12 Network analysis of world trade in culture and creative industry

Introduction

Culture and related sectors are widely recognized as one of the most rapidly growing industries in the world economy. In the last fifteen years the world trade in cultural and creative industries (CCI) goods grew very rapidly. Global CCI products exports in 2015 reached $ 510 billion (compared to $ 208 billion in 2002) (UNCTAD, 2017). World trade in CCI sector has grown at a similar rate to the ICT market, in developing countries reaching even higher growth dynamics (UNCTAD, 2017). As a result the creative economy is now defined as a new paradigm for development, which is an opportunity especially for developing countries (UNCTAD, 2010).

The purpose of this article is to determine the structure of the network in the global trade in CCI products, in particular the identification of the characteristics of the network as a whole, the position of the countries in the network structure and the groups within it (Białynicka-Birula, 2011, p. 103).

In the first part of the article are presented indicators describing the structure of global trade in the cultural and creative industries sector, the second part focuses on the position of countries in the global market, while in the third on the grouping of countries with the strongest trade relationships.

The study used a network analysis method using UCINET 6 software and a NetDraw data visualization package. The statistical material was taken from the UNCTADStat database.

1. World trade network of cultural and creative goods

The method of network analysis has genesis in sociometry, but now is used in many scientific disciplines: psychology, anthropology, biology, politics, computer science but also in economics and management sciences (Białynicka-Birula, 2014, p. 139). A network is a structure made up of individuals called "nodes", which are tied (connected) by one or more specific types of interdependency. Nodes are the individual elements within the networks and ties are the relationships between them (Kosorukoff, 2011, p. 1). For the purposes of this article, it is assumed that that individual countries will be the nodes in the international network, while foreign trade has the role of one- or bilateral relations (ties) between countries.

Analysis was prepared taking into account the export flows in 2015 of the product groups of the CCI sector used in the UNCTAD's classification of creative economy: art crafts, audiovisuals, design, new media, performing arts, publishing and visual arts. The network of international exports of CCI products is shown in Figure 1.

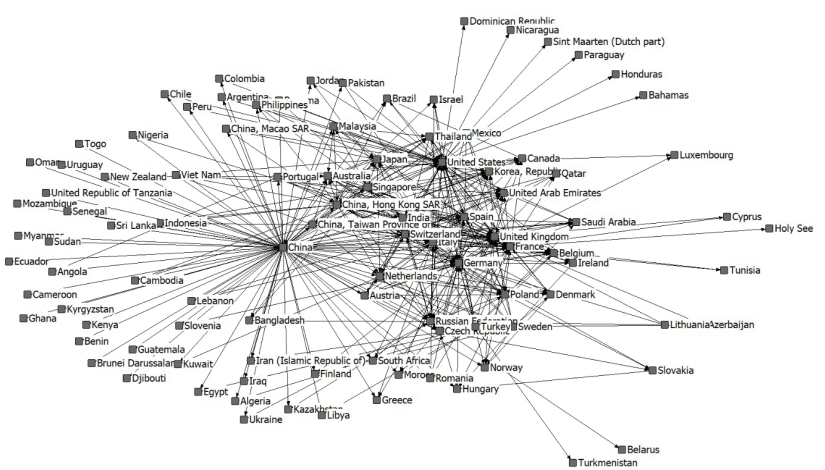

Figure 1. Global network of exports of cultural and creative products (dichotomized at 100 million dollars level)

Source: own studies using UCINET 6 and NetDraw software.

The network as a whole structure is determined by a synthetic network centralization meter that determines the degree of centralization of the analyzed network comparing to the maximum centralized "star" network (Białynicka-Birula, 2014, p. 143). For the global trade network for CCI products (dichotomized at 100 million dollars level) this indicator is 35%, which is mainly due to China and United States. The central position of these states presented in the diagram may suggest higher level of centralization of the network, but it has been reduced primarily by the europocentrism of European Union exports.

An important element of network analysis is the identification of the network structure. Borgatti and Everett (1999, p. 376) assumed that network consists of only one group of all the elements, which belong to network to a greater or lesser extent. This means that the networks have a core/periphery structure. In this concept, core elements are closely interrelated, while peripherals have more relationship to the core than they are to each other.

The identification of the core/periphery structure occurs on the basis of the level of correlation between the analyzed network structure and the ideal core/periphery network (Białynicka-Birula, 2014, p. 141). The coefficient of correlation between the global network of exports of CCI products and the ideal core/periphery network is 0.77, which confirms the existence of this structure in the analyzed network. The core of the analyzed network contains China, Hong Kong, Czech Republic, France, Germany, India, Italy, Japan, Netherlands, Poland, Singapore, Spain, Switzerland, United Kingdom and United States.

In conclusion, despite the fact that the international CCI market is not strongly centralized, the trade flows are primarily between several core countries, i.e. Asian countries (China, Japan), member states of the European Union and the United States.

2. The position of countries on the international cultural and creative industries market

The network approach to the position of countries on the international market emphasizes that power is relative. In this view, countries do

not have power in themselves, but they have power, because their products can dominate the foreign markets (Hanneman, Riddle, 2005). This means that countries that have the largest number of export destinations will be recognized as the strongest and most influential on the worldwide market.

To identify the most important network elements a method of increasing the level of dichotomization of variable was applied. Use of this method causes the exclusion of insignificant states from the network, and as a result, only the most important countries remain. The network of international exports of CCI products at higher level dichotomization of variable "export" is shown in Figure 2.

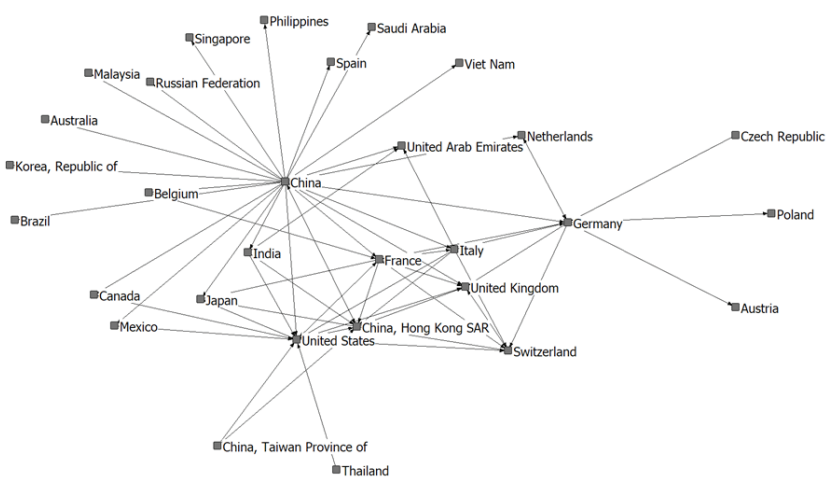

Figure 2. Global network of exports of cultural and creative products (dichotomized at 1 milliard dollars level)

Source: own studies using UCINET 6 and NetDraw software.

The applied dichotomization of the variable resulted in the reduction of global network elements to thirty states. The characteristics of the resulting network were determined using selected network analysis

measures: node degree, Bonacich's power and Freeman's betweenness. The results of the analysis are shown in Table 1.

Table 1

The results of an analysis of the international trade network for cultural and creative products

State	OutDegree	InDegree	Bonacich's power	Freeman's betweenness
Australia	0	1	0.449	–
Austria	0	1	0.841	–
Belgium	1	1	0.704	–
Brazil	0	1	0.449	–
Canada	1	2	1.729	–
China	23	1	2.510	0.639
China, Hong Kong	4	8	5.890	0.146
China, Taiwan	2	0	0.449	–
Czech Republic	1	0	–	–
France	6	6	5.320	0.136
Germany	6	5	4.715	0.260
India	3	1	0.449	–
Italy	6	2	2.238	0.009
Japan	2	4	3.726	–
Korea, Republic of	0	1	0.449	–
Malaysia	0	1	0.449	–
Mexico	1	2	1.729	–
Netherlands	1	2	1.417	0.014
Philippines	0	1	0.449	–
Poland	1	1	0.841	–
Russian Federation	0	1	0.449	–
Saudi Arabia	0	1	0.449	–
Singapore	0	1	0.532	0.015
Spain	0	1	0.449	–
Switzerland	4	5	4.544	0.015
Thailand	1	0	0.449	–
United Arab Emirates	0	3	1.926	–
United Kingdom	3	6	6.033	0.061
United States	7	11	7.189	0.549
Vietnam	0	1	0.449	–

Source: own studies using UCINET 6 software.

The degree of the node determines the number of connections to the remaining nodes of the network. Number of connections going into a node is understood as in degree of the node, while number of connections coming out of it is understood as outdegree of the node. This measure is interpreted as the ability to directly influence other network elements (Białynicka-Birula, 2014, p. 140). The analysis of this indicator has shown that the international market for CCI goods is dominated mainly by one state – China, while a significant part of the network has been included in it because of the strong import relation with the dominant node. From the perspective of international market position, China has more export opportunities and alternatives than other states and will be less likely to notice a decline in demand for Chinese goods on other markets.

The measure of the position and importance of individual states in the structure of the network is also the index of centrality. To assess the impact of countries in the international CCI market was used Phillip Bonacich's power based centrality measure. In this indicator a unit's centrality is it's summed connections to others, in this case countries, weighted by their centralities (Bonacich, 1987, p. 1172). This means that not only the number of export directions is taken into account, but also their quality measured by the influence of trading partners on the international market. Analysis of this indicator shows that the United States, China, Hong Kong and France are the most influential countries in the CCI global market.

According to the concept of network analysis, another aspect of a structurally advantaged position is position of the node among other nodes, which gives the capacity to broker contacts among other elements (Hanneman, Riddle, 2005). The measure of this position is Freeman's betweenness, which takes into account the number of connections passing through the network element and assumes higher values for the bridging nodes (Białynicka-Birula, 2014, p. 140). The intermediaries between the rest of the global network of trade in CCI products are China, the United States and Germany.

3. Sub-groups in the network of international trade of cultural and creative products

The subgroup (clique) is part of the network in which the nodes are more closely and intensely tied to one another than they are to other members of the network (Hanneman, Riddle, 2005). As a result of the analysis, apart from the selection of the minimal subgroup size, only two groups were distinguished, which means that the international trade network of CCI is not fragmented (Figure 3):

1. Australia, Austria, Belgium, Brazil, Canada, China, China, Hong Kong, China, Taiwan, Czech Republic, France, Germany, India, Italy, Japan, Malaysia, Mexico, Netherlands, Philippines, Poland, Russian Federation, Singapore, Spain, Switzerland, Thailand, United Kingdom, United States.
2. Australia, Austria, Belgium, Brazil, Canada, China, China, Hong Kong, China, Taiwan, France, Germany, India, Italy, Japan, Malaysia, Mexico, Netherlands, Philippines, Russian Federation, Saudi Arabia, Singapore, Spain, Switzerland, Thailand, United Kingdom, United States.

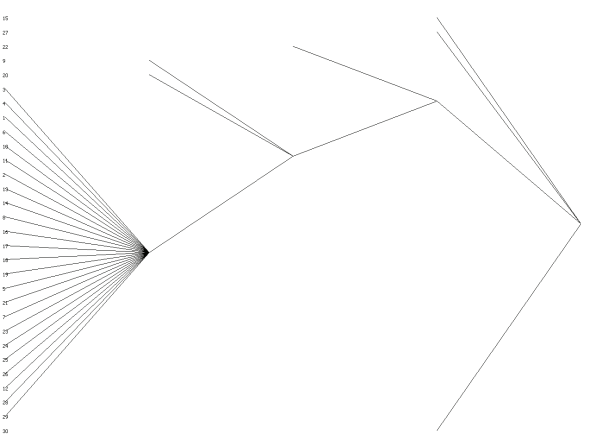

Figure 3. Graphical interpretation of subgroup analysis results in international trade in cultural and creative products

Source: own studies using UCINET 6 software.

Matrix of co-membership in the subgroup (actor-by-actor clique co-membership matrix) indicates how many shared groups belong to a given pair of network elements (Figure 4). The results of the analysis in the matrix show that in the international trade network of CCI products the Czech Republic, Poland and Saudi Arabia are the least dependent on other countries, while the Republic of Korea, United Arab Emirates and Vietnam proved to be excluded countries. The large number of countries participating in both groups again proves the non-fragmentation of the network.

Actor-by-Actor Clique Co-Membership Matrix

		1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0
		A A B B C C C C C F G I I J K M M N P P R S S S S T U U U V
		- -
1	Australia	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
2	Austria	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
3	Belgium	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
4	Brazil	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
5	Canada	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
6	China	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
7	China, Hong Kong SAR	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
8	China, Taiwan Province of	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
9	Czech Republic	1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 0 1 1 1 1 0 1 1 0
10	France	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
11	Germany	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
12	India	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
13	Italy	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
14	Japan	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
15	Korea, Republic of	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
16	Malaysia	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
17	Mexico	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
18	Netherlands	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
19	Philippines	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
20	Poland	1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 0 1 1 1 1 0 1 1 0
21	Russian Federation	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
22	Saudi Arabia	1 1 1 1 1 1 1 1 0 1 1 1 1 1 0 1 1 1 1 0 1 1 1 1 1 1 0 1 1 0
23	Singapore	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
24	Spain	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
25	Switzerland	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
26	Thailand	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
27	United Arab Emirates	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
28	United Kingdom	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
29	United States	2 2 2 2 2 2 2 2 1 2 2 2 2 2 0 2 2 2 2 1 2 1 2 2 2 2 2 0 2 2 0
30	Viet Nam	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Figure 4. Matrix of co-membership in subgroups

Source: own studies using UCINET 6 software.

Clique-by-clique co-membership matrix (Figure 5) is interpreted analogously to actor-by-actor clique co-membership matrix. This matrix indicates the number of common elements in groups. In the case of the analyzed subgroups, the vast majority of countries were included in both groups, indicating a high degree of similarity of cliques.

Clique-by-Clique Actor Co-membership matrix

	1	2
1	26	24
2	24	25

Figure 5. Results of subgroup analysis in international trade in cultural and creative products

Source: own studies using UCINET 6 software.

Conclusions

The research shows that the CCI global trade network in 2015 was not strongly centralized. In spite of this, global trade is mainly concentrated around core countries while other states play a peripheral role. Major players in the global CCI market have been the United States, European Union Member States, and Asian countries such as China and Japan. In addition, the analysis of subgroups in the network has shown that all the most influential states in the global CCI market are closely related.

Based on the research carried out in the article, it can be stated that network analysis can be a useful tool in the study of the structure of international trade. This method allows to get a wider approach to the subject of global, allowing to get information about network, its structure, subgroups, and elements, that would not have been able to obtain using other research tools. The results can be a starting point for further analysis taking into account the structural changes in the network.

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Network analysis of world trade in culture and creative industry

Summary. The purpose of this article is to identify the network of global trade in cultural and creative industries (CCI). The paper presents the results of network analysis of global trade in these products. In the first part of the article are presented indicators describing the structure of global trade in the cultural and creative industries sector, the second part focuses on the position of countries in the global market, while in the third on the grouping of countries with the strongest trade relationships. The analysis has shown the global cultural and creative industries market is not strongly centralized, but the trade flows are primarily between several core countries (Asian countries, United States and EU member states).

Keywords: culture and creative industries, international trade, network analysis

JEL classification: F14, Z11

Analiza sieciowa światowego handlu produktami kultury i przemysłów kreatywnych

Streszczenie. Celem artykułu jest identyfikacja sieci powiazań w globalnym handlu produktami kultury i przemysłów kreatywnych. Zaprezentowano w nim wyniki analizy sieciowej globalnego handlu tymi produktami. W pierwszej części przedstawiono wskaźniki opisujące strukturę światowej wymiany handlowej sektora kultury i przemysłów kreatywnych, w drugiej skupiono uwagę na pozycji państw na światowym rynku, natomiast w trzeciej – na wyróżnieniu grup państw o najsilniejszych powiązaniach. Analiza wykazała, że światowy rynek kultury i przemysłów kreatywnych nie jest silnie scentralizowany, ale przepływy handlowe odbywają się głównie między krajami dominującymi (państwa azjatyckie, Stany Zjednoczone oraz państwa Unii Europejskiej).

Słowa kluczowe: kultura i przemysły kreatywne, handel międzynarodowy, analiza sieciowa

Klasyfikacja JEL: F14, Z11