

# Analysis of the Research Trend of Global Value Chain Based on Literature Metrology and Visualization Technology

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**Abstract:** With the improvement of international division of labor and cooperation and the refinement of production process division, the global value chain division of labor system is becoming the latest mode of product division. In order to deeply analyze and explore the research status and development trend in the field of global value chain, based on the Web of Science core collection SCIE and SSCI database, this paper uses the literature metrology method and CiteSpace software to conduct a visual analysis of the literature in the field of global value chain. The study discovered research hotspots, research processes, development frontiers, research distribution, and citation status of global value chains. We have comprehensively grasped the literature status of global value chain research, providing scholars with new research directions, and also providing strong reference and guidance for investment decision-making of multinational corporations and trade policy formulation of countries and international organizations.

**Keywords:** global value chain; literature metrology; research trend; visualization technology

## 1 INTRODUCTION

Since the 1980s, with the development of communication technology and logistics industry, enterprises from various countries have begun to engage in trade activities on a global scale, and global value chains have gradually become the main form of international division of labor. At the same time, the shortcomings of traditional trade statistics methods are gradually emerging. Vertical specialization characterized by intra product division and fragmentation of production process makes producers only participate in the international division of labor in a certain link, thus making the existing trade accounting system based on gross value form "repeated statistics" due to the multiple circulation of intermediate products among different countries, which cannot clearly describe the value creation of participants in the international division of labor. Especially in China, where processing trade is more common, it will significantly overestimate its trade surplus in the global value chain, providing seemingly credible false evidence for the so-called "China threat theory" accusation. Since the outbreak of the COVID-19, the international trade situation has changed, and the global value chain is facing reshaping. Therefore, it is particularly important to analyze the research hotspots, progress, and cutting-edge developments in the field of global value chains.

## 2 LITERATURE REVIEW

On the origin and early research of the value chain. The research on value chain originated in the mid-1980s. Porter proposed the concept of "value chain". He believed that enterprises are the aggregation of various activities in the process of designing, producing, selling, sending, and assisting their products. These activities can be indicated by a value chain. Porter provided a micro analysis framework for industrial economic organizations and enterprise strategic management, and believed that in the era of globalization, the competitiveness of enterprises depends on whether or not they can operate these value chains and occupy the high value links in this chain. The logic of this analysis has become an important part of Porter's enterprise competitiveness theory, and is one of the

important theoretical bases of his "diamond five forces analysis model" and industrial clusters. Gereffi (2001) expanded to the "global value chain" based on the network to analyze international production [1]. Dietzenbacher (2005) believed that the global value chain could maximize the resource endowment advantages of various countries, and conducted research on the continuous production sequence and length of industrial chain [2]. Koopman (2014) extensively studied the problem of value-added decomposition of global value chain [3]. Timmer (2014) decomposed the final product value of the value chain into labor and capital remunerations of various countries and industries [4]. Domestic scholars have also measured the forward and backward participation of global value chains by decomposing added value and final product. Meng (2017) measured the value-added gains of participating in the global value chain and the distance between producers and consumers [5]. Overall, early analysis of value chains mainly focused on concepts, types, and measures, and value chains were mainly applied in the field of enterprise analysis, rarely used in macroeconomic aspects.

Many scholars have conducted in-depth research on the value chain. They expanded their research perspective from micro to macro, studying the value chain of the commodity itself and also study the overall value chain status of the industry in which the product belongs, as well as the impact of the value chain on the economic development of various countries. Mukhtar (2020) believed that if all enterprises in the supply chain improve their value co-creation ability and integrate them, the competitiveness of the entire supply chain will be improved [6]. Xu, W. et al. (2022) think that reducing production and operation costs, improving production efficiency, and enhancing the position of enterprises in the global value chain are problems that enterprises need to consider [7]. Dünhaupt, P. and Herr, H. (2020) argue that global value chains provide opportunities for countries in the South to integrate into international trade, but this is not enough to bring them up to the per capita gross domestic product level of countries in the North, and there is even a risk of countries falling into low value-added activities [8]. Kondratiev, V. B. (2018) evaluated the impact of digital technology on the position of various industries in the global value chain and believed that an increase in global value chain participation alone cannot guarantee a long-

term increase in returns. Comparative advantages determined by technological progress in specific countries and industries are important in certain industries [9].

In conclusion, scholars have theoretically constructed the concept, classification and measures of the value chain, and the research content has gradually extended from the micro enterprise level to the macro industry and national level. However, there are few literature metrology studies on the global value chain, which still need to be improved. Therefore, this paper elaborates on global value chain, and the research questions are as follows: What is the research focus of GVC? How is the research process? What is development frontier? What is the distribution of GVC research in terms of countries, institutions, and authors? How is the literature on GVC cited?

### 3 RESEARCH METHOD

#### 3.1 Research Tool

This research is based on the literature metrology method, and uses CiteSpace software to visually analyze the selected and de-duplicated literature. Bibliometric method is a quantitative analysis method that uses mathematical and statistical methods to describe, evaluate, and predict the current status and development trends of science and technology, based on the quantity of various features in the literature.

In the research results section below, we have analyzed the research hotspots, research processes, development frontiers, research distribution, and literature citation of the global value chain. The specific operations are explained at the beginning of each section, and will not be repeated here.

#### 3.2 Data Source

In this paper, the core collection of Web of Science is selected as data source, and the retrieval formula is determined to be (TS = ("global") AND ("value chain") OR ("value chains")). Language is limited to "English", document type is limited to "Article", time span is "2011-2021", the data set is limited to "SCIE" and "SSCI", and 3799 records are obtained.

### 4 RESEARCH RESULTS

#### 4.1 Research Hotspot of Global Value Chain

##### 4.1.1 Keyword Co-Occurrence Analysis

Keywords of the literature are the core point of the paper and the refined expression of the research theme, which can highlight the core content of the full text. Therefore, analysis of keywords is beneficial to tap the research hotspots in this field. In this paper, the collected de-duplication sample data are imported into CiteSpace. The time segment in the TimeSlicing column is set as 2011-2021, and the time segment is set as 1 year. Node type is selected as keyword. After the setting, the software is run to analyze. This paper disregards the nodes in the atlas that do not adapt to the research hotspot or cannot express the complete meaning. Thus, we can obtain the literature keyword co-occurrence map in the field of global value chain (see Fig. 1). The map has 509 nodes and 715 connections, and network density is 0.0055. The larger the node and font size, the higher the frequency of keyword

use; and the thicker the connection, the closer the connection between the two keywords.

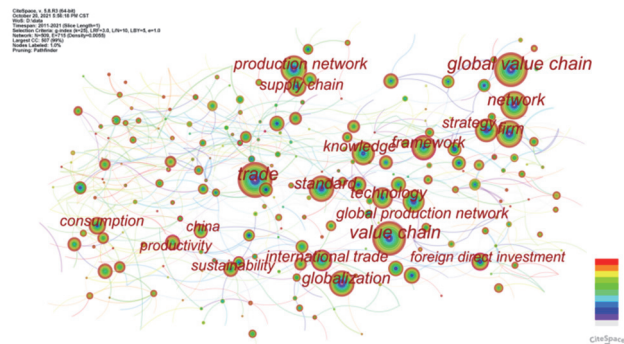


Figure 1 Keyword co-occurrence map

To select keywords accurately, this paper uses frequency and centrality as bases to measure the importance of keywords. Keyword frequency is positively related to the focus of the academic community on the keyword, so it can effectively reflect the research enthusiasm of the keyword, and is suitable for the evaluation criteria of research hotspots. Centrality of keywords reflects their importance in the entire keyword co-occurrence network and represents the core research theme of a certain period. The higher the centrality, the more important the keywords are. In general, keywords with centrality above 0.1 are markedly important, so they are also suitable as evaluation criteria for research hotspots.

After full consideration, this paper selects 20 keywords to analyze research hotspots (see Tab. 1). The top five keywords are trade, global value chain, value chain, network, and globalization. Keywords with high frequency and centrality are listed in the form of keywords (frequency/centrality), framework (146/0.13), international trade (126/0.13), FDI (86/0.12), and China (86/0.19) and indicate that the four keywords are suitable for evaluating research hotspots.

Table 1 High frequency keywords and their centrality

No.	Keyword	Count	Centrality	Year
1	trade	321	0.01	2011
2	global value chain	316	0	2011
3	value chain	303	0.01	2011
4	network	188	0.01	2011
5	globalization	161	0	2011
6	firm	160	0.06	2011
7	standard	155	0.05	2011
8	framework	146	0.13	2011
9	production network	142	0	2011
10	technology	136	0.05	2011
11	knowledge	133	0.01	2011
12	international trade	126	0.13	2011
13	global production network	121	0.04	2011
14	supply chain	118	0.03	2011
15	strategy	115	0.09	2011
16	consumption	101	0.07	2012
17	sustainability	99	0.05	2012
18	foreign direct investment	86	0.12	2011
19	china	86	0.19	2011
20	trade	83	0.01	2011

China, as the most central keyword, indicates that China is considerably important in the research of global value chain. In recent years, scholars have gradually diversified their research on China, such as the upgrading

of China's industrial value chain and the participation of global value chain in the analysis of China's development and CO<sub>2</sub> emission decoupling. Qin, Metc (2020) discussed the short-term impact of the COVID-19 pandemic on the global value chain. The aforementioned study found that China's position in the global value chain is important and cannot be replaced in the current world economy [10]. Currently, the global value chain faces three challenges, including trade wars, technological decoupling, and supply chain disruptions caused by the pandemic. In the future, scholars can further study how China responds to the challenges of global value chain restructuring, which is crucial for China's future development.

#### 4.1.2 Keyword Cluster Analysis

Keyword clustering analysis can reflect the most popular research topic in this field. CiteSpace is used to cluster high-frequency keywords in the field of global value chain and set the number of clusters to eight. Eventually, eight cluster points on the global value chain are obtained (see Fig. 2): value chain activities, global value chain, knowledge transfer, transactional actor, price transmission, global production network, small film, and CO<sub>2</sub> emission.

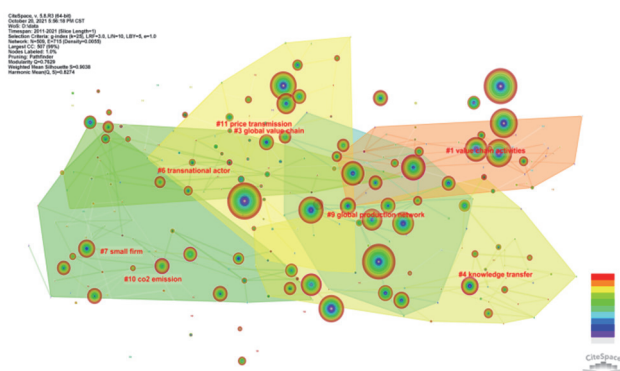


Figure 2 Keyword cluster analysis atlas

Each cluster is composed of closely related keywords. When the cluster *S* values are above 0.5 and over 0.7, the cluster is reasonable and convincing, respectively. The *S* value of the eight clusters shown in Fig. 6 is 0.9038, which is over 0.7. Hence, the clustering results have high reliability.

#### 4.2 Research Process of Global Value Chain

This paper discusses the evolution of GVC-related research by using time zone map analysis method, and summarizes and observes its research development trend. Time zone analysis is performed in the mode of taking each year as a time zone. Moreover, the "Timezone" function in CiteSpace is used to generate a hot time zone map in the field of global value chain research. Fig. 3 shows a trend in the development of highly prominent words and keywords with a frequency of over 120 in the field of global value chain from 2011 to 2021. The position of each circle in the map represents the year when the keywords were first published, thickness of the annual ring represents the research heat, lines between the keywords represent the co-occurrence relationship, and trend of the lines represents

the development of this research direction.

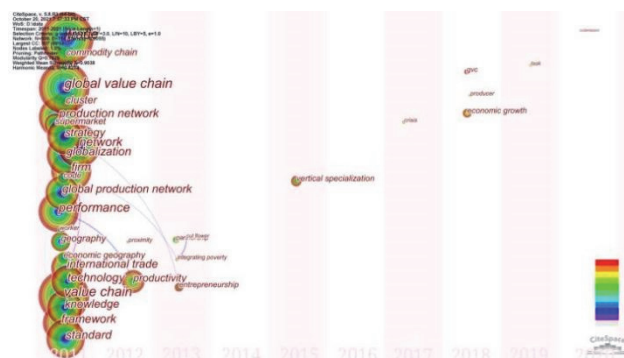


Figure 3 Keyword time zone

The research on global value chain in 2011 mainly focused on geography, production, industrial cluster, and other aspects. Industrial cluster refers to a group of interconnected enterprises with concentrated geographical locations in a certain industrial environment. The steady global value chain resulting from economic globalization and trade liberalization also makes local industrial clusters embedded in the global economic system. Industrial clusters face local and global competitions. Therefore, how to measure the role of industrial clusters in the global value chain and analyze the impact of the global value chain on the development of industrial clusters has become a research focus of scholars. Naqvi, I. B. (2018) combined cluster theory, innovation system framework, and global production network theory to assess the upgrading of industrial clusters in developing countries in the global production network [11]. Jankowiak, A. H. (2021) proposed that the current global value chain is being shortened, and production is becoming more concentrated geographically. Reconfiguring the supply chain and directing it locally will help to develop local clusters [12].

In 2015, scholars began to study vertical specialization in the global value chain network. Division of labor in the global value chain refers to division of labor and production links that countries or regions are responsible for when participating in the global value chain. Given the continuous development of the global value chain, the corresponding division of labor in the global value chain will also change. At present, the mode of international division of labor has begun to change from vertical division of labor to horizontal division of labor. That is, enterprises of various countries participating in international division of labor and cooperation have changed from producing final products to completing only one link in the process of forming final products according to their own factor endowment. China participates in the manufacturing and processing links in the global value chain with cheap labor costs, and has been locked in the low end of the industry for a long time. Therefore, the mode of division of labor should be studied for China to participate in the division of labor in the global value chain. Tong (2017) showed that the applicability of vertical specialization in the global value chain is not strong [13]. Gimet, C. (2015) believed that vertical specialization is driven by comparative advantage and location, which determine the role and bargaining power of local producers in their value chain [14].

In 2018, research on global value chain and economic



growth achieved certain results. Global value chain can facilitate the integration of developing countries into the global economic system. They no longer need to develop a complete industry but only need to focus on one link in the industrial chain. Accordingly, joining the global value chain can create employment and promote the growth of national income. Mao, Z. (2022) examined the relationship between economic growth and participation in global value chains. The aforementioned study believed that emerging markets should reduce foreign-dominated global value chains, increase domestic value chains with high added value, and improve the participation of global value chains in economic growth [15]. Jangam, B. P. (2021) was convinced that trade related to GVC promoted economic growth, and economic growth had higher benefits related to regional value chains. Therefore, promoting participation in global value chains is the goal for countries to further benefit from trade [16].

CO<sub>2</sub> emission will become a new topic in 2020. Carbon emissions generally refer to greenhouse gas emissions, which will cause the greenhouse effect and increase global temperature. On August 9, 2021, the IPCC released a report indicating that owing to global warming, extreme weather, such as heat waves, heavy rains, and droughts, has become more frequent, clearly blamed the increase in temperature on greenhouse gas emissions. Moreover, the report explained that the way to slow and reverse global warming is to reduce greenhouse gas emissions to zero. With the increasing attention to the environment, research on value chain and the environment will become a new research hotspot. Wang, H. (2021) believed that the decoupling of economic activities and CO<sub>2</sub> emissions is at the core of achieving China's climate goals. From the perspectives of production and consumption, he quantified the determinants of China's CO<sub>2</sub> emission intensity in the global value chain. The study found that the main driving factor of China's decoupling from emissions is the global value chain [17]. Zhang, L. et al. (2022) found that the carbon emissions of industrial sectors mainly come from high carbon emission industries, so it is necessary to save energy and reduce emissions in sub industries [18]. The government should refine the specific indicators of carbon emissions in various industries and establish a green energy economic system. Enterprises should also actively upgrade energy conservation and emission reduction technologies, jointly prevent carbon emissions from increasing, and achieve the goal of double carbon and value chain structure optimization.

In 2021, research on COVID-19 began to emerge. The prevalence of anti-globalization and trade protectionism has put the global economy in a situation of great change not seen in a century. The outbreak and persistence of COVID-19 has accelerated the reconstruction of GVC. During the outbreak of COVID-19, Santacreu, A. M. (2021) found that GVC played an important role in the decline of output and employment in the US manufacturing industry [19]. Zhao, L. (2021) studied how the clothing and textile industry implemented appropriate strategies to reshape its value chain during the COVID-19 [20]. Hayakawa, K. (2021) used COVID-19 cases and deaths as indicators to measure the impact of the epidemic and analyzed the impact of the epidemic on GVC [21].

### 4.3 Development Frontier of Global Value Chain

The research on the literature frontier can provide researchers with the latest evolution trends of discipline research, and identify the problems that should be further explored in the future. Compared with traditional high-frequency keyword analysis, emergent analysis is more suitable for detecting emerging trends and sudden changes in the development of disciplines. Specific steps are to select keywords for the node type, set the time cut to 1, take TOP25 as the threshold, run CiteSpace, and obtain the distribution map of global value chain emergent words from 2011 to 2021. A total of 25 emergent words are obtained (Fig. 4).

The analysis indicates numerous emerging words in the research of global value chain in 2011, and the average emerging time is about 4 years, indicating that scholars proposed important core ideas and problems at that time and have continued to explore and solve them. From 2011 to 2021, there will be emergence of new words almost yearly, indicating that scholars in the field of global value chain research have been innovating. In particular, globalization is the most intense, with a sudden emergence intensity of 15.12. The year of emergence was 2012 and ended in 2014, and was an early area of concern. Economic growth, CO<sub>2</sub> emission, vertical specialization, and entrepreneurship have emerged in the recent two years, and are research topics of considerable concern at present.

#### Top 25 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2011 - 2021
globalization	2011	15.12	2011	2014	
organization	2011	8.29	2011	2015	
commodity chain	2011	7.85	2011	2016	
cluster	2011	6.81	2011	2013	
geography	2011	5.83	2011	2015	
code	2011	5.81	2011	2017	
worker	2011	5.17	2011	2016	
global production network	2011	6.68	2012	2016	
performance	2011	4.44	2012	2012	
supermarket	2011	4.06	2012	2013	
strategy	2011	3.84	2012	2014	
cut flower	2011	4.28	2013	2015	
integrating poverty	2011	3.89	2013	2014	
partnership	2011	3.82	2013	2016	
economic geography	2011	4.35	2014	2016	
east	2011	4.66	2015	2016	
proximity	2011	4.23	2016	2017	
crisis	2011	3.82	2017	2018	
producer	2011	3.8	2018	2019	
task	2011	4.38	2019	2019	
economic growth	2011	4.17	2019	2021	
co2 emission	2011	4.88	2020	2021	
gvc	2011	3.99	2020	2021	
vertical specialization	2011	3.83	2020	2021	
entrepreneurship	2011	3.77	2020	2021	

Figure 4 Key words of high sudden present value

Currently, the research topics that have received much attention include "economic growth" and "carbon emissions". In the new situation, "anti-globalization"

"COVID" and "digital trade" may become the next stage of research hotspots. Although economic globalization is an irresistible trend, the current global economy is facing a huge challenge of anti-globalization. Some countries represented by the US pursue unilateralism and trade protectionism, withdraw from many international organizations, and the continuing political and economic friction between China and the US. Since 2020, the COVID-19 pandemic has had a huge impact on the global value chain, leading to the decoupling and rupture of the import and export industry chains of various countries, the continued downturn in global demand, and the regression of economic globalization. Therefore, studies should be conducted on the changes of the global value chain in the new situation and how China can better participate in the global value chain in the post epidemic era. In addition, with the emergence of the digital economy, digital trade has increasingly affected the pattern of international trade. In this context, exploring the interaction between digital trade and traditional trade and its impact on the status and division of labor of economies in the global value chain has also become an important direction of global value chain research.

#### 4.4 Research Distribution of Global Value Chain

##### 4.4.1 Analysis of Sending Countries

Through the visual analysis of the author's sending country through CiteSpace, set node type to country, and countries with over 80 starting documents are obtained (see Fig. 5). From the co-occurrence analysis of national cooperation, there are 170 nodes, 189 connections between nodes, and network density is 0.0132. Note that the current national cooperation in the field of global value chain is relatively close. The larger the country name and the thicker the node ring, the more documents issued by the country, the thicker the connection between nodes, and the closer the cooperation between countries.

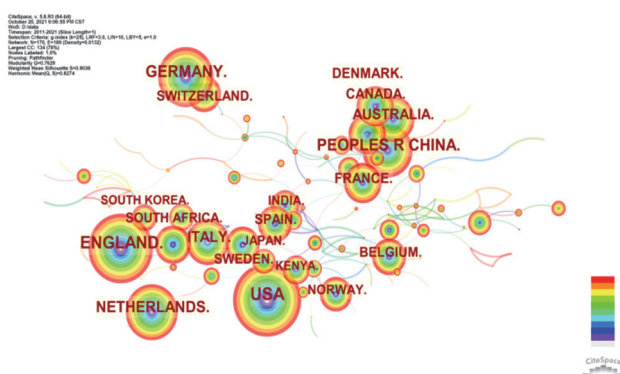


Figure 5 Co-occurrence map of issuing countries

Tab. 2 shows the number of published papers ranked first in the USA, with 644 published papers, followed by ENGLAND with 563 articles, GERMAN with 402 papers, PEOPLES R CHINA with 395 papers, and NETHERLANDS with 300 papers (see Tab. 2). Note that the US, the UK, Germany, the Netherlands, China and other countries with high economic development level remain dominant in this research field. However,

the top five countries in terms of the number of documents issued are not closely related to each other, forming several large groups, which are extremely independent.

Table 2 Countries with 80 or more documents

No.	Country	Count
1	USA	644
2	ENGLAND	563
3	GERMANY	402
4	PEOPLES R CHINA	395
5	NETHERLANDS	300
6	ITALY	217
7	AUSTRALIA	215
8	CANADA	168
9	FRANCE	166
10	DENMARK	151
11	SPAIN	148
12	BELGIUM	144
13	SWITZERLAND	136
14	SWEDEN	136
15	SOUTH AFRICA	123
16	INDIA	106
17	NORWAY	106
18	JAPAN	96
19	SOUTH KOREA	84
20	KENYA	83

##### 4.4.2 Analysis of Document Issuing Agency

CiteSpace is used to conduct visual analysis on the sending organization, set node type to institution, and organizations with over 20 published papers are obtained (see Fig. 6). The graph of institutional cooperation shows 409 nodes, 396 connections between nodes, and network density of 0.0047. Note that there is relative cooperation among institutions in the field of global value chain, but such a cooperation is not sufficiently close. The larger the name of the organization and the thicker the node ring, the more documents issued by the organization, the thicker the connection between nodes, and the closer the cooperation between the representative organizations.



Figure 6 Organization co-occurrence map

Tab. 3 shows 24 organizations with at least 20 documents. The top three organizations are Wageningen Univ., Univ. Manchester, and Copenhagen Business Sch. However, the top three organizations are not closely connected, forming several groups, which are relatively independent of one another.

**Table 3** List of organizations with 20 or more documents

No.	Institution	Count
1	Wageningen Univ.	85
2	Univ. Manchester	69
3	Copenhagen Business Sch.	55
4	Int. Livestock Res. Inst.	39
5	Univ. Sussex	37
6	Katholieke Univ. Leuven	35
7	Univ. Copenhagen	34
8	Wageningen Univ. & Res.	33
9	Univ. Sydney	30
10	Int. Food Policy Res. Inst.	29
11	Univ. Oxford	27
12	Univ. Cambridge	27
13	Natl. Univ. Singapore	26
14	Univ. Int. Business & Econ	26
15	Swiss Fed Inst. Technol.	26
16	Humboldt Univ.	23
17	Australian Natl. Univ.	23
18	Cornell Univ.	23
19	Univ. Queensland	22
20	Univ. Groningen	22
21	Erasmus Univ.	22
22	Univ. Johannesburg	21
23	Chinese Acad. Sci.	21
24	Harvard Univ.	21

**4.4.3 Author Analysis**

Co-occurrence analysis can reflect cooperation between core authors and researchers in this field. Price's Law states that the calculation formula for high-yield authors is as follows:  $N_{min} = 0.749\sqrt{N_{max}}$ , where  $N_{max}$  is the number of papers issued by the author with the most number of papers in the field. If the number of papers issued by an author is not less than  $N_{min}$ , then the author is called a high-yield author. Tab. 3 shows that the value of  $N_{max}$  is 13, 2.7 is obtained, and the integer is 3. That is, the number of papers issued is at least 3. By using CiteSpace, the authors of 3799 documents retrieved are counted, and 95 authors are high-yield authors with at least 3 articles. Set the node type to Author for visual analysis of the author of the article.



**Figure 7** Co-occurrence map of high yielding authors

A total of 469 nodes, 260 connections between nodes, and network density of 0.0024 are shown in the high-yield authors' atlas (Fig. 7). This result indicates that researchers in this field are not closely cooperating. Tab. 4 shows that from the perspective of the author group, global value chain research is in a state of "partial centralization and overall decentralization", and the mutual reference relationship between research teams is weak. Common research teams are often composed of authors from the

same institution, such as JOHAN SWINNEN, MIET MAERTENS, and BART MINTEN, as a research team; and MICHAEL HEINRICH and ANTHONY BOOKER, as a research team. Eventually, this situation is not conducive to the theoretical development in the field of value chain.

From the perspective of the number of documents issued, JOHAN SWINNEN has the highest number (13), followed by LAURENS KLERKX (12) and MICHAEL HEINRICH, LIZHI XING, and SIMON R BUSH (11).

In short, from the perspectives of countries, institutions, and authors with high publication volume, several major groups have formed, which are very independent and not closely related to each other, which is not conducive to the theoretical development of the value chain field in the long run. In the future, various countries, institutions, and authors should strengthen academic cooperation to promote academic development.

**Table 4** High yielding authors with 6 or more papers

No.	Author	Count	Year
1	JOHAN SWINNEN	13	2015
2	LAURENS KLERKX	12	2017
3	MICHAEL HEINRICH	11	2014
4	LIZHI XING	11	2017
5	SIMON R BUSH	11	2013
6	KARL M RICH	9	2011
7	MIET MAERTENS	9	2015
8	ANTHONY BOOKER	9	2014
9	DELIA GRACE	9	2016
10	BART MINTEN	9	2013
11	BO MENG	8	2017
12	JUN GUAN	8	2017
13	STEFANO PONTE	7	2014
14	LEI WANG	6	2017
15	RAM MUDAMBI	6	2013
16	JOONKOO LEE	6	2012
17	FRIEDER GRAEF	6	2017

**4.5 Citation of Global Value Chain Documents**

The co-citation analysis of references is mainly to study the key literature and research hotspots in this field, and the co-citation clustering reflects the hot topics and research directions of common concerns among the clustering literature.

**4.5.1 Co-Occurrence Analysis of Documents**

Using Citespace software, set the node type to co cited literature for visual analysis, and obtain the results shown in Tab. 5 and Fig. 8.



**Figure 8** Co-citation and co-occurrence of literature



The literature cited in the top three are Gereffi G, 2014, REV INT POLIT ECON, V21, P9, DOI 10.1080/09692290.2012.756414, and the cited frequency is 111, Timmer MP, 2015, REV INT ECON, V23, P575, DOI 10.1111/roie.12178, cited 95 times, Koopman R, 2014, AM ECON REV, V104, P459, DOI 10.1257/aer.104.2.459, cited 80 times.

**Table 5** Citation frequency and starting year of highly cited documents

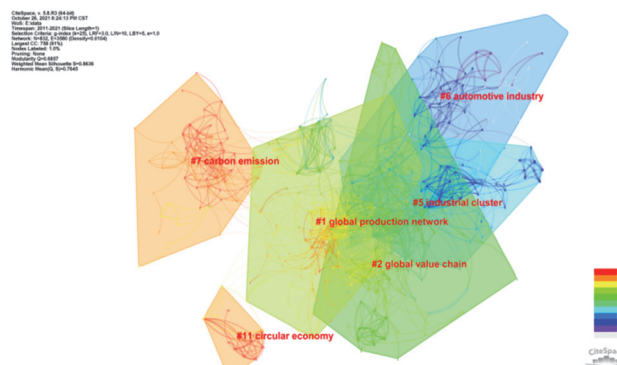
No.	Cited Reference	Count	Year
1	Gereffi G, 2014, REV INT POLIT ECON, V21, P9, DOI 10.1080/09692290.2012.756414	111	2014
2	Timmer MP, 2015, REV INT ECON, V23, P575, DOI 10.1111/roie.12178	95	2015
3	Koopman R, 2014, AM ECON REV, V104, P459, DOI 10.1257/aer.104.2.459	80	2014
4	Coe NM, 2015, GLOBAL PRODUCTION NE, V0, P0	75	2015
5	Ponte S, 2014, REV INT POLIT ECON, V21, P195, DOI 10.1080/09692290.2013.809596	70	2014
6	Gereffi G, 2016, J BUS ETHICS, V133, P25, DOI 10.1007/s10551-014-2373-7	65	2016
7	Timmer MP, 2014, J ECON PERSPECT, V28, P99, DOI 10.1257/jep.28.2.99	60	2014
8	Yeung HWC, 2015, ECON GEOGR, V91, P29, DOI 10.1111/ecge.12063	59	2015
9	Baldwin R, 2015, WORLD ECON, V38, P1682, DOI 10.1111/twec.12189	55	2015
10	Los B, 2015, J REGIONAL SCI, V55, P66, DOI 10.1111/jors.12121	49	2015
11	Yin R K, 2018, CASE STUDY RES DESIG, V0, P0	48	2018
12	Kee HL, 2016, AM ECON REV, V106, P1402, DOI 10.1257/aer.20131687	46	2016
13	Johnson RC, 2012, J INT ECON, V86, P224, DOI 10.1016/j.jinteco.2011.10.003	41	2012
14	Taglioni D, 2016, MAKING GLOBAL VALUE, V0, P0	41	2016
15	Barrientos S, 2011, INT LABOUR REV, V150, P319, DOI 10.1111/j.1564-913X.2011.00119.x	40	2011
16	Coe NM, 2008, J ECON GEOGR, V8, P271, DOI 10.1093/jeg/lbn002	38	2008
17	Gereffi G, 2016, GLOBAL VALUE CHAIN A, V2nd, P0	37	2016
18	Dietzenbacher E, 2013, ECON SYST RES, V25, P71, DOI 10.1080/09535314.2012.761180	34	2013
19	Neilson J, 2014, REV INT POLIT ECON, V21, P1, DOI 10.1080/09692290.2013.873369	32	2014

#### 4.5.2 Literature Cluster Analysis

A total of 13 clusters are obtained by cluster analysis of the cited documents. Fig. 9 shows that the global value chain research network has strong concentration and high network overlap. Node literature is highly related and explanatory, and certain key node literature is located at the junction of knowledge groups, serving as a link between the preceding and following, providing theoretical support and direction guidance for subsequent research. From the connection perspective, inter-group correlation is strong, and the research has formed multiple literature clusters around key nodes. This paper selects six clusters with high correlation.

#Cluster 1 refers to the global production network and cluster #2 refers to the global value chain. The two clusters are at the center of the network and closely related to the

surrounding areas. They are the theoretical bases of the entire global value chain research field. # Cluster 5 refers to the industrial cluster and cluster #6 refers to the automobile industry. The two clusters are closely related to cluster #1 and cluster #2. They have become the leading branches in the field of value chain research and are the theoretical extension and practical application of the cluster. The manufacturing industry plays an important role in the global value chain, and the automobile industry is also an industry significantly affected by the value chain in the manufacturing industry. Many scholars, such as Zenka, J. (2013), have conducted research and drawn on the perspectives of the global value chain and global production network, and evaluated the industrial upgrading of 490 Jack automobile companies during the period when foreign direct investment flowed into the Czech automobile industry in large quantities from 1998 to 2008. The results show that industrial upgrading is selective at the enterprise level [22]. Lampon, J. F. (2021), under the global value chain approach, analyzed how domestic suppliers outside the automotive industry are affected by their relationships with foreign multinationals [23].



**Figure 9** Cluster diagram of co cited documents

#7 Clusters are carbon emission and cluster #11 is circular economy. The two clusters are at the edge of the network, showing a certain degree of independence and have no strong relationship with other studies. Wiebe, K. S. (2018) proposed that consumption-based carbon emission data improve the understanding of the link between the final product and environmental pollution caused by upstream production processes. Among the numerous global value chains analyzed, the overall impact is that low-carbon electricity replaces the use of upstream coal power [24]. Naims, H. (2020) analyzed the potential economic impact of new carbon capture and utilization technologies on the industrial value chain [25].

## 5 DISCUSSION

This paper mainly uses CiteSpace, an econometric analysis software, to perform statistical analysis of the global value chain by using a combination of qualitative and quantitative analysis methods, and draw relevant research conclusions. The inadequacy of this article is that it only uses English core papers as research samples and does not include relevant Chinese literature, which may lead to incomplete research results. Subsequent research will further optimize this aspect to draw more comprehensive and scientific research conclusions.

The theoretical and practical significance of this article is as follows. This article, as a literature review, provides an overall grasp of existing literature in the field of global value chains, analyzing research hotspots, research processes, and development frontiers, enabling people to efficiently and accurately understand the past, present, and future research on the topic of global value chains. It provides scholars with new research directions and is conducive to finding their own research breakthroughs. Three years after the outbreak of the COVID-19, the international trade situation has been changing, and the global value chain is facing the risk of interruption. To some extent, the research on the development process of the value chain in this paper can provide strong information support for the investment decisions of multinational companies and the formulation of trade policies of countries and international organizations.

## 6 CONCLUSION

This paper systematically summarizes and analyzes the current research status and development trend of global value chain, and draws the following conclusions.

From the perspective of research hotspots, international trade and foreign direct investment have been research hotspots in the past decade. The current research hotspots are economic growth, CO<sub>2</sub> emission, vertical specialization, and entrepreneurship. Scholars' research directions are gradually shifting from geography, production, and industrial cluster to vertical specialization, economic growth, and CO<sub>2</sub> emission.

From the perspective of research distribution, the total number of papers from countries such as USA, ENGLAND, GERMAN, PEOPLES R CHINA, and NETHERLANDS is the highest, while papers from Wageningen Univ., Univ. Manchester, and Copenhagen Business Sch. are the highest. JOHAN SWINNEN and LAURENS KLERKX are LAURENS KLERKX, MICHAEL HEINRICH, LIZHI XING, and SIMON R BUSH are the authors with the highest number of papers published, but there is not enough close cooperation among countries, institutions, and authors. In the future, it is necessary to strengthen academic exchanges.

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