to meet farm assurance and quality management principles required for continued participation in certification schemes (Ouma 2010; Kersting and Wollni 2012; Kuwornu and Mustapha 2013; Brandi et al. 2015; Annor 2017, 2018; Kassem et al. 2021). It was revealed that compliance among cash crop farmers was motivated by perceived economic benefits, as well as other financial motivators and barriers (Pongvinyoo

**Table 11.** Barriers to certification standards compliance

Barriers	References
Small farm sizes	(Pandit et al. 2017)
Lack of land ownership	(Brandi et al. 2015; Jelsma et al. 2017)
High production cost/compliance costs	(Ouma 2010; Kersting and Wollni 2012; Kuwornu and Mustapha 2013; Brandi et al. 2015; Annor 2017, 2018; Pandit et al. 2017; Kassem et al. 2021)
Lack of financial capacity	(Kuwornu and Mustapha 2013; Pandit et al. 2017; Karalliyadda and Kazunari 2020)
Low financial benefits	(Ouma 2010; Pongvinyoo et al. 2014; Ansah et al. 2020)
Inadequate training	(Kuwornu and Mustapha 2013; Pongvinyoo et al. 2014; Annor 2018)
Low literacy levels	(Kassem et al. 2021)
Insufficient knowledge and skills	(Pongvinyoo et al. 2014; Brandi et al. 2015; Lemeilleur et al. 2015; Jelsma et al. 2017; Kassem et al. 2021)
High workload and time consuming	(Kersting and Wollni 2012; Lemeilleur et al. 2015; Wongprawmas et al. 2015a)
Complicated production principles and manuals	(Ouma 2010; Kersting and Wollni 2012; Pongvinyoo et al. 2014; Lemeilleur et al. 2015; Wongprawmas et al. 2015a)
Records keeping/documentation problems	(Kersting and Wollni 2012; Kuwornu and Mustapha 2013; Brandi et al. 2015; Kassem et al. 2021)
Lack of information on standards & markets	(Hutabarat et al. 2019; Kassem et al. 2021)
Lack of risk awareness/capacity to avert risk factors	(Karalliyadda and Kazunari 2020)
Lack of access to credit	(Jelsma et al. 2017; Annor 2018; Kassem et al. 2021)
Unavailability of inputs and planting materials	(Kuwornu and Mustapha 2013; Brandi et al. 2015; Jelsma et al. 2017; Hutabarat et al. 2019; Karalliyadda and Kazunari 2020)
Poor market conditions/absence of price incentives	(Kersting and Wollni 2012; Kuwornu and Mustapha 2013; Pongvinyoo et al. 2014; Annor 2017, 2018; Kassem et al. 2021)
Lack of external support	(Pongvinyoo et al. 2014; Brandi et al. 2015; Pandit et al. 2017; Karalliyadda and Kazunari 2020; Kassem et al. 2021)
Machinery and infrastructural gaps	(Kuwornu and Mustapha 2013; Pandit et al. 2017; Kassem et al. 2021)
Lack of quality of packaging	(Kassem et al. 2021)
Poor water quality/unavailability of water	(Pandit et al. 2017)
High rate of pests and diseases	(Annor 2018; Kassem et al. 2021)

et al. 2014; Ni et al. 2016; Ansah et al. 2020; Karalliyadda and Kazunari 2020). For example, continued compliance has been linked to increasing income (Krause et al. 2016; Gichuki et al. 2019; Kassem et al. 2021), and subsidies which led to a 40% increase in compliance among poor farmers (Gichuki et al. 2020). Holzapfel and Wollni (2014) noted that farmers' decision to comply with standards fundamentally depend on changes in their annual income over the previous year. According to them, certification resulted in a 90% increase in household income, and farmers who saw only a small or no increase in farm income were not motivated to comply and renew their certificates

**Table 12.** Facilitators of certification standards compliance.

Facilitators	References
Small farm sizes	(Annor 2018)
Higher sales volumes	(Tey et al. 2015)
Higher expected losses for non-compliance	(Tey et al. 2015; Karalliyadda and Kazunari 2020)
Boosted consumer confidence	(Tey et al. 2015)
FBO membership	(Okello and Swinton 2007; Kuwornu and Mustapha 2013; Brandi et al. 2015; Lemeilleur et al. 2015)
Threats of contract termination	(Okello and Swinton 2007)
Better market conditions & customer demand	(Okello and Swinton 2007; Lemeilleur et al. 2015; Tey et al. 2015; Wongprawmas et al. 2015a; Annor 2017)
Guaranteed access to inputs and planting materials	(Annor 2018; Hutabarat et al. 2019)
Access to support services (extension & export-oriented)	(Ouma 2010; Lemeilleur et al. 2015; Wongprawmas et al. 2015a; Jelsma et al. 2017)
Credibility of standard	(Wongprawmas et al. 2015a)
Frequent inspection	(Okello and Swinton 2007; Pongvinyoo et al. 2014; Ansah et al. 2020)
Hazard free neighbourhood	(Karalliyadda and Kazunari 2020)
Food safety awareness	(Tey et al. 2015; Wongprawmas et al. 2015a)
Expectations of high yields/high produce quality	(Lemeilleur et al. 2015; Annor 2017, 2018; Kassem et al. 2021)
Sustainability of soil health	(Pandit et al. 2017)
Effective quality assurance systems	(Karalliyadda and Kazunari 2020)

in subsequent years. In a recent study conducted in Egypt, Kassem et al. (2021) confirmed that farmers receiving higher annual income were well-informed about the importance of complying with certification standards and were encouraged to implement sustainable production practices.

All things being equal, income realized from non-farm activities is expected to enhance the risk-bearing capabilities of smallholder producers and increase annual household income. This review found mixed findings among scholars regarding the influence of non-farm income on the compliance behaviours of cash crop farmers. Largely, farmers with low or no off-farm income could not finance their farming activities from personal resources and could not establish facilities required for compliance, especially where they received no subsidies from the government or donors (Annor et al. 2016; Kassem et al. 2021). In variance, increasing off-farm income was observed to decrease compliance (Asfaw et al. 2009, 2010; Muriithi et al. 2011; Kersting and Wollni 2012), possibly due to absenteeism and lack of time to implement good agricultural practices.

While the expected farm output and agronomic benefits such as yield and farm efficiency are frequently reported among the important drivers of compliance among many producers (Akinwale et al. 2019; Gichuki

et al. 2019), yield has been revealed not to influence compliance among poor producers in Kenya (Gichuki et al. 2020). The compliance decision of producers was reported to improve with low compliance costs and farmers' ability to invest in protective clothing (Kariuki and Loy 2016). Under normal circumstances, increasing the cost of production means a decrease in funds available for other farm expenditures, which may negatively affect the implementation of good agricultural practices. Surprisingly, production cost was reported to influence compliance decisions in Kenya positively. However, as Kibet et al. (2018) pointed out, French beans farmers willing to expend on a single increase in cost of production were more than two times likely to comply with international certification standards. A possible explanation is that, despite the high costs of certification, farmers were motivated by the high level of profitability accompanying production under certification and therefore were not deterred from complying.

Other economic factors reported to determine farmers' willingness to comply with certification standards include regular cash outflow factors such as household expenditure (Kibet et al. 2018) and payment of debt (Rodthong et al. 2020; Kuldilok 2021). If not managed effectively, these expenditure items can deplete producer liquidity and affect the proportion of farmers' income invested in farm activities and infrastructure, including those required for better compliance with certification standards.

Risk and uncertainty are important considerations in the decision-making processes of producers. Farmers complained that the lack of risk awareness and the lack of capacity to avert risk or losses were significant barriers to the implementation of standards (Karalliyadda and Kazunari 2020). Only Kibet et al. (2018) illustrated the impact of this variable. They demonstrated that, risk-averse farmers were over 26 times more willing to comply with certification standards. In contrast, loss-averse farmers were discouraged from complying with standards due to the high costs, expected losses and unreliable income associated with certification standards compliance.

### ***Social capital and institutional support factors***

Being social actors, smallholder farmers acquire and exploit social capital in their decision-making. The effect of social capital is usually evidenced by the influence of institutional actors and social networks in

providing access to finance, infrastructure, knowledge and policies (Carolan 2006; Carlisle 2016). These external influences have been reported to explain variations in cash crop farmers' decisions to comply with sustainable agricultural practices.

First, membership in a producer association yields some influences on farmers (Okello and Swinton 2007; Kuwornu and Mustapha 2013; Brandi et al. 2015; Lemeilleur et al. 2015). It can provide social collateral and has a way of mending attitudes and behaviours, while the group can provide support to members, with individual members whipping themselves in line with overall group decisions. As reported in the available literature, long-standing group members tend to comply more with certification standards than those with few years of membership (Asfaw et al. 2009; Muriithi et al. 2011; Kersting and Wollni 2012; Krause et al. 2016; Fakkhong and Suwanmaneepong 2017; Gichuki et al. 2020; Kassem et al. 2021). What explains this is the fact that compared to non-members or newcomers, old members may have had the opportunity to participate in several group activities and capacity-building interventions that drive conformity to their group's collective decisions.

Qualitative literature opined that, compliance among export producers could be motivated by the threat of contract termination (Okello and Swinton 2007), as it could rob them of guaranteed credit, quality inputs, price incentives, and other important services (Lemeilleur et al. 2015; Tey et al. 2015; Wongprawmas et al. 2015a; Annor 2017, 2018; Hutabarat et al. 2019). Nonetheless, quantitative studies have reported mixed results testing the relationship between contract farming and farmers' compliance with certification standards. For instance, in Kenya, where up to 99% of certified farmers operated under contracts (Muriithi et al. 2011), farmers' participation in contract farming was noted to increase the possibility of compliance (Asfaw et al. 2010; Gichuki et al. 2020), while Kibet et al. (2018) found it to discourage compliance.

Being perceived as a good farmer is prestigious for many smallholders and often outweighs immediate financial benefits. In this review, social recognition was reported to exert positive influences on the compliance decisions of some farmers. In a study conducted in Sumatra, Indonesia, Apriani et al. (2020) observed that social status explained the willingness of certified farmers to comply with standards. For some

compliant producers, peer recognition and invitation to advice non-certified producers on sustainable plantation management is enough reason to comply. Similarly, Pandit et al. (2017) found social participation to be an important driver of compliance among GlobalGAP-certified basmati rice farmers in India.

Knowledge and awareness are central to the adoption and implementation of technology. These traits are shaped through training and the availability of appropriate information. These factors were part of the most important facilitators of compliance among cash crop farmers cultivating different commodity crops (Asfaw et al. 2009, 2010; Muriithi et al. 2011; Srisopaporn et al. 2015; Annor et al. 2016; Suwanmaneepong et al. 2016; Rodthong et al. 2020; Kuldilok 2021). There were reported cases in qualitative studies, where information deficit (Hutabarat et al. 2019; Kassem et al. 2021), inadequate training (Kuwarnu and Mustapha 2013; Pongvinyoo et al. 2014; Annor 2018) and insufficient knowledge (Brandi et al. 2015; Lemeilleur et al. 2015; Jelsma et al. 2017) acted as barriers to compliance. A number of quantitative surveys corroborated these observations. In a study of compliant and non-compliant farmers, Asfaw et al. (2009) observed differences in training, knowledge levels, mobile phone use and mass media exposure which increased producer awareness of emerging sustainability principles and facilitated compliance. A significant increase in compliance was also reported among fruit crop farmers after receiving additional training (Suwanmaneepong et al. 2016). Likewise, Rodthong et al. (2020) and Kuldilok (2021) revealed similar improvements in the compliance decisions of RSPO-certified oil palm farmers after they attended series of training and obtained access to market information. According to Rodthong et al. (2020), farmers upgrade their knowledge through more training and adequate access to market information, which ultimately improved compliance by 35.4%. These authors further asserted that more sustainability practices would be adopted if farmers perceived techniques as easily adoptable.

Across different countries in Africa and Asia, compliance was reported to have improved due to the availability of extension support services (Annor et al. 2016; Kariuki and Loy 2016; Akinwale et al. 2019; Rodthong et al. 2020). Through training and extension services, producers received support for documentation and the cumbersome certification manuals and principles were simplified (Ouma 2010; Pongvinyoo et al. 2014; Brandi

et al. 2015; Lemeilleur et al. 2015; Wongprawmas et al. 2015a). Extension support services led to improved compliance among 83% of certified producers (Muriithi et al. 2011).

Further, Akinwale et al. (2019) observed that compliance facilitators include knowledge of standards and agronomic practices, which was very high (94.74%) in cocoa farming communities. This was attributed to the intervention of the private sector, government (Srisopaporn et al. 2015; Ni et al. 2016), and donors (Holzapfel and Wollni 2014), who provided support services, access to credit and access to irrigation infrastructure, which were reported to increase compliance and continued certification (Asfaw et al. 2010; Kersting and Wollni 2012; Kassem et al. 2021). Without donor or governmental financial support, some farmers would be unable to implement international sustainability standards due to high compliance costs (Ouma 2010; Kersting and Wollni 2012; Kuwarnu and Mustapha 2013; Brandi et al. 2015; Annor 2017; Lippe and Grote 2017). The critical role of donors and other private players was further highlighted by Kersting and Wollni (2012) who reported that donor-managed quality management systems raised compliance by 88%, while exporter-managed systems increased the probability of compliance by 48%.

The expected economic benefits can only accrue to farmers if they have access to markets where they can offload their produce in exchange for financial rewards. Apart from Asfaw et al. (2010) who reported an inverse relationship for experience in export, factors related to market access and participation in export production were observed to positively boost farmers' willingness to comply with certification standards (Kersting and Wollni 2012; Holzapfel and Wollni 2014; Gichuki et al. 2020). Other market-associated factors that were found to drive compliance include the length of the seller-buyer relationship, the number of sellers supplying the market (Kariuki and Loy 2016) and price premiums (Apriani et al. 2020). GlobalGAP-certified pineapple producers were more than willing to shift to either Organic or Fairtrade in Ghana because of expected price premiums and better market conditions (Annor 2018).

Also, the impact of proximity indicators such as distance to market (Muriithi et al. 2011), distance to input seller (Asfaw et al. 2010) and distance to district or provincial capital (Kersting and Wollni 2012), cannot be ignored. These factors were reported to

influence access to market centres and recommended agro-inputs, which could facilitate compliance.

Notwithstanding the significant observations discussed above, the evidence on the influence of training, extension services, agronomic knowledge, market access, price incentives and access to credit, were largely mixed. This paints a general picture of uncertainty regarding their overall impact on the compliance decisions of the widely heterogeneous groups of cash crop producers across Africa and Asia. Lastly, qualitative synthesis observed producer compliance behaviour to be motivated by frequent inspection (Okello and Swinton 2007; Pongvinyoo et al. 2014; Ansah et al. 2020), awareness on food safety (Lemeilleur et al. 2015; Tey et al. 2015; Wongprawmas et al. 2015a; Lippe and Grote 2017), soil health sustainability and water quality, concerns (Pandit et al. 2017). However, only Lippe and Grote (2017) conducted a study to illustrate the quantitative link between certification standards compliance and producers' health and water quality consciousness, but the result was statistically not significant.

## Discussions

### **Active contributors and emerging trends in agricultural certification compliance research in Africa and Asia**

The present review provides a snapshot of academic work on compliance drivers among producers of cash crops in Africa and Asia. The study observed that, interest in the factors influencing farmers' compliance decisions has only increased slightly within the last six years, as witnessed in the number of articles published within the period, following a pioneering study fourteen years ago. Much of the issues behind the relatively increasing attention can be associated with recent growth in food safety and environmental issues and the increasing border rejections and rising awareness in the media. Siddh et al. (2017) noted similar trends in the agri-fresh industry where growing interest in sustainability management was equally attributed to increased awareness among practitioners and scholars. Despite aggregate increases in the volume of publications, fluctuations within the last four years create the impression that the certification standards compliance research area suffers maturation problems. The developmental laxity of agricultural

certification compliance research is affirmed by the underrepresentation of some certification schemes, value chains and countries, which was also reported in the reviews of (Tröster and Hiete 2018; Schleifer and Sun 2020; Reiss-Woolever et al. 2021; Traldi 2021; Abas et al. 2022). This may partly be attributed to the generally declining inflows for agricultural research in developing economies (Pardey et al. 2006; Jayne et al. 2021), and its competition with other areas of interest.

An analysis of contributors revealed the involvement of 109 researchers, with the dominance of Germany affirmed by the influence of Ouma Stefan of *Geoth University Frankfurt* and Wollni Meike of *Georg-August-Universität Göttingen*, whose contributions provided guidance for other researchers in this field. This paper observed stronger partnerships between researchers based in major agri-food importing countries in the EU and North America, and exporting countries in Africa and Asia. This was evident in the influence of other authors and institutions based in Germany, United States, Netherlands, Kenya, Thailand, Ghana and Indonesia. Similar findings were published in another review where (Brito et al. 2022) noted the greater contributions of Europe and US-based scholars to agricultural certification research. Apart from being the main generators of publications on the topic, researchers from the most productive countries also demonstrated a greater willingness to collaborate towards the development of the domain. For example, the trend saw scholars in Germany and United States linking up with partners in Kenya, Ghana, Thailand, Indonesia and Malaysia to influence the stream of sustainability and certification standards research. Given that the global south are net exporters of raw agricultural materials to the north in exchange for finished products and foreign exchange earnings, their mutual economic expectations and benefits may explain these collaborative networks. In recent decades, border rejections and sanctions over non-compliant and unwholesome agricultural products have led to frequent tussles between exporter and importer countries (Bovay 2016; J. Buzby et al. 2008; Jaud et al. 2013). Such occurrences have negative implications for the food security status of importing nations, and also affect the economies of exporting countries. It is possible that the disputes coupled with rising food safety, environmental and ethical concerns among consumers in Europe and North America, may have engineered the burgeoning research partnerships

between institutions at both ends seeking to contribute insights towards producer compliance with standards.

Moreover, productive linkages can enhance the capacity of researchers and advance the knowledge base through the exchange of ideas and best practices that can facilitate improvements in food safety standards. Such research partnerships are important for some countries in Africa and Asia, which may not possess the economic and research wherewithal to conduct solo studies into the certification and sustainability standards domain. For scholars in these less-endowed countries, funding from partner countries provide the fuel for quality publications (Carbonnier and Kontinen 2015). Perhaps, the increasing patronage of internationally co-authored articles may have partly contributed to the relatively strong connections between researchers in the different countries seeking to increase their impact.

In recent decades, strategic increases in the proportion of China's GDP going into research and development expenditure has resulted in qualitative and quantitative growth in its international collaborative publications (see reviews by Wang et al. 2013; Ma and Li 2018; Feng 2020; Zhu et al. 2021; Adams et al. 2022; Mitchell Crow 2022). In a bibliometric review, (Yang et al. 2017) reported that between 2006 and 2015, China's international collaboration research output quadrupled to about 71,000 publications. Even in large multi-author scientific studies, Chinese researchers contributed to more than half (2,724) of the 4,976 papers published globally. The same review ranked the nation's collaborative performance in agricultural research above average. China's position as a leading exporter of fresh produce (Shields and Huang 2004; WITS Data 2019), makes it an important stakeholder in agricultural standards discussions, and requires the country to pay attention to the topic. Surprisingly, in this review, China performed outside the top 10 countries influencing the stream of agricultural standards compliance research, and seems to have kept a rather reserved posture, with limited collaborations with other countries. However, it is possible that the contribution of China was understated since most publications from that country may have been published in Chinese language source journals and therefore were not indexed in Scopus.

Furthermore, from the journal distribution angle, *Agribusiness* was the most productive source during the observation period, while *Economic Geography*

was the most cited and influential journal. While the review notes that there were many articles from journals in the agriculture and biological sciences category than any other category, the interdisciplinary nature of the certification compliance domain is made visible with many selected articles published in journals focusing on environmental sciences, business and economics, social sciences, behavioural sciences and technology disciplines.

### ***Determinants of farm certification compliance***

A frequent challenge in most certification schemes is unequal adoption and compliance across socially and economically diverse producer groups. Consistent with the review of (Wongprawmas et al. 2015b), the current study uncovers large compliance gaps among certified cash crop farmers in Africa and Asia (e.g. Kuldilok (2021); Mansor et al. (2021); Rodthong et al. (2020); Schoneveld et al. (2019); Pandit et al. (2017); Fakkhong and Suwanmaneepong (2017); Srisopaporn et al. (2015); Asfaw et al. (2009)). That notwithstanding, cases of moderate to full compliance levels have also been reported in existing literature (e.g. Annor et al. 2016; Annor 2017; Kassem et al. 2021). To a large extent, producer compliance decisions are a collective outcome of a multiplicity of demographic, economic, and social capital factors embedded at farmer, buyer and institutional levels. In detail, there appears to be some level of agreement among scholars that the compliance decisions of certified farmers across various value chains in Africa and Asia are partly shaped by their farm income and wealth. In the case of agricultural producers, wealth includes physical assets such as farm machinery, storage facilities, irrigation, land, and the number of additional farm enterprises (e.g. poultry and livestock), which has been reported to improve compliance.

Further, from the results, despite the overwhelming qualitative evidence among producers that premium market outlets, long-term contracts can facilitate compliance, researchers appear divided over the role of market-related factors and interventions such as export access, price incentives, credit access, contract farming and distance to market. Nevertheless, quantitative evidence reveals that increasing access to market information encourages compliance, particularly among producers certified under schemes focused on food quality and environmental protection.

From the review, the barriers to compliance include insufficient knowledge and skills as significant barriers and the time-consuming production and records keeping processes. To facilitate compliance, these cumbersome activities may require additional labour, training, extension support and producers' ability to comply improves as they acquire more experience through years of certified production. With each additional year of certified production, producers become aware and rectify areas of non-compliance that are highlighted during audit processes. With time, farmers could become used to the hitherto cumbersome production principles and record-keeping procedures and overcome such compliance barriers. Even though certification experience is identified to increase Global-GAP compliance, there is little evidence in the current literature to conclude that producers with more farming experience can overcome compliance challenges, as most studies found its influence to be insignificant within different contexts.

Additionally, the results revealed mixed effects relative to the effect of education, training, and agronomic knowledge. That notwithstanding, there is convergence among researchers that the provision of extension support services improves farmer practices and lead to better compliance in almost all certification schemes.

In order to meet increasing labour demands for compliance with certification standards, household heads sometimes resort to hired labour or family labour (Oya et al. 2018). However, this review points to an evidence base questioning the influence of both hired and family labour. Interestingly, the results reveal a link between female household membership and compliance can be traced to the value they provide to support farm labour. Apart from their normal household duties, women have been the preferred choice for jobs in the upstream sector of agricultural export value chains (Meemken and Qaim 2018; Oppong and Bannor 2022) which could be the reason for the effect.

In several cases, the absence of bigger groups and inactive participation has discouraged compliance as smallholder producers have been found to lack the level of organization needed for enrolment into certification schemes (Okello and Swinton 2007; Kuwornu and Mustapha 2013; Brandi et al. 2015; Lemeilleur et al. 2015). However, through collaborative efforts, producer associations can pull resources together towards joint investments that can reduce per

farmer cost of mechanized assets and provide technical assistance for members to comply with standards. The crucial role producer group membership plays in the compliance behaviour of certified farmers has been confirmed in this review, which notes congruent findings. Likewise, other social influence factors, i.e. social recognition and a producer's status in the group, have also led to better compliance with standards. In one example, compliant farmers expressed pleasure at the precision and neatness of their farms compared to the state before compliance and seemed fulfilled by the recognition awarded them by members who invite them to help rectify non-compliances on their farms. These observations are consistent with the findings of farmer decisions reviews conducted by Dessart et al. (2019) and Fadeyi et al. (2022).

There is a growing evidence base demonstrating how compliances challenges bordering on access to external support services, credit, infrastructure and policy, can be minimized through the collective intervention of government, donors and private companies. Partnerships between these entities generated increased access to quality inputs, extension services, training, information, irrigation, storage, credit and subsidies which stimulated compliance to international standards in some cases. Financial incentives from the government, donors and exporters are crucial factors that enable less-endowed farmers to improve farm facilities and implement better management practices, as reported in previous reviews by Liu et al. and (Tröster and Hiete 2018).

In summation, evidence shows that, there have been significant efforts to investigate how a wide range of factors influence the decision-making processes of compliant farmers in Africa and Asia. Between Africa and Asia, there are no specifically significant trends with regards to how each of the factors of compliance affect producers on each continent differently and how they play out differently across the different schemes or value chains. It appears that what happens in Africa also happen in Asia, which is not quite surprising given that most countries on both continents are culturally collectivists (Hofstede 2001), with traits that shape individual attitudes and affect innovation diffusion and technology efficiency patterns in similar ways (Hofstede 2001; Desmarchelier and Fang 2016; Oyetunde-Usman et al. 2021; Ruzzante et al. 2021; Tanko and Ismaila 2021). However, the few conclusive results and many mixed evidence witnessed in

both continents means that the effects of the various factors are not market or continent-specific but cut across different certification schemes, value chains and country contexts. Therefore, similar to the reviews of Schleifer and Sun (2020), Oya et al. (2018), and Meemken (2020), the current review observes that the impact of these factors remain context-specific. This implies that producers in different commodity value chains differ in how they are affected by the barriers to compliance within the same certification schemes and may even react differently to similar interventions. For example, the influence of training on farmers' compliance decisions has varied dramatically across different certification schemes, value chains, and geographical settings. Therefore, it is essential to prioritize evaluations into factors that affect compliance within individual certification schemes, since most certification systems expand their range of standards in different settings (Oya et al. 2018).

## Conclusions

This paper provides the first bibliometric study and literature survey of scholarly publications on agricultural producers' compliance with certification standards. We articulate evidence on how various factors interact to engender compliance among certified cash crop producers in Africa and Asia, to provide baseline data for future research, programme and policy development. The review showed that many international research collaborations occurred between financially-endowed institutions in Europe and North America and partner institutions in Africa and Asia, resulting in some quality publications. Such research partnerships can encourage the exchange of best practices and facilitate improvements in the research capacity of scholars. International research collaborations provide funding for scholars in countries where public expenditure on agricultural research is declining (Jayne et al. 2021). The result of these collaborations are that, Germany, Kenya, Thailand, Ghana, and the USA are among the leading actors advancing knowledge on certification standards compliance. Germany and the USA are the most influential constituents providing guidance and baseline funding for academic research in this area.

This review summarized the literature on the drivers of the compliance behaviours of certified cash crop producers and found that empirical research has been attentive to a broad range of factors

related to producer characteristics and physical capital, economic capital, social capital, and institutional capital support. The authors observed that some factors such as asset value, risk aversion, household expenditure, debt payment, social status, ease of compliance, information channels, and donor and government support influence certification standards compliance. The impact of many other factors, including age, education, gender, household size, farm and off-farm income, farm size, experience, training and knowledge, contract farming, and producer group membership, was mixed. Therefore, any immediate efforts to promote compliance should involve multiple interventions targeting the different contexts and actors. Further, the review also highlighted the significance of social influence and peer-to-peer learning on knowledge sharing, which can improve the sustainability practices of non-compliant farmers. Therefore, farmer-to-farmer participatory approaches should be adopted in future training and awareness campaigns.

## Implications and directions for future research

Going forward, scholars in Africa and Asia should explore more avenues for international cooperation, given the better funding opportunities available to their counterparts in developed countries, and their willingness to collaborate as reported by the reviews of Adams et al. (2013) and Sweileh (2020). However, it is important to caution that such partnerships must strategically aim at improving best practices and the quality of literature on agricultural sustainability standards compliance. Because, beside the strong partnership affinity shown by certain institutions in the global north, incidents of unilateral agenda-setting have been of great concern to their collaborating partners in the south. Such practices bring less benefits to scholars and institutions in resource-poor countries as they tend to focus on the priorities and perceived quality of the funding partners given their minimal input in the research design. To address this problem, this review adds to the suggestion of Carbonnier and Kontinen (2015) that southern scholars should accentuate their engagements with the Dutch and Swedish aid agencies, who are known to offer more symbiotic research collaboration. Shih and Forsberg's (2022) review of Swedish-Chinese research collaborations provides evidence of such beneficial relationships. Essentially, these funding agencies permit



southern scholars to make an input into research design and in some case empower them to appoint their own northern partners prior to the submission of proposals.

Second, while the number of certified farmers and arable areas keeps increasing across Africa and Asia, the aggregate volume of available literature and the slow growth suggests that the research domain related to agricultural certification standards compliance is relatively immature. Consequently, significant research gaps exist within the underrepresented or unexplored certification schemes and product value chains in specific countries. Also, given the many mixed and inconclusive evidence exposed in the current review and the fact that these certification schemes apply to commodities that contribute significantly to the export earnings of most economies in Africa and Asia, empirical research recommendations in this direction would provide a concrete knowledge base to support programmes aimed at improving compliance and the market integration of agricultural producers in the two regions. Thus, the strength of influence of the key determinants of compliance behaviour can vary significantly across different certification schemes, value chains and geographical settings. Besides, currently, there are no studies evaluating the determinants of compliance within six certification schemes, namely, *Cotton Made in Africa (CmiA)*, *Better Cotton Initiative (BCI)*, *Common Code for the Coffee Community (4C)*, *ProTerra*, *Roundtable on Responsible Soy (RTRS)* and *Bonsucro*. However, for all these schemes, there are certified producers in Africa and Asia (ITC 2018, 2021), and therefore the scarcity of literature on them represents a significant research gap that needs to be filled.

Over the years, researchers have drawn from behavioural theories as well as theories on technology adoption, acceptance and innovation diffusion to explain the decisions of producers and consumers of agricultural products (e.g. Wang et al. (2022); Bannor et al. (2021); Bunei et al. (2021); Monjardino et al. (2021); Pan et al. (2021); Kaler and Ruston (2019)). These theories and many other frameworks provide reasonably coherent explanations to what researchers observe and can provide an excellent basis for practice. Apart from econometric theories applied in the quantitative analysis, none of the selected literature on certification standards compliance was conducted

within an existing behavioural theory. This review suggests that producers' compliance intentions and decisions can be explained by integrating the key contextual factors, facilitators, and barriers within the framework of two or more of the theories mentioned above. It would be intriguing to see future researchers employ the *Unified Theory of Technology Acceptance and Use of Technology (UTAUT)* to synthesize the compliance attitudes of agricultural producers. This theory suggests that usage decision are a function of four important constructs (i.e. 'effort expectancy', 'performance expectancy', 'social influence' and 'facilitating conditions'), moderated by personal and socio-economic factors (e.g. gender, age, income, experience, etc.) (Venkatesh et al. 2003). The appropriateness of *UTAUT* for this domain is that, these constructs align with the various motivators or barriers of acceptance or use, which would allow the researcher to track the key motivators behind farmers' intentions to comply with certification standards in any given context. Also, the extent to which practices of peers and neighbouring farms influence compliance decisions warrants deeper investigations. In this direction, the *Social Network Theory* can also provide better explanations on the role of peer influence in future studies.

### Limitations

Many review methods have inherent flaws. However, this study minimizes the bias of a single technique by integrating high-level bibliometric analysis with a traditional content review of existing literature. With a considerable number of qualitative studies, a rich source of information is provided on the barriers and facilitators to support the analysis of the quantitative influence of the factors associated with compliance.

Despite the rigorous and systematic search for pertinent literature with no date restriction and the large volume of literature that resulted, the study found only a limited number of eligible studies on certification standards compliance, with certain certification schemes, commodities and active countries under-represented in the evidence base. This study is based largely on academic peer-reviewed articles retrieved from the Scopus database and published in English. However, since the certification standards literature involves a sizeable volume of documents that may not be hosted in Scopus, evidence from non-English speaking countries may have been

underestimated. This has implications for the findings on active contributors to this research domain. The involvement of a wider range of databases could provide a detailed evidence base and additional perspectives. For example, academic databases like the Web of Science, AgEconSearch, Google Scholar, grey literature catalogues and an exhaustive manual search of specialist magazines, databases of certification bodies and NGOs, were not possible in this review due to resource limitations, could be considered.

Nonetheless, the robustness of this review is not dimmed, as the Scopus database includes the highest quality peer-reviewed literature and has been employed by many authors to accomplish quality reviews. Moreover, the findings of this review present a comprehensive picture of the knowledge landscape of research related to certification standards compliance, highlighting the drivers of compliance, potential research areas and possible directions for future action on policy and programming.

## Note

1. In the context of this review, cash crops refer to primary crop commodities whose yields are intended to generate income rather than for farm family consumption. Cash crops may differ by country but include both food and nonfood crops usually cultivated as export or commercial crops and sold on the domestic or international markets (Mulvaney and Robbins 2011; Robbins 2007).

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No potential conflict of interest was reported by the author(s).

## Data availability statement

The data used for the study is from the Scopus database by using keywords as indicated in the methodology, and is widely available for any researcher. However, the key search string has been deposited in the Mendeley database at <https://data.mendeley.com/datasets/cvngx9s3xrt/1>.

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