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Agricultural labor in global value chains: a bibliometric review from Web of Science

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Abstract: *Agricultural labor is of great importance as it employs a large part of the population and provides food and other products to everyone around the globe. However, job opportunities in this agricultural sector have been decreasing. In order to change this situation, the rural population seeks to increase productive efficiency and added value in the production stages to enter in agricultural value chains and remain in global markets. However, there are no studies that summarize the advances of the main contribution of global value chains approach to labor studies in agriculture. To fill this knowledge gap, the aim of the study was to characterize the research domains on agricultural labor in global value chains through a bibliometric review study. Our main findings are that (1) knowledge production on agricultural labor in global value chains is structured in three main research domains: socioeconomic aspects of labor in value chains; implications of global value chains on labor; technological development of global value chains; (2) the top countries, top institutions, top journals, top authors and most-cited articles are identified. We show for the first time the overview of research on agricultural labor in global value chains indexed in Web of Science, which provides the path of references that can be used as background for further studies. The paper encourages research on new topics and collaborations between authors and institutions for such achievement.*

Keywords: *labor, agriculture, value chains, bibliometric analysis, research domains*

Introduction

Agricultural labor is of great importance, as it employs about 30% of the world population, in addition to that, agricultural activity feeds all people around the globe (Worldbank, 2020). However, the percentage of the rural population in relation to the total population has decreased 9% in the last 20 years, which reduced employment opportunities in 32% when comparing ten years ago (Worldbank, 2020).

In order to get out of these trends, rural population seeks to increase productive efficiency and adds value in the production stages in order to enter in agricultural value chains and remain in competitive global markets (Kaplinski and Morris, 2000). This behavior is related to the increasing requirement of value chains for product quality and reduction costs, which promotes a systemic worldwide competition to serve different markets (Kaplinsky and Morris, 2000; Trienekens, 2011). However, the high demand for agricultural products and required quality standards are difficult to be met by smaller producers, excluding them from the market and discouraging rural labor (Kaplinsky and Morris, 2020; Trienekens, 2011).

Global Value Chain is a recent research theme, and the concept of "value chain" came up with Porter (1985) to understand the globalization phenomenon to discuss the addition of value in processes, and with the studies of Gereffi (1994) on commodity chains, who investigated the relationship between multinational companies in international trade. The development of the theoretical framework and application in empirical studies occurred mainly from the 21st century onwards, starting with researches performed by Gereffi *et al.* (2005), Gibbon *et al.* (2008) and Dijk and Trienekens (2011), for example. Such studies affirm that global value chains represent an evolution of international trade, which is no longer just an exchange of goods between countries, but an integrated production between them, with each one performing a productive stage in which they have more skills to execute.

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Specifically on agricultural sector, studies have focused on socioeconomic impacts of global value chains in developing countries (Trienekens, 2011), sustainability issues in agricultural production (Vurro *et al.* 2009), value chain governance (Humphrey and Schmitz, 2001), among other subjects.

Considering that Global Value Chains represent a recent and growing phenomenon, it is necessary to deepen their implications, including on agricultural labor, considering that global value chains have been changed the dynamics of agricultural production and, consequently, the labor involved in this process. Nevertheless, the Global Value Chains approach minimizes the role of labor, considering it as a passive productive asset, leaving aside important issues such as labor rights, quality of labor, labor exploitation and labor organizations (Riisgaard, 2009). Studies exploring this gap have been focused on types of agricultural production (*e.g.*, horticulture, livestock, fisheries), and in specific regions or countries. Although, there are no studies that summarize the advances of global value chains approach to labor studies in agriculture.

We are concerned about the scientific knowledge produced about agricultural labor in global value chains and its dynamics. Such concern drives us to the following question: what are the main researches developed about agricultural labor in global value chains and what are their evolutions? In order to answer this question, the aim of the article was to characterize the research domains on agricultural labor in global value chains through a bibliometric review. Bibliometrics are important to identify concepts, authors, institutions and countries of reference, summarize the main discussions, guide researchers on more or less explored issues, discover new research gaps, facilitate the search for partnerships between universities, advise on journals relevant to the discussions, in addition to present the evolution of this theme.

In the next session, we describe the methodology design used to build and analyze the database. Then, our results summarizing and mapping the main research in agricultural labor in global value chains are described and discussed.

Building and analyzing the database

The database was obtained from the Web of Science Core Collection through an advanced search based on keywords related to the topic of interest in this research: "agricultural labor in global value chains". First, the keywords were identified through Thesaurus Agrovoc to standardize the terms and obtain greater accuracy in the search, resulting in the identification of relevant articles for the topic under analysis. For the word "labor", the similar terms identified were: "work", "job", "employment" and "occupation". For the word "value chain", we remained with the same term, as it encompasses global value chains, a concept that is also of interest for our analysis. The term supply chain was not used because it gathered many off topic articles, especially related with logistics. All time available was considered (from 1945 to 2019) in order to have an overview of the theme and its evolution. Articles in English were selected in order to analyze international publications. Preference was given to topic-oriented search (title, abstract, keywords) to identify a greater number of articles than by title-oriented search. Thus, the search on the Web of Science was based in the following equation: (TS=(("value chain*") AND ("work*" OR "labo*r" OR "job*" OR "employ*" OR "occupation*")).

According to those criteria, we identified 1,973 articles. These articles were then manually filtered in two steps. First, the articles were selected according to Web of Science categories, shown in table 1 below. The aim was to exclude articles from areas not relevant to the research, such as biochemical and logistics. At this stage, 1,485 papers were selected. The second step was manual filtering of agricultural

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scope by analyzing the title and abstract and checking whether the articles fit the agricultural labor in global value chains theme. We finally selected 324 articles published between 2000 and 2019.

Economics	Social Sciences Interdisciplinary
Management	Ergonomics
Business	Area Studies
Ecology	Business Finance
Geography	Education Educational Research
Geosciences Multidisciplinary	Health Policy Services
History of Social Sciences	Ethics
Development Studies	Horticulture
Food Science Technology	Transportation
Law	Humanities Multidisciplinary
Asian Studies	Agricultural Engineering
International Relations	Forestry
Fisheries	Anthropology
Operations Research Management Science	Communication
Public Environmental Occupational Health	Cultural Studies
Agricultural Economics Policy	Agronomy
Agriculture Dairy Animal Science	Urban Studies
Public Administration	Regional Urban Planning
Agriculture Multidisciplinary	Sociology
History	History Philosophy of Science
Industrial Relations Labor	Oceanography
Multidisciplinary Sciences	Archaeology
Women's Studies	Psychology Applied
Telecommunications	Psychology Clinical
Political Science	Psychology Social

Table 1. Web of Science categories selected as a filter.

Bibliometric analysis was performed using the CorText Platform (IFRIS and INRAE, https://www.cortext.net/), which has tools for measuring the number of authors, affiliations, countries and keywords. The aim was to identify the main references that discuss agricultural labor in global value chains. The ranking of institutions and countries that most publishes in the field was determined by the number of publications. The most cited articles were analyzed considering the top articles within a period of 5 years to identify evolution of the topics. A Network Analysis based on the keywords of the articles was performed too. The Louvain algorithm was used to calculate distributional metrics and detect communities based on the frequency of co-occurrence of keywords (Tancoigne *et al.*, 2014). The resulting network graph displayed keywords and their links. The keywords are represented by triangles and the larger the triangle, the greater the frequency of the keyword. Co-occurrence between keywords is represented by a gray connection line, the greater the connection between them, the darker grey is the line. High density of co-occurrence

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between keywords is displayed in circles. The larger the circle, the greater the number of co-occurrences. The circles represent the research domains related to agricultural labor in global value chains, since the keywords suggest what is discussed in the international literature. The distance between words and circles has also meaning. The more distant, the smaller the association of words and, consequently, themes.

Bibliometric characteristics of literature on Agricultural labor in global value chains

Institutional context of research: countries and institutions

The identified articles included research from developed and developing countries. The top three countries that publish the most on Agricultural labor in global value chains are the United Kingdom, the United States and Germany. The table below shows the countries with the highest number of published articles.

Ranking	Country	No. of Publications
1º	United Kingdom	70
2º	USA	60
3º	Germany	38
4º	Netherlands	24
5º	Australia Kenya	23
6º	India	19
7º	South Africa	16
8º	Belgium	15
9º	Denmark	13
10º	China Italy	12
11º	Canada France	11
12º	Japan	10
13º	Brazil	9

Table 2. The top countries that publishes on agricultural labor in global value chains.

Studies from 49 institutions located in 48 different countries were identified, including universities, research centers and institutes. Half of the papers were carried out in partnership between institutions, with 34% between institutions from different countries, and 16% from the same country. The top institutions were responsible for 45% of all articles in our database. The Kathoelieke Universiteit Leuven, Wageningen University, and University of Manchester were identified as those that most published about agricultural labor in global value chains. With the exception of the Swedish University of Agricultural Sciences, all institutions belong to the countries that publish the most. Below is the table with more institutions responsible for several publications.

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Ranking	Institution	Country	No. of Publications
1º	Katholieke Universiteit Leuven Wageningen University	Belgium Netherlands	14
2º	University of Manchester	United Kingdom	13
3º	International Livestock Research Institute	Kenya	12
4º	Charles Sturt University	Australia	9
5º	University of Kassel	Germany	7
	University of Kentucky Stellenbosch University	United States South Africa	
6º	Cornell University University of Sheffield University of Sussex	United States United Kingdom United Kingdom	6
7º	Colorado State University Copenhagen Business School CSIRO Land and Water Michigan State University Swedish University of Agricultural Sciences University of Copenhagen University of Groningen University of Nairobi University of Sydney	United States Denmark Australia United States Sweden Denmark Netherlands Kenya Australia	5

Table 3. Top institutions that publishes on Agricultural labor in global value chains.

Overview of journals and disciplines

The articles were published in 50 different journals, but the top journals that most published accounted 22% of articles. Most journals adresses social issues in their aim and scope, such as World Development, Journal of Agrarian Change, Geoforum, Food policy, Agriculture and Human Values, Journal of Agribusiness in Developing and Emerging Economies, Outlook in Agriculture and Marine Policy. In addition, most top journals are focused on development and policy discussions. The ranking of the top journals in terms of publication is in the table 3.

Ranking	Journal	No. of Publications
1º	World Development	9
2º	Agricultural System	6
	Journal of Agrarian Change	
	Marine Policy	
3º	Agriculture and Human Values	5
	Aquaculture	
	British Journal of Industrial Relations	
	Competition and Change	
	Food policy	
	Geoforum	
	International Food and Agribusiness Management Review	
	Journal of Agribusiness in Developing and Emerging Economies	
	Outlook on Agriculture	

Table 4. *Top journals that publishes on Agricultural labor in global value chains.*

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Top productive authors, their affiliation, top journals of publication and partnerships

952 authors published about agricultural labor in global value chains. Table 5 shows the top authors that most published on the field. The top authors were responsible for 17% of the publications. S. Barrientos was the author who published the most, and her research dates from 2001 to 2019. The author mainly discussed labor standards in value chains in developing countries, and their implications for the division of labor and gender issues. Her most cited articles referred specifically to the "gendered value chain approach", a term first introduced by the author, which refers to division of labor and its socioeconomic implications for women.

Ranking	Authors	No. of Publications	Country	Institution	Top journal of publication
1º	Barrientos S.	8	United Kingdom	University of Manchester	World Development
2º	Maertens M.	7	Belgium	Katholieke Universiteit Leuven	Food Policy World Development
3º	Swinnen J.	5	Belgium	Katholieke Universiteit Leuven	Food Policy Journal of Agrarian Change
4º	Durr J.	4	Germany	University of Kassel	Journal of Agrarian Change
	Mutersbaugh T.		USA	University of Kentucky	Agriculture and Human Values
	Van den Broeck G.		Belgium	Kathoelieke Universiteit Leuven	Food Policy World Development Geoforum
5º	Christensen V.	3	Canada	University of British Columbia	Marine Policy Geoforum
	Dalemans F.		Belgium	Kathoelieke Universiteit Leuven	-
	Grace D.		Kenya	International Livestock Research Institute	Food Policy
	Lyon S.		USA	University of Kentucky	Agriculture and Human Values
	Riisgaard L.		Denmark	Roskilde University	World Development British Journal of Industrial Relations
	Singh S.		India	Indian Institute of Management	Journal of Agrarian Change
	Steenbeek J.		Canada	University of British Columbia	Marine Policy
	Tallontire A.		United Kingdom	University of Leeds	World Development Agriculture and Human Values

Table 5. *Top authors that publishes on Agricultural labor in global value chains.*

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M. Maertens is the second author that most published on agricultural labor in global value chains, and has publications from 2015 to 2019. The author's research topics were related to development and poverty reduction through labor in global value chains. Currently, his studies are focused on agroforestry and technology for socioeconomic development. J. Swinnen is the third most published author. She worked with M. Martens at the beginning of her publications on the subject and continued performing studies on labor for socioeconomic development in developing countries inserted in global value chains. All top authors belong to the top countries (Table 2). Among those who published the most are authors from Belgium with 4 top authors, followed by the United Kingdom, United States and Canada with 2 top authors each. The majority of the top authors (71%) belong to the institutions that publish the most (Table 3). The most frequent institutions among the top authors were Katholieke Universiteit Leuven with 4 top authors, University of Kentucky with 2 top authors and University of British Columbia also with 2 top authors. Excepted by F. Dalemans, all top authors published in the top journals (Table 4). The most frequent are World Development with 5 top authors, Food Policy with 4 top authors, Agriculture and Human Values and Journal of Agrarian Change, both with 3 top authors each.

Most top authors (93%) published articles in partnership with authors from foreign institutions. These authors are J. Steenbeek, A. Tallontire, V. Christensen, S. Lyon and D. Grace. Excepted for A. Tallontire, all publications by these authors are in partnership with institutions in other countries.

Most-cited articles

The articles published around the year 2000 (the beginning of period analyzed) were the highest cited ones. The three most cited articles of each five-year period were selected to build the ranking providing the evolution of the themes studied between 2000 and 2019 (Table 6). The majority of articles were based in empirical studies. The few theoretical articles are 1) S. Barrientos (2001) on Gendered value chain analysis; 2) M. Rawling (2015) on Legislative regulation of global value chains to protect workers; 3) L. T. Raynolds (2018) on Labor Standards; and 4) D. Marie-Vivien *et al.* (2019) about controversies around Geographical Indications.

Most of the articles were written by the top authors, especially S. Barrientos who counts three highly-cited articles in two different periods. Four out of 12 articles were published in the top journals. The majority of articles were published in journals focused on development and policies issues (according to their descriptions of aim and scope), except the journals American Journal of Tropical Medicine and Hygiene and Annual Review of Resource Economics. Thus, this result is consistent with the social perspective found in the top journals mentioned above (Table 4).

The most-cited articles had authors from developed countries, except Kenya and South Africa. All the most-cited articles belong to the countries that published the most, excepted the article of K.M. Rich and F. Wanyoike (2010), which has Norway's first author.

Three of the top articles were published by the top institutions: Stellenbosch University, University of Kentucky and University of Sussex. American universities were responsible for 4 of the 12 most cited articles, followed by the United Kingdom with 3 most cited articles.

Most articles were focused on specific key entries, such as a country, region or type of agricultural production. An example is the article of A. Kritzinger *et al.* (2004) on South African Horticulture; S. Smith and S. Barrientos (2005) on UK supermarket value chains; and V. Christensen *et al.* (2014) on Peruvian Fisheries sector. There were a few broader studies covering the entire globe, such as the article of T. Mutersbaugh (2005) on Agrifood Standards, which used literature review and worldwide statistical data for analysis; J.C. Beghin *et al.* (2015) on non-tariff measures and standards in global value chains;

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and Jackson *et al.* (2012) which empirically analyzes eight different regions of the globe, discussing the socioecological and regional adaptation of agrobiodiversity management.

Standards are the topic that appears in all identified periods. S. Barrientos *et al.* (2003) analyzed the codes of conduct, which are later referred by A. Kritzinger *et al.* (2004) as standards, followed by the studies of S. Smith and S. Barrientos (2005) on standards as Fair Trade and Ethical Trade, L. Riisgaard's (2009) on private social standards, L. Riisgaard and N. Hammer (2011) on labor standards, and J.C. Beghin *et al.* (2015) on standards and their non-tariff measures. These studies showed the implications of standard requirements for employment conditions and social protection for workers.

Flexible labor was a highlighted theme in the first period (2000-2004), and represents an important factor to design employment strategies in agricultural value chains (A. Kritzinger *et al.*, 2004). The topic labor organizations emerged in the second period (2005-2009), which is related to precarious employment and the lack of social protection, and the role of organizations that represent and defend workers in global agricultural value chains (L. Riisgaard, 2009). In this sense, ethical standards were studied, as seen in S. Smith and S. Barrientos (2005).

In the third period (2010-2014), labor standards were highlighted. They represent a new multifaceted approach that involves different labor organizations, work-friendly NGOs as well as consumer organizations concerned with labor issues (L. Riisgaard and N. Hammer, 2011). Furthermore, environmental issues are discussed through studies showing forms of crops production based environmentally and socioeconomically sustainable cultivation, including impacts on the workforce, which is evidenced in the paper of Jackson *et al.* (2014).

In the fourth period (2015-2019), the socioeconomic impacts of standards (*e.g.*; quality, ethical and labor standards) on job generation, labor characteristics, and rural development are highlighted. This is evidenced in the study of J. Beghin *et al.* (2015) and M. Mwambi *et al.* (2016).

Therefore, standards are a significant topic in agricultural labor in global value chains since it is a large area of research. In addition, Africa is the main region where studies in the field were performed.

The most used keywords

999 different keywords were identified in the articles from our Web of Science database, which shows the diversity of vocabulary used in the studies related to agricultural labor in global value chains. Table 7 presents the most frequent keywords and allows us a view of what issues are most addressed in the 324 articles analyzed.

The rank of keywords confirmed the accuracy of our database regarding the theme under analysis. This is indicated the following most frequently cited keywords: "value chain", "global value chain", "global production network", "agriculture", "labor" and "employment". Forms of agricultural production exemplified with the words "smallholder farmer" and "contract-farming" also highlights a discussion of agricultural labor. The keywords "governance", "gender", "development", "poverty reduction" and "poverty" show the social aspects of the studies, which is consistent with the top journals and most-cited articles identified. Likewise, keywords referring to countries, such as "Kenya", "India", "Africa", "China" and "Vietnam" show that developing countries are largely involved in research as empirical context of the studies.

Research Domains on agricultural labor in global value chains

The network analysis of keywords generated a graph that allowed us to identify three research domains on agricultural labor in global value chains: 1) socioeconomic aspects of labor in value chains; 2) implications of global value chains on labor; 3) technological development of global value chains.

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Period	Ranking	Times Cited	Authors	Title	Journal	Year	First author's Affiliation	First author's Country
2000 - 2004	1°	181	Barrientos, Dolan and Tallontire	A gendered value chain approach to codes of conduct in African horticulture	World Development	2003	Institute of Development Studies	United Kingdom
	2°	79	Carr, Chen and Tate	Globalization and home-based workers	Feminist Economics	2000	Harvard University	USA
	3°	52	Kritzinger, Barrientos and Rossouw.	Global production and flexible employment in South African horticulture: Experiences of contract workers in fruit exports	Sociologia Ruralis	2004	Stellenbosch University	South Africa
2005 - 2009	1°	141	Mutersbaugh	Fighting standards with standards: Harmonization, rents, and social accountability in certified agrofood network	Environment and Planning A	2005	University of Kentucky	USA
	2°	114	Riisgaard	Global Value Chains, Labor Organization and Private Social Standards: Lessons from East African Cut Flower Industries	World Development	2009	Danish Institute of International Studies	Denmark
	3°	60	Smith and Barrientos	Fair trade and ethical trade: Are there moves towards convergence?	Sustainable Development	2005	University of Sussex	United Kingdom
2010 - 2014	1 °	97	Rich and Wanyoike	An Assessment of the Regional and National Socio-Economic Impacts of the 2007 Rift Valley Fever Outbreak in Kenya	American Journal of Tropical Medicine and Hygiene	2010	Norwegian Institute of International Affairs	Norway
	2°	77	Riisgaard and Hammer	Prospects for Labor in Global Value Chains: Labor Standards in the Cut Flower and Banana Industries	British Journal of Industrial Relations	2011	University of Leicester	United Kingdom
	3°	57	Jackson et al.	Social-ecological and regional adaptation of agrobiodiversity management across a global set of research regions	Global Environmental Change - Human and Policy Dimensions	2012	University of California	USA
2015 - 2019	1°	43	Beghin, Maertens and Swinnen	Nontariff Measures and Standards in Trade and Global Value Chains	Annual Review of Resource Economics	2015	Iowa State University	USA
	2°	30	Christensen et al.	Valuing seafood: The Peruvian fisheries sector	Marine Policy	2014	The University of British Columbia	Canada
	3°	25	Mwambi et al.	Does contract farming improve smallholder income? The case of avocado farmers in Kenya	Journal of Agribusiness in Developing and Emerging Economies	2016	Egerton University	Kenya

Table 6. Characteristics of the most-cited articles by period of five years.

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Ranking	Keyword	Frequency	Ranking	Keyword	Frequency
1º	Value chain	66	14º	Globalization	7
2º	Global value chain	49	15º	Labor	7
3º	Agriculture	22	16º	Supply chain	7
4º	Global production network	14	17º	Development	7
5º	Gender	14	18º	Innovation	7
6º	Smallholder farmer	14	19º	China	6
7º	Governance	10	20º	Poverty reduction	6
8º	Kenya	10	21º	Coffee	6
9º	Contract farming	9	22º	Poverty	6
10º	India	9	23º	Employment	6
11º	Africa	8	24º	International trade	5
12º	Trade	8	25º	Aquaculture	5
13º	Sub-saharan africa	8	26º	Vietnam	5

Table 7. The most frequent keywords used related to Agricultural labor in global value chains.

First research domain is "value chains and its implications on socioeconomic aspects of labor", which is composed by five main topics. The first topic is related to the social perspective of this research domain, which is evidenced by the keywords "aid", "poverty reduction" and "labor and livelihood". Studies deal with actions in chains to generate income for producers and their families, such as the paper of Makuya *et al.* (2017) about the impacts of watermelon value chain logistics costs on poverty reduction in Tanzania; the study of N. Mtimet *et al.* (2018) regarding the impacts of the pork value chain on work in rural livelihoods in Uganda; and the research of A. Omore *et al.* (2019) on interventions in agriculture to catalyze the transformation of small dairy farmers' value chains in Tanzania. Sub-Saharan Africa is the region of study, where particular social conditions such as
labor exploitation, lack of workers protection and unemployment, are explored by the articles.

The second main topic is female labor, which is evidenced through the keywords "gender" and "women". Some studies in this research domain are about the differences between female and male employment in African global agricultural value chains (Barrientos *et al.*, 2003), and the growth of women's participation in the production of fair trade organic coffee that does not equally reflect their representativeness in producer unions or participation in income (Lyon *et al.*, 2010); and the paper of A. Loconto (2015) that analyzes whether voluntary agrifood standards contribute socially in an equal way to male and female workers. Thus, women's labor is analyzed on their effective socioeconomic contribution to such workers.

The thirty topic is focused in small producers, which is evidenced by the keywords "smallholder agriculture" and "smallholder farmer". Studies in this topic addressed political interventions in the milk value chain in Nicaragua to include and strengthening the competitiveness of small and medium producers in global markets (Lie, *et al.*, 2018); and the study of S. Burkitbayeva and J. Swinnen (2018) that analyzes the reduction of smallholder farmers in transition economies. Thus, the social and rural development focus identified in the top journals and most-cited articles is related to this research domain.

The fourth topic is food security, which is evidenced in the keywords "food security", "nutrition" and "food policy". The articles address ways of generating employment and using certain agricultural crops to ensure food for families. In this context, there is the paper of M. Qureshi *et al.* (2015) which analyzes public policies related to value chains that aims to guarantee consumers access to food; and the study

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of L. Hernandez, *et al.* (2019) which analyzes the impacts of some strategies to improve food security in rural value chains in Tanzania through employment.

The fifty topic is governance, which is connect to "global production network" and "global value chains". The concept of governance, according to B. Burmester, *et al.* (2019) defines power in a value chain. Differences in power in global value chains have consequences for agricultural labor such as exploitation, lack of protection, and gender inequality. These issues are evidenced in the papers of B. Burmester *et al.* (2019), O. Abel *et al.* (2019) and A. Tallontire *et al.* (2011).

Many case studies are observed in this research domain, as showed by keywords like "Africa", "Mexico", "Cambodia", "India", "Vietnam" and "Tanzania". Examples of these studies are those of B. Saripalli *et al.* (2018) who analyze the actions of three Indian companies that seek to foster and encourage the work of small producers, especially women, in order to strengthen their relations with civil society and markets; the article of D. Luan and A. Kingsbury (2019) who demonstrates the restrictions on obtaining credit by small cinnamon producers in Vietnam and the impacts that such limitations have on income of rural workers; and the paper of M. Alford, *et al.* (2017) about the implications of global value chains for precarious employment found in the South African fruit sector.

In addition, the case studies were performed in diverse agricultural production, as showed by keywords such as: "aquaculture", "coffee", "sugarcane" and "cinnamon". Some examples of studies are those of S. Mudombi *et al.* (2019) that analyzed and compare the level of poverty of sugar cane plantation workers in Malawi, Mozambique and Swaziland; and the paper of O. Bergesen and R. Tveteras (2019) that addressed the contribution of innovation processes to the aquaculture chain in Norway in terms of labor productivity.

The second research domain is "implications of global value chains in labor", which is composed by two topics. The first topic explores how job creation, employment quality, labor protection and workers' rights are addressed in global value chains. The global scope of the discussions is highlighted by the concepts of "global value chain" and "global production network" linked to keywords such as "labor", "labor-rights", "exploitation" and "employment". Examples of studies performed in this research domain are the study of J. Pattenden (2016) which addressed the lack of associative power of workers involved in rural global production networks in India; and the article of G. Van den Broeck *et al.* (2017) about the impact of the expansion of global value chains and large-scale export-oriented farms in developing countries, especially regarding job creation. The article of M. Rawling (2015) who defends the national legislative regulation of global value chains to protect offshore workers; the study by S. Ma *et al.* (2019) that analyzes the impacts of global value chains on job creation, showing that employment structure of countries in these chains is improved; and the study of S. Jacobs *et al.* (2015) that highlights sexual harassment of workers in global horticultural value chains in Africa.

The second topic is about standards in global value chains that influence labor within global value chains. Examples of articles on this topic are those by J. Beghin *et al.* (2015) who analyze the impact of agricultural quality Standards on welfare, labor and other issues, checking whether they represent non-tariff measures in the international market; There is also the study by K. Van Herck and J. Swinnen (2015) that analyzes the introduction of quality standards in milk in Bulgaria as one of the reasons for the reduction of the country's agricultural dairy labor; and the paper of J. Swinnen (2016) who observes different socioeconomic impacts of agricultural standards, depending on the interest in welfare and job creation, or lobbying.

The thirty research domain is "technological development of global value chains", which is related to increasing labor productivity and sustainability in agribusiness through technology and innovation. It has

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connections with "globalization" and "global value chain", since increased productivity and investments in technology and innovation are necessary for the growth of global value chains.

Highlighted empirical studies were developed in "Brazil" and "Asia". Examples of studies performed in this research domain is that of S. Singh (2019) who analyzes the contribution of agribusiness in India to employment creation; and N. Langford (2019) which compares the benefits of sugar production in Germany and Brazil, the impacts that these chains generate for producers and, consequently, for the labor force in each region.
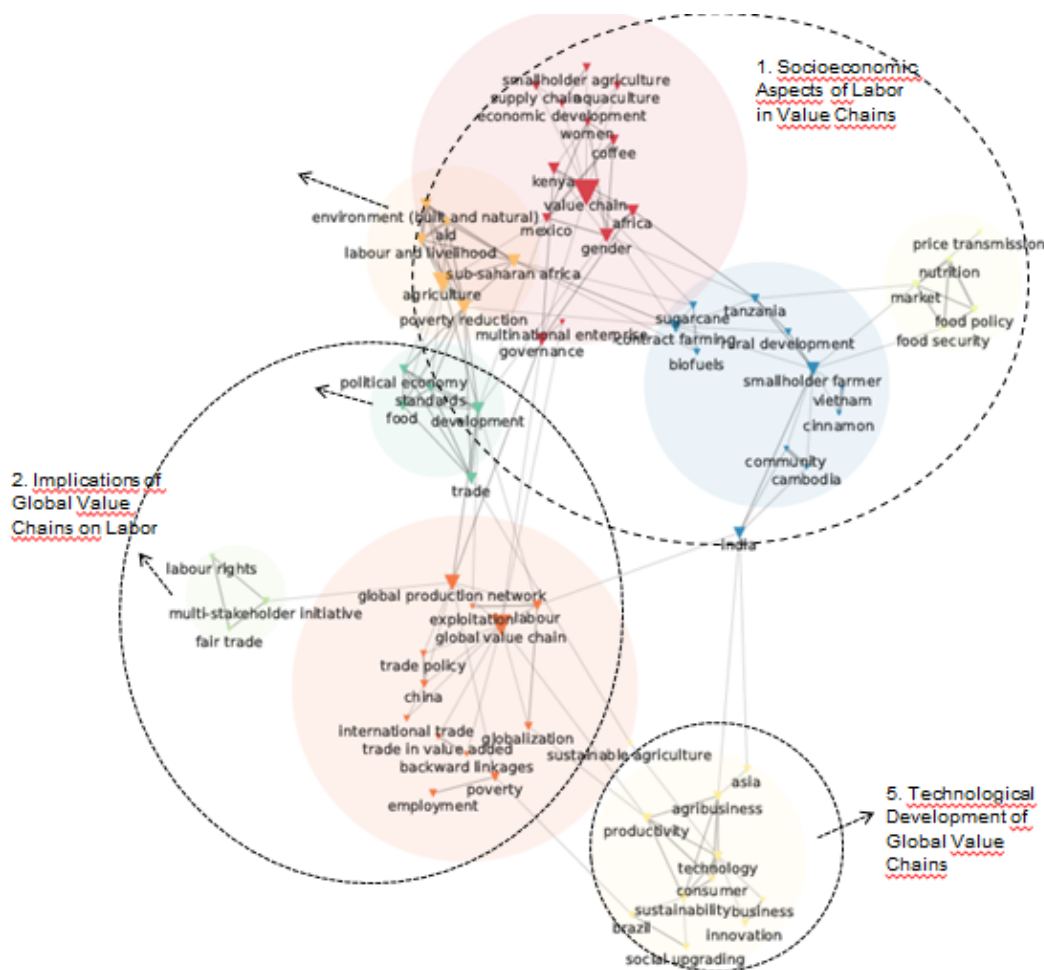

Figure 1. *Three main research domains on agricultural labor in global value chains.*

Conclusion

Agricultural labor in global value chains is related to diverse issues, and different levels of approach (*e.g.* farm, country, global chains). We identified three research domains through a bibliometric review of the articles indexed in Web of Science, which represent the main worldwide researches on agricultural labor in global value chains. On the one hand, our results provide a map of the main countries, main institutions, main journals, main authors and most cited articles contributing to knowledge production in the field. This map indicates the prevalent themes, institutions and authors for strategic partnerships,

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suitable journals for publication and the reference papers that provide background for research. On the other hand, network analysis provides a frame for researchers to locate their own topics within the international research landscape and identify how to advance on the topics, whether by deepening the analysis or opening it through the relationships between research domains.

Our results highlighted that the integration of researchers from different nationalities contributes to the development of their studies and their relevance, since all top authors publish in partnership with other institutions, especially those from other countries.

Gaps between research domains indicate ways for future research. For example, studies associating technological developments to increase labor productivity with social aspects of labor governance in global value chains, such as gender. These are topics displayed distant in the network graph.

The Web of Science bibliographical base covers many indexers related to agricultural science, but social sciences are less prevalent, which influence the results. An advance would be the comparison with Scopus bibliographical base, where social sciences are better represented, which may reveal different research domains.

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