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Priscila Duarte Malanski, Sandra Schiavi, Benoît Dedieu, Julio Cesar Damasceno. Labor in agrifood value chains: a scientometric review from Scopus. *International Food and Agribusiness Management Review*, 2022, 25 (3), pp.449 - 468. 10.22434/ifamr2021.0066 . hal-03721691

**HAL Id: hal-03721691**

**<https://hal.science/hal-03721691v1>**

Submitted on 12 Jul 2022

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*International Food and Agribusiness Management Review*

*Please cite this article as 'in press'; DOI: 10.22434/IFAMR2021.0066*

Received: 19 May 2021 / Accepted: 24 December 2021

## **Labor in agrifood value chains: a scientometric review from Scopus**

### **REVIEW ARTICLE**

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### **Abstract**

Addressing labor issues is crucial to agrifood value chain analysis, improvements and sustainability. However, the specific contribution of value chain approaches to discussions on labor in agriculture is still a research gap. To fill this gap, we reviewed the international literature on labor in agrifood value chains. We performed a scientometric analysis of the articles indexed in Scopus, which was composed by a bibliometric, diachronic and synchronic analysis. The main results show that labor in agrifood value chains is a relative new scientific community. Researchers' interest evolved around three hotspots over the past 20 years, and five consolidated research domains. Our review provides an overview about the main characteristics of a rising scientific community, and a synthesis of knowledge produced to support scientific innovation on labor in agrifood value chains. Regarding chain agents, our results stress the importance of governance for improving employment and working conditions to promote chain sustainability.

**Keywords:** labor, agriculture, value chain, governance, scientometric analysis

**JEL code:** J43, J8, Q17, Q18

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## 1. Introduction

Agricultural sector is responsible for 3.4% of the world's gross domestic product (GDP), 27% of global employment, and near half of the global population lives in rural areas (World Bank, 2021). It is a sector with contrasted relation to employment: on the one hand, we observed the decrease of agricultural workforce in OECD countries; on the other hand, there is a need for decent employment in many rural areas in the Southern countries facing high demographic growth, particularly in Africa (Losch, 2016). In this sense, agrifood value chains are a significant lever to promote the creation of rural employment and to connect farmers to markets.

A value chain is defined as the full range of activities required to bring a value-added product from production to consumption (Kaplinsky and Morris, 2000). This process can take two ways in agrifood value chains, such as global value chains – generally connecting agricultural producers in developing countries to consumers in developed ones (Barrientos, 2013; Riisgaard and Hammer, 2011), and short value chains – generally connecting local farmers to local consumers (Dupré *et al.*, 2017; Mundler and Jean-Gagnon, 2019).

Since agricultural sector is organized into diverse activities, such as vegetal production, livestock, fishery, among others, several studies have been published focusing on specific type of agrifood value chains worldwide, such as coffee in Brazil (Piao *et al.*, 2019), dairy in Tanzania (Lie *et al.*, 2012), fisheries in Malawi (Manyungwa *et al.*, 2019), rice in Bangladesh (Minten *et al.*, 2013), and horticulture in Mexico and African countries (Barrientos *et al.*, 2003; Grammont and Flores, 2010; Kritzinger *et al.*, 2004). These studies were performed in different agricultural models, considering farm size and labor, such as large-scale farms based on hired labor (Barrientos *et al.*, 2003; Gibbon and Riisgaard, 2014), peasant and small-scale agriculture based on family labor (Manyungwa *et al.*, 2019; Pegler, 2015). Despite all these differences, labor is the common issue among those studies.

According to the Food and Agriculture Organization (FAO), addressing labor issues by promoting decent work is a crucial condition to develop sustainable agrifood value chains (FAO, 2014). Agrifood value chains sustainability is based on three principles: (1) economic – related to competitiveness and profit generation, increasing wages and income to distribute value-added among stakeholders; (2) social – related to inclusiveness, equitably distribution of benefits along the chain, and healthy working conditions; and (3) environmental – related to rational use of natural resources to avoid depleting them. Decent work conditions are directly linked to economic and social sustainability through creation of employment opportunities and high-quality jobs, increasing wages and income, supporting labor productivity, providing safety working conditions, and complying with workers' rights (FAO, 2014). In this sense, addressing labor issues through mechanisms of value chain coordination and governance is a medium to achieve agrifood value chain sustainability. For example, in coffee value chain in Nicaragua, fair trade is a mechanism that regulate the distribution of value through: (1) a price premium for farmers, which improved wages and income; (2) a premium for social development, which was used to promote training programs to improve technical skills of farmers to increase coffee quality (Valkila and Nygren, 2010). Addressing these labor issues increased the capacity of farmers to face market price fluctuation and access niche markets, which encourages farmers to keep producing coffee and contributes to the sustainability of coffee value chain.

Value chains are pointed as a key lever to address the ongoing and future transformations in rural labor at farm level and beyond, especially in developing countries experiencing the movement of farm workforce to food processing and services (Christiaensen *et al.*, 2020). Recent reviews on work in agriculture highlighted the increasing importance of value chain approach for understanding current labor dynamics (Christiaensen *et al.*, 2020; Malanski *et al.*, 2019, 2021). These reviews are focused on work at farm-level, although they point out that labor is an issue that can be analyzed at chain-level through the lens of value chain approach (Malanski *et al.*, 2019, 2021). In this sense, we assume that vertical relations between upstream and downstream agents are both impacting and addressing labor issues in agrifood value chains. The dyadic interaction between agents along the chain are central to understand the mechanisms allowing decent work conditions in a sustainable agrifood value chain. These mechanisms are even more important in global value chains,

considering that upstream and downstream agents are imbedded in different institutional contexts, which implies in different labor regulations and governance mechanisms.

Value chain approach provides a framework to analyze arrangements between agents, and how they are coordinated and governed to make agrifood value chain works (FAO, 2014; Gereffi *et al.*, 2005; Kaplinsky and Morris, 2000). The focus on chain agents is an advantage of value chain approach to analyze labor, principally comparing with closely approaches, such as food systems – more focused on the outcomes of value chain activities (e.g. nutrition, food security, socio-economic growth, equity and environmental sustainability); or supply chain – more focused on the flow of product through time and space (FAO, 2014; Farmery *et al.*, 2021). Therefore, value chain is an original and appropriate theoretical point of view to analyze labor issues, considering that division of labor on farms or rural labor market dynamics are the dominant subjects in work studies in the agricultural sector (Malanski *et al.*, 2019, 2021).

The major advances of value chain background on labor studies in agricultural sector remains unclear, despite the recognized importance. Therefore, the specific contribution of value chain approaches to discussions on labor in agriculture is still a research gap. In order to fill this gap, the aim of this study was to review the state of the international literature connecting labor and agrifood value chains through a scientometric analysis of the articles indexed in Scopus bibliographical database.

In the next section, we detailed the methodological design of the scientometric analysis. Then, we present the results related to the international literature review. Advances, limitations and perspectives for studies on labor in agrifood value chains are finally discussed.

## 2. Methodology design of the scientometric analysis

The scientometric analysis was performed in three steps, according to the PRISMA guidelines for reviews (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Moher *et al.*, 2009) (Figure 1).

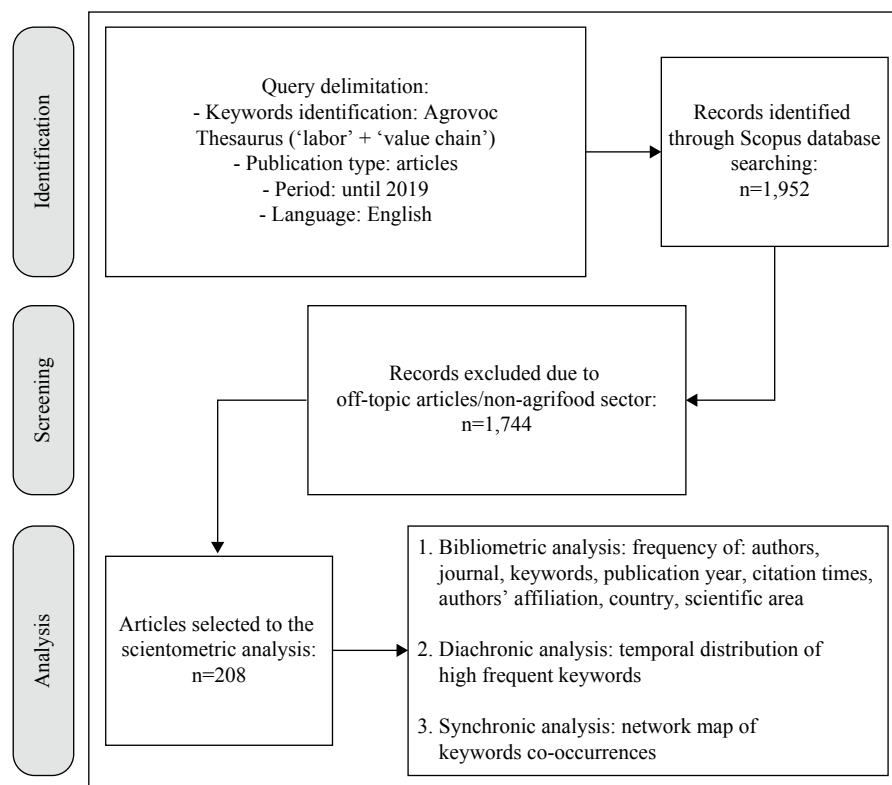
The first step was data collection (Figure 1). Since the article identification in Scopus is keyword-oriented, the standard vocabulary related to 'labor' and 'value chain' were identified in the Agrovoc Thesaurus, which is the reference thesaurus in agricultural sciences.

Conceptually speaking, in a broad sense, a value chain comprises 'activities that are carried out by actors, and actors of different types comprise a strategic network' (Donovan *et al.*, 2015), which emphasizes actors' interaction and relates to labor issues. The term value chain 'is inclusive and incorporates supply, value addition, transactions, and market linkages' (Webber, 2007).

We understand an agrifood value chain as 'the full range of farms and firms and their successive coordinated value-adding activities that produce particular raw agricultural materials and transform them into particular food products that are sold to final consumers and disposed of after use' (FAO, 2014; Kaplinsky and Morris, 2000). Agrifood value chains comprise all the firms and functions involved in production of a broad category of related food products.

Value chain approach emphasizes the adding value, and the coordination and governance aspects (FAO, 2014), and it is generally linked to issues like smallholder farmers, the improvement of the participation of the poor in the markets, developing countries' farmers inclusion of developing countries' farmers, poor rural households and decent work (Donovan *et al.*, 2015).

For developing this research, we didn't mean to focus on input-output relations (filière approach); or on the process of globalization and the power relations of globally dispersed agents (global commodity chain approach); or on logistics and the optimization of the flow of products and services through the chain (supply-chain approach), or on intrafirm strategies (Porter's value chain approach) (FAO, 2014; Kaplinsky



**Figure 1.** Methodological design of the scientometric analysis structured in three main steps: (1) identification of articles; (2) screening to exclude off-topic articles; (3) final selection of articles and scientometric analysis. Adapted from Moher *et al.* (2009).

and Morris, 2000). Besides, we didn't mean to draw attention to the integration all food value chains in a particular country, or focus on issues like food security, innovation, food system resilience (food system approach) (FAO, 2014). On the contrary, the choice for value chain concept has allowed the observation of specific product chains. Finally, the term 'value chain' was found in Agrovoc Thesaurus, which means it is part of a controlled and standardized vocabulary for indexation. Despite its limitations, the concepts' complementarities and overlaps, and the trend to more holistic approaches (FAO, 2014), value chain concept has been widely used and fits the purposes of the present research. All those elements have driven us to adopt (agrifood) value chain as a conceptual and methodological choice. Therefore, 'value chain' was the broad term retained.

The query used to identify the articles was (('value chain') AND ('labour' OR 'labor' OR 'work' OR 'job' OR 'occupation' OR 'employment')). At least two of these keywords appeared in the title, abstract or keywords. We limited the publications type to articles in order to focus on the recognized scientific knowledge based on empirical work (e.g. field or database), thus we did not include in the query secondary papers summarizing or introducing topics, such as reviews and editorials, nor non-serial sources (e.g. books and book chapters), nor grey literature (i.e. proceedings papers). No period limitation was applied, in order to identify the greatest number of articles published until December 2019. We selected only articles in English in order to limit the analysis to the international scientific knowledge, and to avoid the language bias in keyword analysis. Thus, we identified 1952 articles related to labor in value chains, which includes labor at farm-level and across the chain.

Screening was the second step (Figure 1). Manual selection of articles were performed by reading the title and abstract, and checking the pertinence of the article to our analysis. Thus, articles related to agricultural sector were maintained and articles related to non-agricultural sectors were excluded (e.g. garment, fashion,

and automobile industry). Finally, we selected 208 articles related to labor in agrifood value chains. Their following metadata composed the variables of our database: authors, title, journal, authors' keyword, publication year, citation times, authors' affiliation, country, scientific area. When authors' keywords are not indicated in the article, we used the words from the title to fulfill this information in order to maintain the article in our database, since keywords are central in our scientometric analysis.

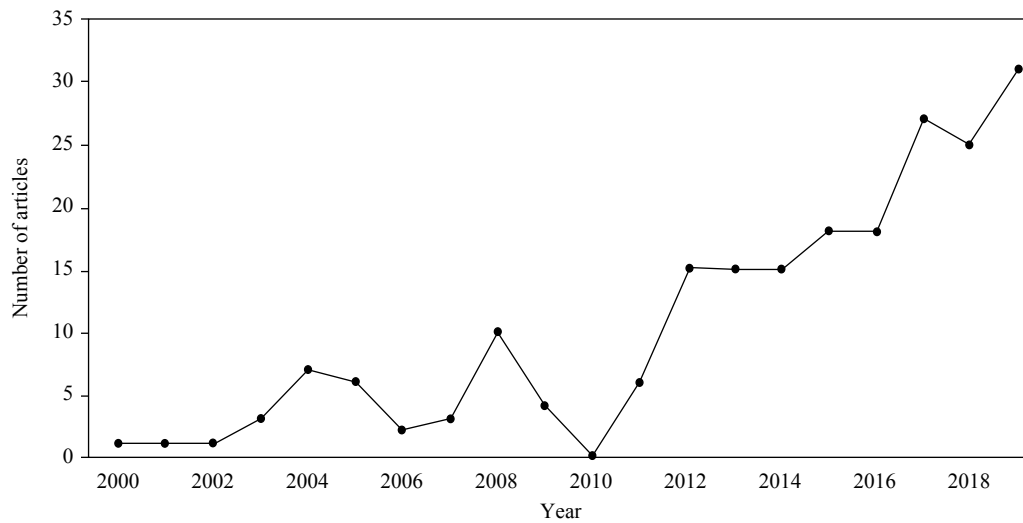
Third step was the scientometric analysis, which was organized in bibliometric analysis, diachronic analysis, and synchronic analysis (Figure 1). The bibliometric analysis aimed to identify the reference authors, journals, institutions, countries, and scientific areas related to labor in agrifood value chains. The analysis was performed using the 'Analyze search results tool' from Scopus, which is based on the frequency of each item previously cited. The results are displayed in histograms or tables. The diachronic analysis allowed us to identify the hotspot topics related to labor in agrifood value chains, and their evolution over time. Keywords indicating countries and type of agricultural production were excluded in this specific analysis. The analysis was performed using the 'demographic analysis' tool in the CorText Platform (IFRIS and INRAE, <https://www.cortext.net/>), which is based on the frequency of keywords. The result is displayed in a distributional histogram (e.g. bar graphic) with temporal distribution in year-steps of the keywords and their frequency in a given year. The diachronic analysis of keywords mapped the predominant hotspot in a given period. However, hotspots are still representing just a fragment of the overall scientific publication. In this sense, synchronic analysis provides an overview of the knowledge production. The aim was to identify the main research domains related to labor in agrifood value chains. The analysis was performed using the 'network analysis' tool in the CorText Platform, which is based on the frequency of keywords co-occurrence. The Louvain algorithm was used to calculate the distributional metrics and detect communities based on the frequency of co-occurrence of keywords. The result is showed in a network graphic composed by nodes represented by triangles (i.e. keywords) and their linkages. The triangle size indicates the keyword frequency – the bigger the triangle size, the higher the keyword frequency. Mutual citation between keywords are represented by a grey line linking them – the darkest the line, the highest the frequency of keyword co-occurrence. The distance or proximity between keywords indicates their association, distance means low association, while proximity means high association. High frequency of co-occurrence of keywords often associated are displayed in a cluster (e.g. colored circle).

### 3. Results

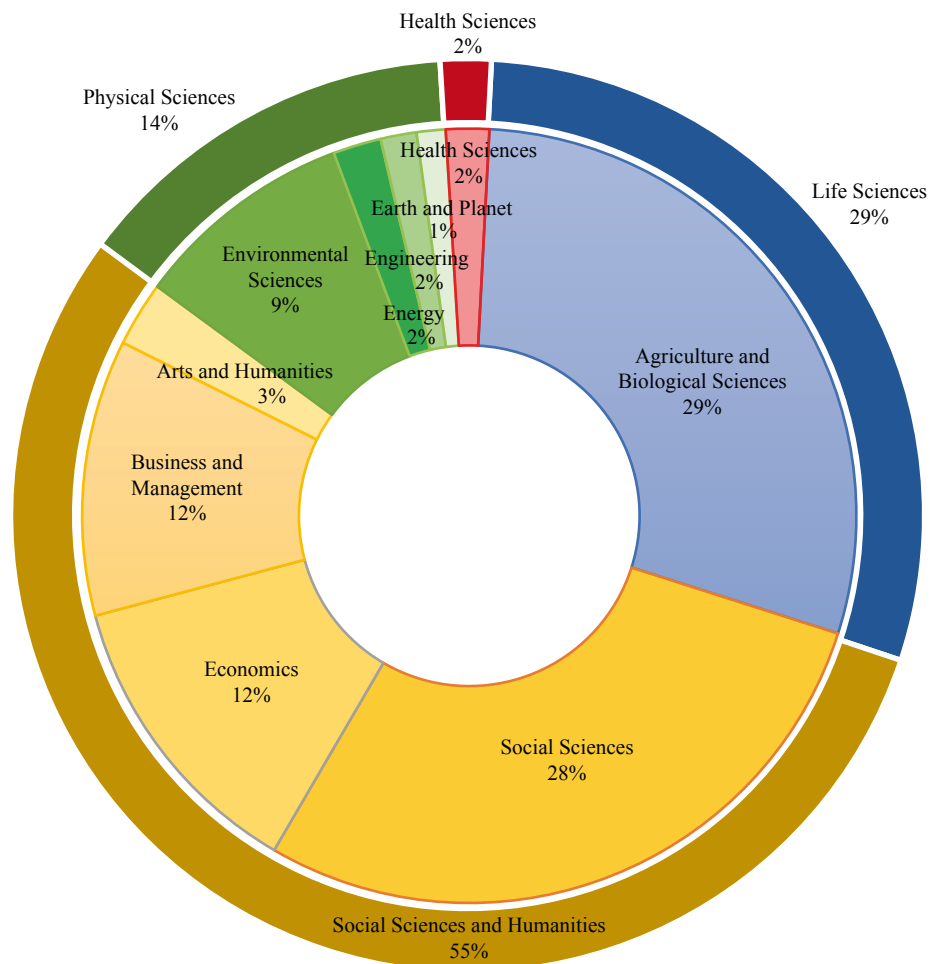
#### 3.1 Publications' overview

Labor in agrifood value chains is a relative new topic discussed by the international scientific community, as the 208 articles identified have been published since 2000. However, the recognizing importance of labor to reach sustainable development has been stimulating the interest of academics, according to the strongly growing number of publications over the past 20 years (Figure 2).

Moreover, according to the Scopus classification, the articles in our database were related to four broad scientific areas, which were represented by 10 major subject areas (Figure 3). The prevalent broad scientific area was social sciences and humanities, since it concentrated 55% of the overall publications. This area is divided into four major subject areas: social sciences, economics, business and management, and arts and humanities (Figure 3). Life sciences was the second broad scientific area (29%), which was represented by agriculture and biological sciences. Following, physical sciences counted 14% of overall publications with strong concentration on environmental sciences. Then, health sciences represented 2% of articles published over the past 20 years. This finding indicates that labor in agrifood value chains is a theme that encourages multidisciplinary studies.



**Figure 2.** Increasing number of articles per year related to labor in agrifood value chains over the past 20 years.



**Figure 3.** Scientific areas that published about labor in agrifood value chains over the past 20 years according to the share of articles published. The classification is provided by Scopus according to its own classification scheme, which is performed by its experts based on the aims and scope of the title, and on the content it publishes. The classification is composed by four broad scientific areas (i.e. external pie graph), which are further divided into 27 major subject areas (e.g. central pie graph shows 10 out of 27 major subject areas).

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### 3.2 Scientific landscape: reference journals, authors and articles

The 208 articles were published in 136 different journals. The reference journals are shown in Table 1, they concentrated more than 30% of publications. Journals were characterized by their focus on agricultural production (e.g. *Acta Horticulturae*, *Aquaculture*, *Livestock Research for Rural Development*, *Maritime Studies*), or the multidisciplinary approach (e.g. *Agriculture and Human Values*, *World Development*), or the focus on business management (e.g. *Enterprise Development and Microfinance*, *International Food and Agribusiness Management Review*, *Journal of Agribusiness in Developing and Emerging Economies*).

Several journals (n=103) published one article in the analyzed field over the past 20 years. This situation shows that, despite the reference journals, publication on labor in agrifood value chains is widely spread, and there is not a main journal gathering the publications, whether related to the type of agricultural production or disciplinary approach.

Among the 160 authors publishing on labor in agrifood value chains, reference authors are displayed in Figure 4. However, a high rate of authors that sporadic published in this topic was observed, since 62% have published one article and 23% published two articles over the past 20 years.

The reference articles are displayed in Table 2, which were mainly published in multidisciplinary journals related to development studies. Three of the reference authors (Barrientos S., Tallontire A., Riisgaard L.) had articles among the top 15 high cited ones. In addition, network of authors was observed through the co-authorship between Barrientos S., Kritzinger A., Tallontire A., and Dolan C. Based on keywords, the main subjects are labor standards and other types of standards (e.g. private standards, private social standards, codes of conduct, corporate codes). University of Sussex and the Danish Institute for International Studies from United Kingdom and Denmark, respectively, had strongly contributed to the development of labor in agrifood value chains studies, since their articles are among the high cited ones (Table 2).

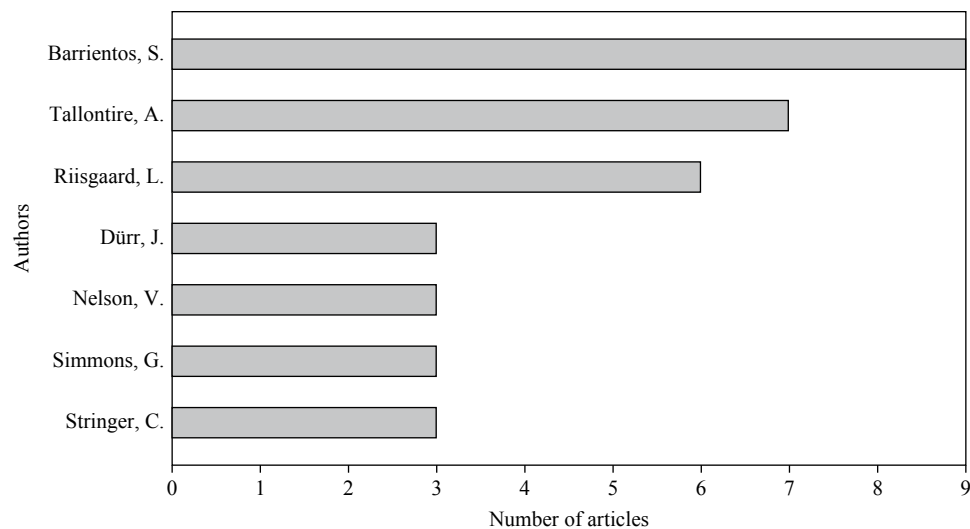
### 3.3 Scientific landscape: institutions and countries

Around 160 institutions published about labor in agrifood value chains. The reference institutions (Table 3) were responsible for 27% of the publications over the past 20 years. Universities from developed countries, and institutes for research and development with headquarters in developing countries composed the main institutions.

**Table 1.** Reference journals publishing about labor in agrifood value chains over the past 20 years.

Order	Journal	Number of articles
1	<i>Acta Horticulturae</i>	8
2	<i>Agriculture and Human Values</i> <i>Enterprise Development and Microfinance</i>	6
3	<i>Agricultural Systems</i> <i>Aquaculture</i> <i>British Food Journal</i> <i>International Food and Agribusiness Management Review</i> <i>World Development</i>	5
4	<i>Journal of Agrarian Change</i> <i>Journal of Agribusiness in Developing and Emerging Economies</i> <i>Livestock Research for Rural Development</i>	4
5	<i>Development in Practice</i> <i>Environment and Planning A: Economy and Space</i> <i>Maritime Studies</i>	3





**Figure 4.** Reference authors publishing about labor in agrifood value chains according to the number of articles published over the past 20 years.

We also verified that the reference institutions are linked to the reference authors: for example, Barrientos S. was affiliated to the University of Sussex; Tallontire A. was affiliated to University of Greenwich; Riisgard L. was affiliated to the Danish Institute for International Studies.

In total, 73 countries (both developing and developed countries) conducted research on labor in agrifood value chains. Figure 5 shows the countries with higher number of publications on the topic, concentrating 92% of them. Although most articles were published by developed countries, especially United Kingdom and USA, three developing countries also excelled on publications: Kenya, India, and South Africa. The leading countries are strongly linked to the leading institutions.

### 3.4 The evolution of hotspots on labor in agrifood value chains

A rich vocabulary describes the studies on labor in agrifood value chains, since more than 1,300 keywords were identified among the 208 articles. Based on the keywords with the highest frequency from 2000 to 2019, we observed that the hotspots related to labor in agrifood value chains have changed along these years. Some topics increased or remained over time, whereas others emerged or decreased. The evolution of the hotspots was distinguished in three main periods (Figure 6).

Period 1 – main starting topics (2000-2004): this period was characterized by employment, labor standards and gender studies. However, employment was an important topic until 2004. After that, it was discussed less often. Labor standards and standards was the starting point of studies on labor governance in value chains. Gender was one of the first topics addressed on the subject, remaining from 2000 to 2005. After a decrease, it strongly increased since 2011 and became a confirmed topic. Gender is the only topic that increased over the last 20 years, but all these hotspots are still studied. The following articles illustrate studies of this period: Barrientos *et al.* (2003) showed that codes of conduct established between European retailers and African fruit and flower producers did not promote the same employment conditions and benefits for women and men; and Dolan (2004) described gender inequalities in employment conditions (contracts, wages) in farms and packhouses in African horticultural value chains.

Period 2 – labor governance in value chains (2005-2011): the period was focused on labor governance and was characterized by studies on regulation of labor through standards associated with distinguished commercial signs. Standards analyses were deepened in private standards, certification, fair trade. These hotspots are still being studied. For example, Valkila and Nygren (2010) pointed that fair trade certification

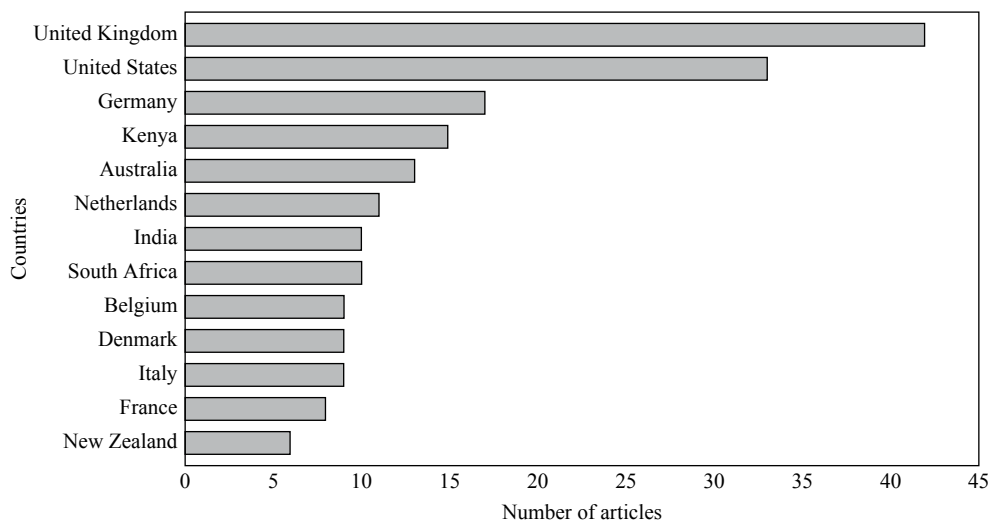
**Table 2.** Top 15 highly cited articles related to labor in agrifood value chains over the past 20 years.

Citation times	Article	Keywords <sup>1</sup>	Institutions	Countries
222	Barrientos <i>et al.</i> (2003)	Africa, gender, codes of conduct, employment, export horticulture	Institute of Development Studies; University of East Anglia; University of Greenwich	United Kingdom
156	Mutersbaugh (2005)	Standards, certification, agrofood network*	University of Kentucky	United States
133	Freidberg (2003)	Retail geography, neocolonialism, agro-food trade	Dartmouth College	United States
114	Riisgaard (2009)	Africa, Kenya, Tanzania, global value chains, labor organizations, private social standards, cut flowers	Danish Institute for International Studies	Denmark
111	Carr <i>et al.</i> (2000)	Globalization, global value-chains, home-based workers, homeworkers, informal sector, economy, market transactions, labor standards	Harvard University, HomeNet	United States, United Kingdom
99	Akinnifesi <i>et al.</i> (2006)	Agroforestry, tree products, enterprise, development, livelihoods, participatory, domestication, rural incomes	World Agroforestry Centre, University of Malawi, ICRAF Southern Africa Regional Programme, Cornell University, Hanover University	Malawi, Zimbabwe, Zambia, Kenya, United States, Germany
96	Barrientos (2013)	Global production networks, labour contracting, unfree labour, South Africa, UK, horticulture	University of Manchester	United Kingdom
96	Barrientos and Kritzing (2004)	Informalization, work, South Africa, fruit export*	University of Sussex, University of Stellenbosch	United Kingdom, South Africa
94	Barrientos (2008)	Contract labor, corporate codes, value chains*	University of Manchester	United Kingdom
88	Riisgaard and Hammer (2011)	Global value chains, labour, labour standards, banana industry, cut flower industry	Danish Institute for International Studies, University of Leicester	Denmark, United Kingdom
78	Selwyn (2013)	Global production networks, ILO, decent work, social upgrading, capitalist labour process, Brazilian horticulture	University of Sussex	United Kingdom
76	Ponte (2009)	Governance, quality, conventions, value chain, South Africa, wine*	Danish Institute for International Studies	Denmark
73	Tallontire <i>et al.</i> (2005)	Marginalized, gender, value chains, ethical trade, Africa, horticulture*	University of Greenwich, Northeastern University, University of Sussex	United Kingdom, United States
65	Tallontire (2007)	Corporate social responsibility, regulation, private standards, agri-food chain*	Chatham Maritime College	United Kingdom
61	Kritzing <i>et al.</i> (2004)	Flexible employment, South Africa, horticulture, contract workers, fruit exports*	University of Stellenbosch, University of Sussex	South Africa, United Kingdom

<sup>1</sup> Due to absence of authors' keyword in the article, the words from the title were used to fulfill this information, indicated here with asterisks.

**Table 3.** Reference institutions publishing about labor in agrifood value chains over the past 20 years.

Order	Institution	Country	Number of publications
1	University of Greenwich University of Sussex	United Kingdom	10
2	Wageningen University and Research Centre	Netherlands	8
3	University of Manchester	United Kingdom	7
4	Danish Institute for International Studies World Agroforestry Centre	Denmark Kenya	6
5	University of Nairobi WorldFish	Kenya Malaysia	5

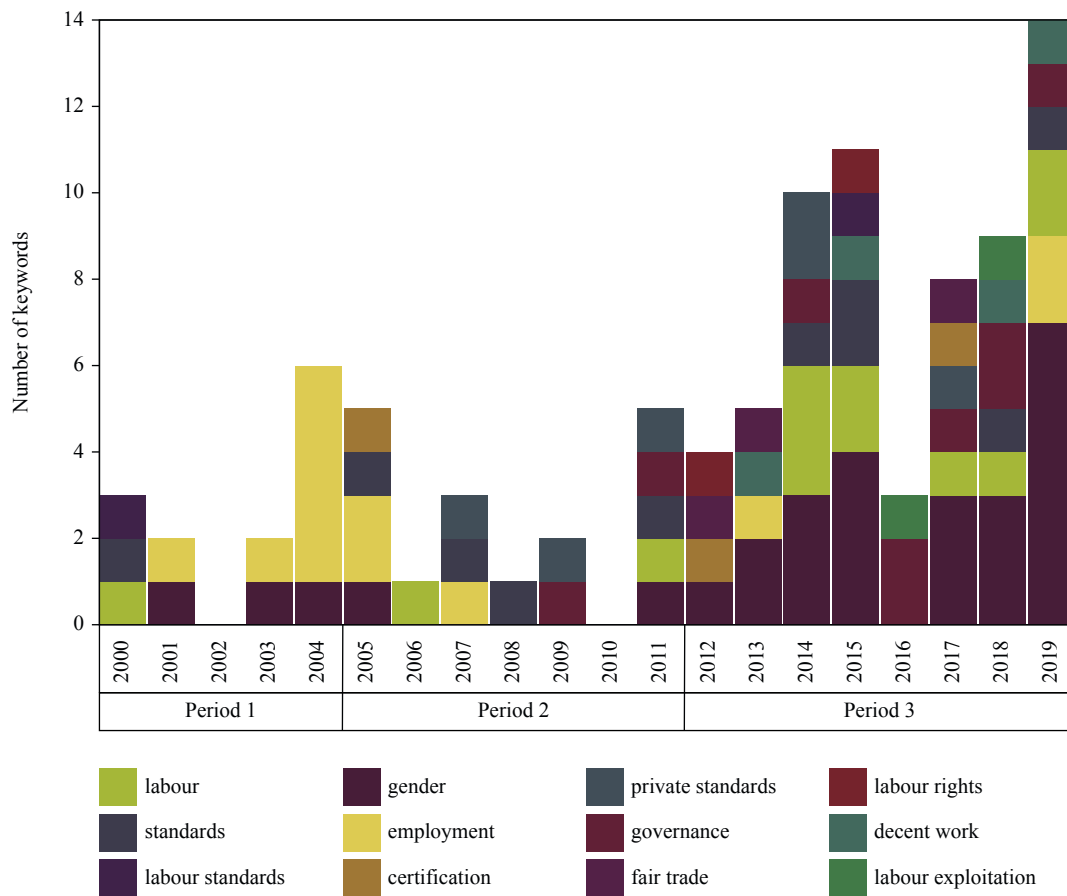
**Figure 5.** Countries with the highest number of articles published on labor in agrifood value chains over the last 20 years.

barely improved working conditions in coffee farms in Nicaragua; whilst Reynolds (2014) showed that fair trade certification improved occupational health of farmworkers in flower farms in Ecuador.

Period 3 – labor-related social issues (2012-2019): the period was characterized by the emergence of hotspots related to the social conditions of labor in agrifood value chains, such as labor rights, decent work, and labor exploitation in farms. Some studies developed in this period pay attention on compliance with national labor laws and the ILO guidelines for decent work, which is the case of mango farms in Pakistan (Ahsan *et al.*, 2018), and horticultural farms in Mexico (Grammont and Flores, 2010).

### 3.5 Diversity of approaches and main research domains linked to labor in agrifood value chains

An overall view of the network graphic linking keywords indicates that conceptual basis and empirical contexts of studies on labor in agrifood value chains were characterized by diversity. Our results showed that several concepts related to value chains were identified among the 208 articles in our database, such as the following: global value chain, global production network, supply chain, value chain, and food system. These concepts are often associated with long chains, which are characterized by several chain agents linking producers to consumers. Based on this, we understand that the articles in our database were focused on long chains rather than short chains (i.e. producers directly linked to consumers). The concepts of ‘global value chain’ and ‘value chain’ (both with high frequency) were displayed in distant clusters (Figure 7), which indicate that the global aspect of the long chain was a crucial factor that distinguished the studies. Regarding

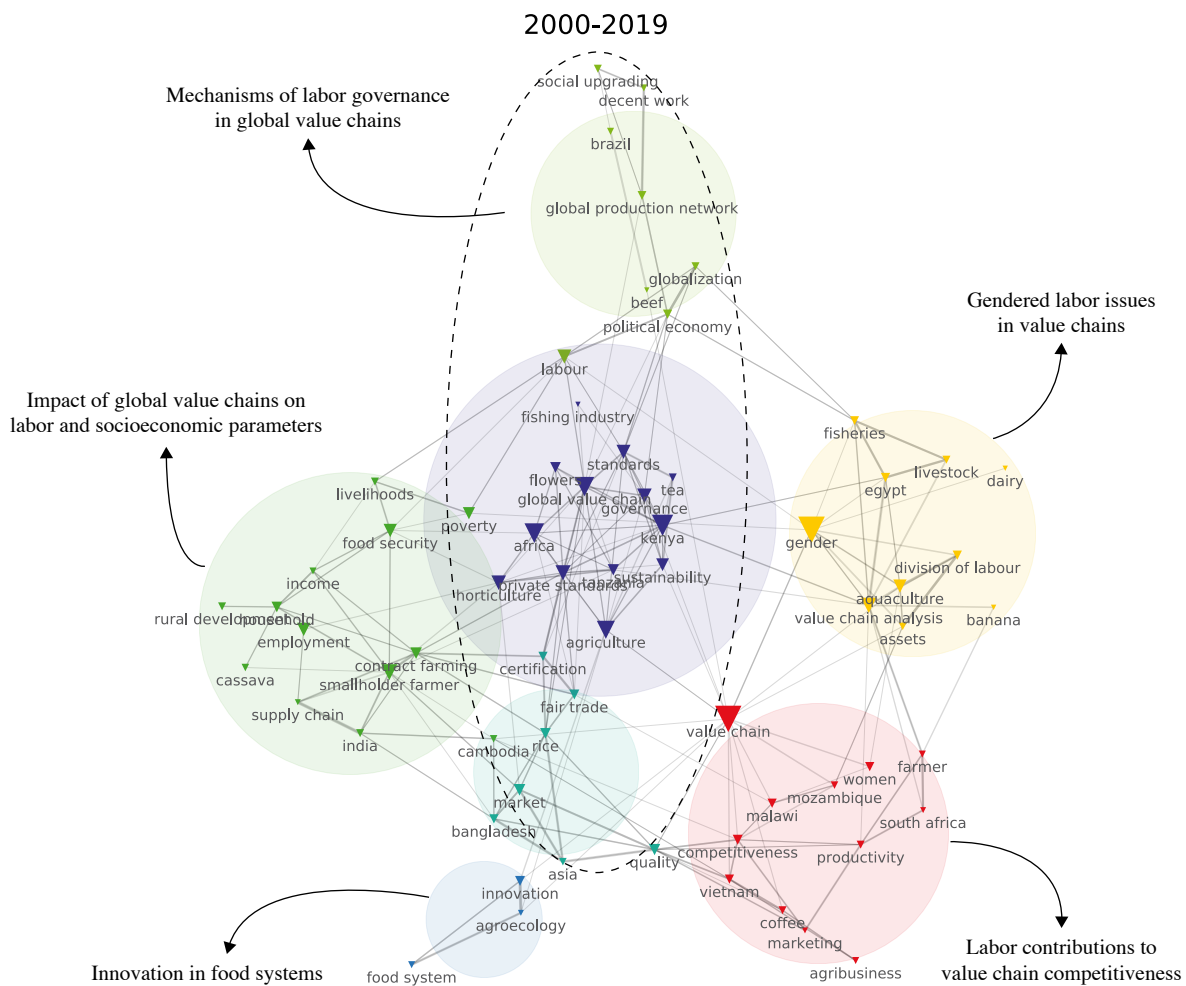


**Figure 6.** Evolution of hotspot topics related to labor in agrifood value chains, based on the temporal distribution of the most frequent keywords over the past 20 years.

agricultural production, empirical studies have covered several sectors, such as: (1) vegetal – horticulture, fruits, flowers, tea, rice, coffee, cassava; (2) livestock – beef and dairy; and (3) fisheries, including aquaculture. In addition, studies have been performed in diverse developing countries, mainly in Africa and Asia. Such diversity indicates that empirical contexts provide a rich basis to understand different labor issues across value chains and countries.

When analyzing the network graphic in detail, five main research domains related to labor in agrifood value chains emerged (Figure 7): (1) mechanisms of labor governance in global value chains; (2) impacts of global value chains on labor and socioeconomic parameters; (3) gendered labor issues in value chains; (4) labor contribution to value chain competitiveness; (5) innovation in food systems.

The first main research domain, ‘mechanisms of labor governance in global value chains’, was characterized by the key role of governance on regulating labor conditions through several mechanisms in order to promote access to market, control product quality, and decent work in global value chains. The focus of analysis was the regulation mechanisms used by downstream agents of value chain (e.g. consumers, retailers) to coordinate upstream agents (e.g. producers). Standards, certifications, and contract farming were the highlighted mechanisms. Labor and sustainability regulations were the main matters of standards, whether private, voluntary or social standard. Certifications, such as fair trade or quality signs, were the main mechanisms indicating the compliance with regulations. Contract farming was a regulating mechanism based on agreements that framed the conditions for agricultural production. The highlighted studies were performed in several vegetal production (e.g. horticulture, fruits, flowers, tea) in African countries (e.g. Kenya, Tanzania), and rice production in Asian countries (e.g. Bangladesh, Cambodia). Linkages were observed with two other research



**Figure 7.** Five main research domains related to labor in agrifood value chains over the past 20 years: (1) mechanisms of labor governance in global value chains; (2) impact of global value chains on labor and socioeconomic parameters; (3) gendered labor issues in value chains; (4) labor contributions to value chain competitiveness; (5) innovation in food systems.

domains: impacts of global value chains on labor and socioeconomic parameters, and labor contribution to value chain competitiveness.

The second research domain was ‘impacts of global value chains on labor and socioeconomic parameters’. The analysis was focused on direct and indirect impacts of global value chain development in rural territories. The direct ones were employment creation and income generation. These employment-related impacts have indirectly affected socioeconomic parameters related to rural development issues, such as poverty and food security in livelihoods. The highlighted empirical analysis was the development of supply chains in India by the inclusion of smallholder farmers in global markets through contract farming.

‘Gendered labor issues in value chains’ was the third research domain. The main contribution was the development of a gendered value chain approach focused on the role of women. The upstream part of value chain was the focus of analysis, which was based on women access to assets for agricultural production and division of labor on farms. Empirical studies have been developed mainly in African countries (e.g. Kenya, Egypt) and have covered diverse sectors, including fisheries, livestock and vegetal production.

'Labor contributions to value chain competitiveness' was the fourth research domain. Upstream and downstream value chain agents were used in the analysis. Competitiveness was deepened into two main topics. Efficiency was the first topic, which was linked to the relation between labor productivity and labor costs in value chains. For the upstream part of value chain, an example was the mechanization to improve labor productivity and reduce labor costs. On the other hand, for the downstream part, an example was the economy of scale for food processors. The highlighted empirical studies have been developed in African countries (e.g. Malawi, South Africa, Mozambique). The second topic was product differentiation, which linked marketing to quality signs and agricultural production, according to quality sign requirements. The coffee value chain was the highlighted case.

The fifth research domain was 'innovations in food systems', which was characterized by the analysis of systemic innovations from production to consumption (e.g. agroecology). The food systems approach provides a framework for integrative analysis of the upstream and downstream parts of the value chain. Such integration demanded institutional innovation related to governance (e.g. coordination) of the food system, whether local or global.

## 4. Discussion

### 4.1 Main contributions of the value chain approach to labor studies in agriculture

Our results showed that labor in agrifood value chains is a relative new theme in the scientific literature, but the increasing interest of researchers and the construction of a consolidated scientific network is in progress. In this sense, we identified the most important research domains developed over the past 20 years, with different hotspots that emerged in the three periods. On the one hand, topics such as gender, employment and rural development are aligned with part of research domains on work in agriculture international literature (Malanski *et al.*, 2019, 2021). On the other hand, labor in agrifood value chains has specific domains, such as governance and standards within the chains.

Our results also showed that governance is a central matter on labor in agrifood value chains, whether they are global or not. Governance is related to how stakeholders who are part of the value chain are coordinated (Gereffi *et al.*, 2005). The agricultural sector is a buyer-driven chain with lead companies that play the pivotal coordination role, which is primarily performed with the use of standards, by mechanisms as certifications and labels (e.g. fair trade and quality signs) (Humphrey and Schmitz, 2001). Thus, standards are used by the chain coordinator to control the set of parameters of the production processes (Humphrey and Schmitz, 2001), which is an important step for normalizing the agricultural production of heterogenous systems, especially in a global value chain with suppliers (e.g. farmers) located in different countries. For example, UK retailers coordinate African horticultural value chains, establishing private standards to suppliers (bottom of the value chain) for meeting consumers' demand (top of the value chain) for information and conditions about food production (Barrientos *et al.*, 2003; Riisgaard, 2009).

Standards implemented on farms allow value chains agents to address sensitive labor issues, such as working conditions, employment security, and gender equalities. Nevertheless, the multiplication of standards and their specific characteristics have different impacts on the issues aforementioned (Henson and Humphrey, 2010). In the Brazilian coffee value chain, for example, environmental requirements are better addressed by certifications than labor ones, which are limited to minimum legal requirements (Piao *et al.*, 2019). In Mexican and African horticultural value chains, private standards have developed a contradictory pattern characterized by: (1) the increasing product quality, increasing employment security for skilled permanent male workers, while (2) increasing employment insecurity without social benefits for women and temporary migrant workers, or outsourcing tasks to labor contractors (Barrientos and Kritzing, 2004; Barrientos *et al.*, 2003; Grammont and Flores, 2010; Riisgaard, 2009; Riisgaard and Hammer, 2011; Tallontire *et al.*, 2005). Despite the limits and barriers of farmers to comply with standards, this is an important lever to keep them connected to markets, since product differentiation due to certifications is becoming a relevant factor to

support the consumers' choice in purchasing an agricultural product (Grunert *et al.*, 2014; Janssen and Hamm, 2012; Liu *et al.*, 2019). These contradictory effects of standards indicate that the current mechanisms of coordination between upstream and downstream agents are not fully adequate to address labor issues. Thus, the revision of agreements and standards conditions related to labor are necessary to develop sustainable agrifood value chains.

Value chains are drivers for social and economic upgrading (Gereffi and Lee, 2016), however, their impact on rural communities is still controversial. On the one hand, the positive impacts are related to the inclusion of farmers in the market, the employment creation and income generation, which represent the capacity of value chains to promote regional development (Hardesty *et al.*, 2014; Lie *et al.*, 2012). This is a very significant aspect considering that more than 75% of the world's poor populations live in rural areas (FAO, 2018). In this sense, value chains are essential for supporting agricultural socioeconomic development, through poverty reduction and employment creation. On the other hand, the negative impact is the precariousness of employment conditions to reduction of labor costs through job instability, which is due to the increasing use of temporary workers, and, consequently, their decreasing social benefits. Studies indicated that farmers are using two strategies to reduce labor costs in large farms: (1) outsourcing tasks to labor contractors, so that the farmer is exempted from paying employment charges; (2) paying low-wages for the most socioeconomic vulnerable people to supply the workforce demand in farms, such as women and migrants (Barrientos, 2013; Barrientos and Kritzing, 2004; Barrientos *et al.*, 2003; Dolan, 2004; Kritzing *et al.*, 2004; Tallontire *et al.*, 2005). Recent European studies confirm the increasing contribution of contractors to the labor organization (Nye, 2018), and the permanent demand for precarious workers (Forget *et al.*, 2019).

These employment dynamics based on precarity are against FAO guidelines for decent work in value chains, which negatively impacts two of three principles of value chain sustainability (i.e. economic and social), since distribution of value-added through increasing wages and income is strongly asymmetric among stakeholders (FAO, 2014). Therefore, value chain agents need to improve value chain sustainability by enhancing labor governance related to employment conditions in order to reduce precarious labor.

Agriculture is considered a strongly gender-biased sector, which may explain the increasingly interest on this topic in value chains studies over the past 20 years. The greatest contribution of value chain analysis to gender studies is the development of a gendered value chain approach. This is a multidisciplinary approach that recognizes that the structural role of women and men in societies implies in work with different natures; while men perform the productive work (e.g. productive activity to earn a wage), women perform both reproductive work (e.g. domestic and family care) and productive work (Barrientos *et al.*, 2003, 2019). This social division of labor directly impacts work organization at the bottom of value chain. In horticultural value chains in Kenya, men mainly perform pre-harvesting tasks in farms (e.g. spraying pesticides, irrigating, building greenhouses), and sealing packages in packhouses; while women mainly perform harvest in farms, pre-packaging tasks (e.g. washing, trimming, and slicing) and packaging in packhouses (Dolan, 2004). In addition, several empirical studies have pointed out the barriers faced by women across the segments of different agrifood value chains, such as insecure employment and low wages in horticulture (Barrientos and Kritzing, 2004; Kritzing *et al.*, 2004; Tallontire *et al.*, 2005), difficulties to access productive resources in dairy chains (Wijers, 2019), and cultural barriers to women's participation and access to markets in maize chains (Adam *et al.*, 2019). These barrier conditions must be considered by the coordinator agent of the value chain to establish guidelines that promote gender equality. This is an important requirement for sustainable development of value chains based on social principles, such as inclusiveness and equity (FAO, 2014), especially considering that increasing participation of women in agrifood value chains is a global trend (Christiaensen *et al.*, 2020).

Other significant changes are taking place, such as the agroecological model of production in food systems. Agroecology is a topic largely discussed by agricultural scientists, and the farm is the prevalent level of analysis when focusing on labor issues, such as the impact of transition from conventional production to agroecological production (Aubron *et al.*, 2016; Chizallet *et al.*, 2018; Parodi, 2018). Our results indicated

that agroecology is also a topic discussed at the value chain level, such as the systemic coordination of the whole value chain to enable the agroecology transition of food systems (Meynard *et al.*, 2017). In addition, the relations between agroecology and food systems linking local producers to local consumers nurture discussions related to food sovereignty (Altieri and Nicholls, 2012). Finally, the nexus between labor and the use of natural resources following the principles of agroecology impacts all the three principles of value chain sustainability: (1) economic – increasing profits, wages and income based on the value-added distribution; (2) social – improving healthy working conditions by reducing the use of chemical products (e.g. pesticides, herbicides); (3) environmental – enhancing ecological cycles in agricultural production, and reducing the use of chemical products.

#### 4.2 Limitations of the value chain approach and opportunities for further research on labor in agriculture

Despite the valuable specific contributions of value chain approaches to labor studies in agriculture, we observed three major limitations, which are related to theoretical contributions, linkages between the upstream and downstream parts of value chain, and labor in short value chains.

The first limitation, the lack of theoretical contributions of the value chain approach to labor studies in agriculture, is linked to the prevalence of empirical studies composing our database, which is evidenced by the several keywords highlighted in the network graph indicating different countries and the diverse types of agrifood value chains analyzed, while conceptual or methodological keywords were underrepresented or absent.

On the one hand, the prevalence of empirical studies focusing on a given value chain or a given country indicates that the development patterns of value chains and their labor governance are diverse around the world. Therefore, characterizing such diversity is a first step for further research. On the other hand, the knowledge accumulated along these 20 years has not provided sufficient background to allow the development of several original frameworks, concepts or methodological design. Nevertheless, theoretical contributions have advanced with the development of the gendered value chain approach (Barrientos *et al.*, 2003, 2019), which is one of the starters topics on labor in agrifood value chains. Based on our analysis, we estimate that the next theoretical advances may be related to mechanisms of labor governance in value chains, since governance and standards are starter topics that have strongly developed overtime, and have reached the point of being a main research domain. In this sense, a framework of governance to analyze private standards has been developed (Tallontire *et al.*, 2011).

Moreover, the lack of an original theoretical basis and the prevalence of empirical studies may justify the publication behavior of authors, since the main journals publishing about labor in agrifood value chains are multidisciplinary ones (e.g. Agriculture and Human Values, World Development, Development in Practice), or focused on specific agricultural production (e.g. Acta Horticulturae, Aquaculture, Livestock Research for Rural Development).

The second limitation identified was the lack of linkages between the upstream and downstream parts of value chain. This limitation is largely criticized by the food system approach, which claims that agricultural issues (upstream) and food issues (downstream) are intrinsically connected, which demand a systemic view to address issues (Meynard *et al.*, 2017). Regarding labor issues, few studies have linked farm and chain levels focusing on the employment perspective in long chains, whether global or not. Examples of such studies are employment characterization (e.g. job position, wages) through occupational gendered segregation in farms and packhouses in horticultural value chains in Kenya (Dolan, 2004), determination of labor costs across all the beef value chain in Costa Rica (Holmann *et al.*, 2008), and the mapping of direct employment in livestock farms and indirect employment across all the chain in livestock value chains in France (Lang *et al.*, 2015).



Nevertheless, linkages between farm and chain levels are a real gap in the literature on labor in agrifood value chains. An integrative and multidisciplinary approach could be developed to better understand how farm-level labor issues are influencing the integration of farms to markets, and how labor governance in agrifood value chains impacts work at the farm-level. This is one of the possibilities that encourages the cooperation between the rising community specialized in the value chain approach, and the diverse scientific communities studying work in agriculture (Dedieu 2019; Malanski *et al.*, 2019, 2021).

The third limitation identified was labor in short value chains. Few studies have been addressed through diversified perspectives, such as the following: analysis of professional satisfaction in organic farms in France, which highlighted that task diversification from production, processing and marketing was a source of satisfaction for farmers, despite their high workload and intense rhythm of work (Dupré *et al.*, 2017); analysis of changes in tasks and skills of workers in horticultural farms in Argentine engaged in agroecological transition and integration to short food supply chains (Parodi, 2018); and, assessment of labor productivity between production, processing and marketing and their associated labor remuneration in farms in Canada (Mundler and Jean-Gagnon, 2019). These topics addressed in the literature related to short value chains are different from the topics highlighted by our analysis. This indicates that governance, standards, and value chain efficiency are topics more likely related to long value chains issues, which is linked to the characteristic of agrifood value chains, that is buyer-driven chain coordinated by a downstream agent (Humphrey and Schmitz, 2001). However, labels are used in short value chains to establish a trust-based relationship between farmers and consumers (Chiffolleau *et al.*, 2017).

This configuration strongly influenced how labor issues in agrifood value chains are analyzed. In global value chains, labor issues of upstream agents are considered through a downstream agent perspective. An example, strategies of labor costs reduction in African large-farms are highlighted in studies in horticultural value chains coordinated by UK retailers, who use standards for producers defining the rhythm of production and quality of vegetables in order to respond to consumers' demand for vegetables and product quality (Dolan, 2004; Tallontire *et al.*, 2005). The value chain efficiency through labor costs reduction is the issue, despite the observed precarity of employment conditions.

In general, downstream agents in global value chains are located in developed countries, where are concentrated the leader countries with leader institutions producing scientific knowledge about labor in agrifood value chains. The prevalence of the USA, UK, and Europe (e.g. main countries, institutions, authors) are confirmed in labor-related studies in agriculture, as well as the raising important position of Oceania, whereas Asia, and Latin America were identified as data-providers (Malanski *et al.*, 2019, 2021; Oliveira *et al.*, 2017). In this sense, labor issues by the perspective of upstream agents located in developing countries are progressively taking place, since we identified that Kenya, India, and South Africa are significant publishing countries, which in contrast with previous studies on work in agriculture indicating that African countries are characterized as data-providers (Malanski *et al.*, 2019; 2021).

This scientometric review from the Scopus database provides an overview about the main characteristics of a new rising scientific community focused on labor in agrifood value chains. However, some limitations are pointed. Because of the quantitative nature of the method employed in this study, the research domains identified represent a prevalent part of the studies developed in the field, and they do not represent the total research domains. A systematic review based on qualitative methods could solve this limitation by identifying the secondary ones. Considering that Scopus is characterized as a bibliographical database better covering social sciences (Mongeon and Paul-Hus, 2016), this may explain the highlighted position of social issues in our review, such as gendered labor and socioeconomic implications of the expansion of the globalization and international trade, as well as the contributions of multidisciplinary studies. A similar analysis could be performed with Web of Science data, the bibliographical database of reference in agriculture science, in order to compare and complement our results. Finally, although sustainability was referred in this research, it was not a deeply issued. In that sense, future research could bring sustainability as a central matter, addressing key economic, environmental and societal elements of sustainable value chains.

## 5. Conclusions

Our scientometric review from the Scopus database provides an overview about the main characteristics of a new rising scientific community focused on labor in agrifood value chains, the evolution of the hotspots analyzed over the past 20 years, and the highlighted research domains.

We showed that labor issues in agrifood value chains are distinguished into five research domains: (1) mechanisms of labor governance in global value chains; (2) impacts of global value chains on labor and socioeconomic parameters; (3) gendered labor issues in value chains; (4) labor contribution to value chain competitiveness; (5) innovation in food systems. Labor governance – standards, certifications, quality sings, and contract farming – were identified as a core subject of the studies in the analyzed field, since it was the central element that connected the synthesis of knowledge produced over the past 20 years.

Despite the increasing production of scientific knowledge mainly based on several empirical studies, the construction of an original theoretical basis of the value chain approach for labor analysis in agriculture is completely open for advances. Such contributions could support the consolidation of this rising scientific community in the international research landscape related to work in agriculture.

Linkages between the upstream and downstream parts of the value chain are still an important gap in the literature. This challenging situation is a significant opportunity for scientists to go forward with multidisciplinary studies and scientific innovation on labor in agrifood value chains. Regarding value chain agents, notably the coordinator, it is necessary to better consider labor issues in governance in order to improve employment relations, safety and healthy working conditions according to international guidelines for decent work. These are relevant issues to be addressed in order to promote the economic and social principles of sustainable development of agrifood value chains.

## Acknowledgements

The authors thank members of the International Association on Work in Agriculture for their support and suggestions. This work was supported by CAPES, Brazil (grant number 88882.463223/2019-01).

## Conflict of interest

The authors declare there are no conflicts of interest.

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