

## Article

# Faux Fur Trade Networks Using Macroscopic Data: A Social Network Approach

Yeong-Hyeon Choi <sup>1</sup>, Seong Eun Kim <sup>1</sup> and Kyu-Hye Lee <sup>2,\*</sup>

<sup>1</sup> Department of Clothing and Textiles, Hanyang University, Seoul 04763, Korea; choiyh@hanyang.ac.kr (Y.-H.C.); william102@hanyang.ac.kr (S.E.K.)

<sup>2</sup> Human Tech Convergence Major, Department of Clothing and Textiles, Hanyang University, Seoul 04763, Korea

\* Correspondence: khlee@hanyang.ac.kr; Tel.: +82-2220-1191

**Abstract:** This study used social network analysis, which is often adopted to analyze changes in trade structures and the world trade network for faux fur products, which are alternative materials used in vegan fashion. The data on the total trade value of artificial fur (HS Code: 4304) and animal fur and leather (HS Code: 0505) imports and exports between countries were collected through UN Comtrade, and the degree and betweenness centralities were used to analyze the trade structure of faux fur in 2009, 2014, and 2019 using NodeXL 1.0.1 programs. The results of the study are as follows: First, while the total amount of export and import of faux fur is increasing globally every day, the total amount of export and import in other Asian countries and Vietnam is decreasing. Second, due to the reduction in exports of the main producing countries of animal materials such as China, global imports of animal fur and leather decreased. Third, China was the largest exporter of faux fur, exporting to a large number of countries; it also played an important role in the intermediation and control over faux fur export. In exporting faux fur, the influence of other Asian countries declined over time, and Vietnam and the United States played an outstanding role as arbitrators in the export network. Fourth, Italy and France were the largest importers of faux fur from various countries and exerted significant influence as intermediaries in the import network of faux fur. On the other hand, Vietnam's influence in import network decreased. Saudi Arabia appeared to be an important arbitrator in mediating the import. This study is significant due to its findings, obtained through micro-trading data, in respect of industrial moves of ethical fashion in the form of increased trade in faux fur and decline in the trade of animal fur and leather.

**Keywords:** faux fur; artificial fur; vegan fur; animal fur; artificial fur trade; trade network analysis; social network analysis



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## 1. Introduction

Fur has a long history of human use, with the dual functions of protecting humans from cold and signifying status symbol. However, by the 1970s, wearing fur has undergone a transformation from being an economic and social symbol to being a target of animal rights activism [1]. About 85% of the animals used for fur products are raised in factory farms, trapped in narrow and dirty cages, and slaughtered by electrocution, strangling, or blood-letting [2]. As a result, wearing fur, which once signified one's wealth, is now considered an unethical clothing behavior in terms of animal welfare, signaling a radical change in fur-wearing as a non-verbal symbol of riches.

Changes in perception of fur are not limited to just a few groups but have support at the national and corporate levels. The United Kingdom was the first country to prohibit fur production for ethical reasons in 2000. As animal rights NGOs criticized Queen Elizabeth II for constantly wearing fur products, she announced in 2019 that the entire royal family, including her, would use faux fur henceforth [3]. London Fashion Week, one of the 'Big Four' fashion events (the other three being those in New York, Milan, and Paris),

has prohibited all its designers from using fur since 2018 [4]. In addition to national-level restrictions in place, such as in the UK, many famous fashion brands and designers around the world have participated in the anti-fur campaigns, as a result of ethical fashion designers' consistent interest in animal welfare and consumers' growing ethical awareness. For instance, many fashion houses and designers, the likes of Stella McCartney, Prada, Gucci, Versace, Maison Margiela, Jimmy Choo, Tom Ford, Hugo Boss, Vivienne Westwood, Calvin Klein, Ralph Lauren, Tommy Hilfiger, Michael Kors, DKNY, and Coach, pledged to ditch fur [5].

With this movement gradually becoming a mainstream culture, vegan fashion is emerging as an alternative clothing behavior to the consumption of natural fur. Vegan fashion encourages products, which do not use animal resources, such as leather, fur, wool, silk, and duck down, and prohibits animal experimentation in the production process [6]. Since the demand for ethical products has increased, many vegan fashion brands have sprouted up, offering a collection of faux-fur coats and outerwear. Apparis, a cruelty-free fur winter coat brand, invested \$3 million to expand its vegan fashion line's presence in online retail in the U.S. as well as in the global markets [7].

This increasing preference and demand for faux fur has had a natural influence on international trade. The supply chain of faux fur production is intertwined with diverse countries, with importance attached to its quality, to enable its perception and acceptance as a substitute for real fur. Therefore, it is expected that the trade network of faux fur industry is complicated. To study the trade network, social network analysis is appropriate to reveal the chronological changes in the quantum of trade and relationship between partner trading countries. Social network analysis is a methodology that can be used for analyzing trade structures; it studies the interaction among actors in a network formed through some relationship such as friendship, cooperation, trade, *inter alia* [8]. The concept of centrality was used to identify national locations and roles within the trade network. Ju et al. [9] analyzed the trade network of leisure wear through social network analysis, while Shirazi et al. [10] compared the crude oil trade networks of Eastern Europe and Eurasia. Vidya and Prabheesh [11] measured the trade interconnectedness among countries before and after the COVID-19 outbreak and forecasted the future direction of trade.

Past studies on faux fur were conducted from various perspectives. Rolling et al. [12] investigated the cognitive dissonance between the faux fur marketing of luxury brands and their new products using real fur and its impact on brand attitude and purchase intention. Lee, Karpova, and Bayter [13] studied how exposure to different types of information (one-sided information against using animal-based materials, one-sided information promoting use of animal-based materials, two-sided information presenting both sides, and information not related to fashion products made of animal-based materials) influenced college students' attitudes and subjective norms towards purchasing fashion products made of fur, leather, and wool. However, the studies on faux fur and vegan fashion have not been sufficient. In particular, research on the trade network between countries of fur products is insufficient. As social consciousness relating to animal fur products changes in the favor of faux fur, further re-research is needed on faux fur products.

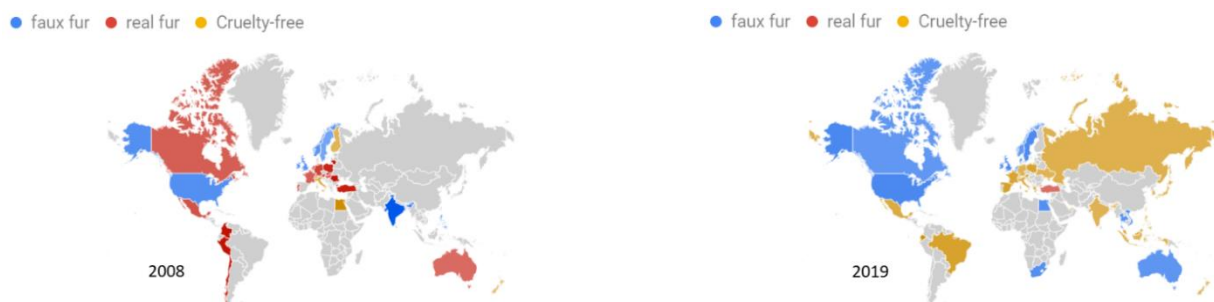
Vegan fashion is not a rejection of fashion itself but a movement that emphasizes ethics in terms of production. It can be interpreted as wanting a fur product but not at the cost of harming an animal. Thus, an ethical movement, reducing the production of animal fur at the designer, corporate, and national levels, will also affect the trade of faux fur. Based on social network analysis, this study also analyzed the trade structure of faux fur network. This study examines (1) the total amount of imports and exports of faux fur and animal fur materials, and (2) the role of major trading countries in the faux fur trade network. Based on the macro trade data, the insights gained from this study can prove that ethical moves appeared in fashion industries.

## 2. Theoretical Background

### 2.1. Faux Fur As an Alternative Material by Vegan Fashion

Originally, veganism was perceived as a certain pattern of lifestyle, restricted to vegetarians. However, today, it has come to be regarded as an indication of ethical consumer behavior [14]. The fashion industry has adopted this behavior trend as well, which makes the trend evolve into vegan fashion. It does not use natural materials such as fur, leather, silk, and wool [6]. Faux fur is suggested as an alternative material to real fur in vegan fashion. In the past, faux fur was used as a cheap alternative to natural fur, but due to advancements in production technologies, the quality of texture and sheen of faux fur have improved [15]. Thus, faux fur has now become the main alternative material to real fur.

One can have a glimpse into the changes in consumer awareness by using Google Trends and analyzing search pattern of the keywords “fur,” “fake fur,” and “cruelty-free” for the years 2008 and 2019 (Figure 1). The red-painted area is the region with most “fur” searches, blue-painted area indicates most “faux fur” searches, and yellow-painted area indicates most “cruelty free” searches. Comparatively, red-painted areas took up most of the map in 2008. However, in 2019, yellow and blue areas in-creased strikingly. It proved that consumers’ interest in natural fur has decreased, while interest in faux fur and cruelty-free products has increased.



**Figure 1.** Google trend of dominant keywords (faux fur, real fur, cruelty-free) in 2008 and 2019.

Bae and Kwon [16] analyzed the faux fur fashion in Specialty store retailer of Private label Apparel (SPA) brands. Outerwear was the most common usage of faux fur, and major figurative characteristics turned out to be ivory color and natural pattern that afford a resemblance to animal’s natural fur. Lee and Choi [17] studied the faux fur-related behavior of female consumers by comparing the variables related to the purchase attitudes towards natural and faux fur clothes. Rarity value and fur familiarity had a positive influence on the purchase intention toward both natural and faux fur. While subjective norms had a negative influence on the purchase intention toward natural fur, it had a positive influence in the case of faux fur.

Some studies proved that the use of faux fur was related to ethical consciousness of consumers. Kim and Kwon [18] divided the consumption of faux fur as a practice of ethical consumption into altruistic disposition and selfish tendency, examining the difference of awareness between the two tendencies. In the case of altruistic tendency, consumers conceived faux fur as an alternative to natural fur, not wanting faux fur to look like natural fur. In the case of selfish tendency, on the other hand, consumers either preferred faux fur products that looked similar to natural fur as a symbol of wealth and luxury or tended to conceive faux fur as a material of a very different category unrelated to natural fur.

Lee, Karpovam, and Baytar [13] examined how one-sided information affects consumer attitudes, subjective norms, and purchase intentions toward clothing made of natural resources like fur, leather, and wool. It was revealed that participants’ attitudes and subjective norms toward purchase of such clothing were significantly different, depending on the type of information they were exposed to (information against using animal-based materials / information promoting use of animal-based materials / offering both sides of information).

## 2.2. Trade Network Analysis through Social Network Analysis

A social network analysis consists of a set of nodes (referred to as actors or vertices) connected through some type of relations (referred to as edge, link, or ties) [19,20]. The actors can be a person, a group, a company, or even a country [8]. The concept of social network has been in vogue in social sciences since the 1970s, beginning with analyzing the relation between organizations [21]; it has been increasingly applied in various fields. The graph theory and network analysis place more emphasis on the relationship between vertices in the graph and on the structure of the system itself, rather than on vertices' attributes, which are generally left in the background.

Therefore, graph theory and network analysis is being suggested as a methodology that can complement the traditional method of gravity model of international trade [22]. The world trade network analysis has the advantage of being able to compare national trade trends over time and to detect and interpret macroscopic patterns of trade relations between countries through open access data. A natural way of representing the trade flow between two countries is by means of a straight-line segment connecting two points representing the trading countries. The segment can be directed, like an arrow, if we knew that the flow originates from one of the two countries and is bound to the second one [23]. Applying this method to all the trading countries in the world, the drawing of international trade flows becomes a graph and, adding all the supplementary information about vertices (nodes) and links (edges), the result would be the world trade network.

Lately, trade network analysis has been used to address international trade. Serrano and Boguna [24] introduced properties such as scale-free network, clustering co-efficient, and degree-degree correlation, centered on the topological nature of the international trade network. Fagiolo, Reyes, and Schiavo [25] emphasized that the connection between countries cannot be simply calculated with the amount of the flow of trade but should be evaluated as a symmetrical and weighted value of trade network based on the average flow of trade of import and export. Since the 2000s, there appeared some studies that actively incorporated social network analysis to explore trade structures, expressing countries as actors and trade connections as links [26–28].

Using social network analysis, Jung and Lee [29] analyzed the global network of shoe import. It turned out that China, Vietnam, Indonesia, Italy, and Belgium were the countries with a high degree centrality of shoe import; China, Italy, Spain, and Vietnam showed a high closeness centrality of import; Spain, France, the Netherlands, Italy, and the United States showed a high betweenness centrality. Ju et al. [9] explored the major producer and consumer country in the athleisure wear trade network, using in-degree centrality, out-degree centrality, and betweenness centrality, finding that the region of major producers has been changing.

Petridis, Petridis, and Stiakakis [30] analyzed the flow of waste electronic equipment trade in terms of environmental ethics through network analysis and linear regression analysis. Moreover, Wang et al. [31] analyzed the indirect influence exerted by China's prohibition of importing plastic waste on the trade networks of paper and global plastic waste. Vidya and Prabheesh [11] revealed that in the trade network using faux neutral networks, there was a drastic reduction in trade interconnections, connectivity, and density among countries since the COVID-19 outbreak. In addition, there was a visible change in the structure of the trade network, and China's central position in the trade network was not affected by the pandemic.

## 3. Method

### 3.1. Data Collection and Analysis

To compare the amount of trade, this study used the trade data provided by UN Comtrade (<https://comtrade.un.org>) that collects the import and export flow and trade value information country-wise. Among vegan fashion products, faux leather has no separate code, and hence the subject of the study is confined to faux fur. This study selected HS code 4304 (artificial fur and articles thereof) as the subject of analysis. Thus, this study

has set HS code no. 4304 for artificial fur and its products thereof and HS code no. 0505 for animal products such as leather, feather, down (skins and other parts of birds with feathers, down; feathers, down and parts thereof; not further worked than cleaned, disinfected, treated for preservation; powder, waste, and parts of feathers) as analysis code.

In terms of trade value, the net import and export values, in USD, for all countries for the years 2010, 2014, and 2019 were collected, and 10 countries with the highest values were selected and compared. Using NodeXL 1.0.1, the network of major nodes and lines of the import and export of faux fur was structuralized, the degree and betweenness centralities were measured by directions and the connection between networks was visualized, weighting the total trade value.

### 3.2. Network Analysis and Centrality Measurement

The fact that a node occupies an advantageous position in a social network indicates that it can wield a greater influence and elicit a better negotiation [19,21,32–34]. Freeman [21] systemized the concept of centrality in a way that expresses the structural importance of each entity in a network quantitatively and can be expressed in various ways according to the standard of the measurement. The most frequently used items in trade network are degree, betweenness, and closeness [34].

Of the centralities, betweenness centrality is the most frequently used indicator in global trade network. According to Kandogan [34], betweenness centrality is the degree to which a country functions as a mediator or a gatekeeper in a network, playing the role of a broker to countries in the international supply chain. Thus, the location of an actor on a global network is considered a remarkable indicator of its role [33]. If it engages in transit trade between other countries, it would run a reprocessing business [29]; moreover, Kim et al. [35] mentioned that as it can easily have an impact on other countries, the latter are likely to be interested in its policies.

Graphs are divided into directed graphs and non-directed graphs, according to whether any directions exist between the nodes or not. Directed graph reflects the direction of the relationship, which can be expressed in terms of in-degree and out-degree. In-degree means the number of arrows from other nodes, while out-degree means the number of arrows toward other nodes [33]. This study expressed the exporters of faux fur products in the trade network with out-degree centrality and importers with in-degree centrality Equations (1) and (2).  $g$  is the number of actor  $i$ .  $C'_D(N_i)$  is a standardized degree centrality of actor  $i$ ,  $C_D(N_i)$  is degree centrality of actor  $i$ .  $C'_B(N_i)$  is a standardized betweenness centrality of actor  $i$ ,  $C_B(N_i)$  is betweenness centrality of actor  $i$ .

This is example 1 of an equation:

$$C'_D(N_i) = \frac{C_D(N_i)}{g - 1} \quad (1)$$

This is example 2 of an equation:

$$C'_B(N_i) = \frac{C_B(N_i) \times 2}{(g - 1)(g - 2)} \quad (2)$$

## 4. Results

### 4.1. Present Status of Trade of Faux Fur and Animal Material

#### 4.1.1. Global Status of Faux Fur Export

The data on the status of global faux fur export for the years 2009, 2014, and 2019 is shown in Table 1. The total amount of faux fur export was \$32,725,649 in 2009, \$45,428,529 in 2014, and \$85,488,046 in 2019, increasing with time, with a significant increase between 2014 and 2019. The weight of the top 10 countries in the global faux fur export was 81.72% (\$26,743,068) in 2009 and 77.23% (\$35,084,004) in 2014, showing a decline in monopolistic tendency. Five years later, however, the weight of main exporting countries touched 88.63%, showing an increase in monopolistic tendency. Overall, the top 10 export countries

of faux fur were accounting for between 77% and 88% of the total exports, thus confirming export oligopoly by major exporting countries. Interestingly, the exports from China increased substantially, by five times, between 2009 (\$8,763,469) and 2019 (\$45,747,986). Italy ranked 5th in 2009 but progressed to 2nd rank in 2014 and 2019, becoming the second largest faux fur exporter following China, increasing its total exports dramatically by 7 times between 2009 (\$1,259,448) and 2019 (\$8,786,431).

**Table 1.** Top 10 faux fur exporting countries (HS 4304).

2009		2014		2019	
Country	Trade Value (in USD)	Country	Trade Value (in USD)	Country	Trade Value (in USD)
Other Asia	9,439,210	China	17,806,348	China	45,747,986
China	8,763,469	Italy	4,061,925	Italy	8,786,431
Germany	1,539,093	Other Asia	2,535,280	Netherlands	4,994,262
Belgium	1,320,268	USA	2,163,769	Thailand	4,160,948
Italy	1,259,448	Thailand	2,091,931	France	4,037,628
USA	1,231,752	Singapore	1,509,156	Poland	1,827,920
France	926,680	Malaysia	1,429,306	Spain	1,787,026
Spain	882,047	Germany	1,306,280	Germany	1,560,956
Denmark	700,560	Netherlands	1,179,450	USA	1,485,074
Viet Nam	680,541	Viet Nam	1,000,559	Denmark	1,378,266

The exportation of faux fur could be an exportation of the faux fur fabric or a fashion product that partially or entirely uses faux fur. The total export of faux fur by other Asian countries has declined over the years. In 2009, other Asian countries ranked 1st (\$9,439,210) in total export of faux fur, but 10 years later, they ranked 33rd (\$100,044) globally, indicating their weight loss in exportation of faux fur. Apart from this, Vietnam also showed a significant decrease in export of faux fur. On the contrary, Thailand has now become the main exporting country of faux fur since 2014. Generally, from the analysis of the total export by various countries in 2019, China and Thailand in Asia; Italy, Netherlands, France, Poland, Spain, Germany, and Denmark in Europe; and United States in North America were the main countries exporting faux fur.

Italy was ranked 1st in the export of faux fur products in 2019 because of its being home to luxury brands such as Gucci, Versace, and Prada. In the context of ‘fur-free’ declaration and anti-fur movement by famous luxury brands in Italy, the demand for faux fur from fashion brands has increased, and thus, it can be inferred that initiative on the part of fashion brands might have influenced the entire export flow of faux fur.

#### 4.1.2. Global Status of Animal Material Export

The data on global status of animal material export for the years 2009, 2014, and 2019 is depicted in Table 2. The global export of animal material increased for a while between 2009 (\$748,538,840) and 2014 (\$2,458,238,343) but decreased in 2019 (\$2,042,849,826). The weight of the top 10 countries in global animal material export was above 88% in 2009 (\$26,743,068, 81.72%), 2014 (88.62%, \$2,178,396,668), and 2019 (88.37%, \$1,805,338,142), which indicates the monopoly held in the industry by the main countries exporting animal materials.

China was the main country exporting animal materials in 2009 (\$248,442,605), 2014 (\$1,023,810,700), and 2019 (\$883,510,639). Out of the total export of animal materials, China’s share was between 33% and 43%, indicating its influence as number 1 in exporting animal materials. However, China’s export declined in 2019 compared to that in 2014. Though the effect of currency exchange rate cannot be excluded in such a result, but based on the decline in global export of animal materials between 2014 and 2019, it can be said that the use of animal materials in fashion industries has decreased.

**Table 2.** Top 10 countries exporting animal fur and leather (HS 0505).

2009		2014		2019	
Country	Trade Value (in USD)	Country	Trade Value (in USD)	Country	Trade Value (in USD)
China	248,442,605	China	1,023,810,700	China	883,510,639
Other Asia	121,316,055	Other Asia	286,640,341	Other Asia	261,462,929
Germany	80,380,146	Rep. of Korea	178,314,224	Germany	114,061,311
USA	67,236,566	USA	158,490,555	Poland	111,530,547
France	40,522,443	Germany	148,413,451	USA	104,619,056
Hungary	34,945,000	France	102,182,006	Hungary	98,538,075
Poland	33,090,088	Hungary	86,312,643	France	69,503,242
Rep. of Korea	14,463,554	Poland	72,477,004	Spain	57,703,600
Netherlands	13,330,529	Netherlands	70,404,939	Rep. of Korea	55,789,440
Italy	10,971,033	Spain	51,350,805	Italy	48,619,303

The amount of export of animal materials by major producing countries such as China and other developing countries decreased in 2019 compared to that in 2014. Further, Korea, which ranked third in the exportation of animal materials in 2014, also exhibited a significant decrease in 2019. The United States, Germany, and France also exhibited a decrease in the export of animal materials in 2019 compared to that in 2014, but some European countries (Hungary, Poland, and Spain) did record a small increase.

Generally, the decline in the export of animal materials by China and other Asian countries, the main producers of animal materials, indicated a decline in the global export of animal materials. Comparing the trends of global exportation of faux fur and animal materials reveals that the export of faux fur has increased in general, while it declined in the case of animal materials. Asian countries like China, Thailand, and Philippines, where there was a proliferation of leather and fur industries in the past [36,37], have now become the main exporters of faux fur, reflecting the direct impact of ethical fashion on the export of animal materials. This confirms the findings of earlier studies that animal ethics are attracting more attention in fashion industries.

#### 4.1.3. Global Status of Faux Fur Import

The data on the status of global faux fur import for the years 2009, 2014, and 2019 is displayed in Table 3. The global import of faux fur increased by three times in 2019 (\$133,123,106), compared to 2009 (\$49,006,413) and 2014 (\$109,606,694), indicating that the import of faux fur is increasing over time. The weight of the top 10 countries in the global faux fur import was between 66% and 71% in the years 2009, 2014, and 2019: 2009 (66.48%, \$508,354,039), 2014 (71.86%, \$1,564,010,332), and 2019 (68.98%, \$1,524,739,571). As in the case of export of faux fur, the top 10 countries were taking more than half the weight of the total import, but the tendency toward monopoly in importation was less than in exportation.

**Table 3.** Top 10 countries importing faux fur (HS 4304).

2009		2014		2019	
Country	Trade Value (in USD)	Country	Trade Value (in USD)	Country	Trade Value (in USD)
Viet Nam	13,757,499	Viet Nam	42,835,177	Viet Nam	39,694,923
Saudi Arabia	3,338,951	Italy	7,515,866	Italy	14,442,741
Italy	2,698,175	UK	5,847,391	France	7,560,874
USA	2,421,135	Russia	5,013,660	Saudi Arabia	5,369,874
China	2,087,659	USA	4,348,868	Rep. of Korea	4,952,500
France	2,020,865	Belgium	3,224,954	Russia	4,717,384
UK	2,019,539	China	2,766,239	UK	3,958,093
Germany	1,897,175	Germany	2,444,240	USA	3,899,526
Belgium	1,254,991	Saudi Arabia	2,401,536	Netherlands	3,713,824
Rep. of Korea	1,085,476	France	2,367,396	Germany	3,521,612

Vietnam appeared to be the main faux fur importing country in 2009 (\$13,757,499), 2014 (\$42,835,177), and 2019 (\$39,694,923). However, the total import of faux fur decreased in 2019 compared to that in 2014. Vietnam is the main OEM (Original Equipment Manufacturing) and ODM (Original Development Manufacturing) country in the production of fashion products and is still ranked number one in the import of faux fur; in course of time, however, its monopolistic position may decrease. This indicates that although a lot of countries are still relying on Vietnam for faux fur products, its position of monopoly may be diluted as other countries start producing faux fur.

Countries like Italy, France, Saudi Arabia, Korea, Russia, and Netherlands had a small variation in 2014 but generally imported more faux fur from 2009 to 2019. Italy ranked 2nd in the importation of faux fur in 2019 and its import stood at \$14,442,741, twice as much as in 2014 (\$7,515,866). In 2019, France increased its imports by 3 times the import in 2014 (2014, \$2,367,396; 2019, \$7,560,874), while Saudi Arabia increased its imports by 2.23 times the import in 2014 (2014, \$2,401,536; 2019, \$5,369,874). Korea, ranked 5th in the importation of faux fur in 2019 (\$4,952,500), exhibited the largest increase in imports, with an increase by 4.5 times the import in 2014 (\$1,085,969). This indicates a significant increase in the degree of dependence on the importation of faux fur in Korea.

While there may be a variety of reasons for this, it can be attributed principally to the recent widespread animal rights movement in South Korean society and ethical moves to improve animal rights [14]. In fact, after 2014, vegan fashion brands using faux fur or faux leather began to be launched [38], and various vegan fashion products were actively traded through crowd-funding platforms. Overall, imports of faux fur were still carried out by OEM and ODM countries such as Vietnam, but imports of raw materials for faux fur were seen to be more distributed than in the past, as fashion brands from various countries such as Italy, France, Saudi Arabia, and South Korea produced their own fashion products.

#### 4.1.4. Global Status of Animal Material Import

The data on the global status of animal material import for the years 2009, 2014, and 2019 is furnished in Table 4. The global import of animal materials increased temporarily in 2014 (\$1,917,688,596) compared to 2009 (\$636,898,657) but decreased in 2019 (\$1,809,044,297). On this basis, both the export and import of animal materials worldwide decreased in 2019 compared to that in 2014. The weight of the top 10 countries in the global animal material import was between 79% and 84%, indicating a slightly lower tendency toward monopoly than in the case of exports; still, the imports are concentrated in the top 10 countries importing animal materials.

**Table 4.** Top 10 countries importing animal fur and leather (HS 0505).

2009		2014		2019	
Country	Trade Value (in USD)	Country	Trade Value (in USD)	Country	Trade Value (in USD)
Japan	119,423,097	Viet Nam	261,837,608	Viet Nam	350,389,433
USA	96,518,996	Japan	238,442,255	China	273,325,739
Germany	82,494,761	Rep. of Korea	214,205,440	Other Asia	173,166,731
Other Asia	76,289,050	USA	212,838,089	Japan	171,832,422
China	54,777,807	Other Asia	202,420,711	USA	154,272,138
Viet Nam	25,548,888	Germany	142,607,804	Germany	119,850,170
Rep. of Korea	14,890,872	China	128,125,154	Indonesia	104,169,814
Italy	14,089,645	Indonesia	58,988,462	Italy	74,328,167
Hong Kong	13,850,038	Italy	55,631,851	Spain	52,006,733
UK	10,470,885	Spain	48,912,958	Hungary	51,398,224

Japan was ranked 1st in the importation of animal materials in 2009 (\$119,423,097) but dropped to number 4 in 2019 (\$171,832,422). The importation of animal materials increased temporarily in 2014 (\$238,442,255) compared to that in 2009 but decreased again in 2019. In South Korea, also a northeast Asian country, the amount of import of animal materials



declined dramatically in 2019 (\$37,689,124) compared to 2014 (\$214,205,440). Other than this, the major countries importing animal materials in 2014 such as the United States, other Asian countries, and Germany showed a decrease in import.

Countries like Vietnam, China, Indonesia, and Spain showed an increase in the import of animal fur and leather in 2019 compared to that in 2014. In 2019, China showed the largest increase in the import of animal materials with 2.13 times the import in 2014, followed by Indonesia with 1.76 times the import in 2014. Similarly, in 2019, Vietnam, Italy, and Spain exhibited minor increase in import by 1.34 times, 1.34 times, and 1.06 times the import in 2014, respectively. Considering that China, Vietnam, and Italy are countries with large OEM and ODM manufacturers, traditionally, generally, countries producing fashion products are trading actively in all materials including faux fur and animal materials.

This also indicates that, until 2019, animal materials such as duck feather, goose feather, fur, and leather were imported by several Asian countries such as Vietnam, China, and Indonesia, with Indonesia being a manufacturer as well. Further, in countries like Italy and Spain, despite the presence of several vegan fashion brands, brands that do not follow vegan practices were also in existence. Thus, the import of animal materials by these countries might have slightly increased due to the demand from their fashion brands.

#### 4.2. Trading Network of Faux Fur

Out-degree indicates the number of countries to which the home country will export to, and out-degree centrality is a standardization to observe the influence of this in the entire network. On the contrary, in-degree centrality indicates the number of links incident upon a node. Thus, in a faux fur trade network, higher the in-degree centrality of a country, the more countries it imported faux fur from. Betweenness centrality is a degree to connect the relationship between the un-connected nodes [33]. Countries with high betweenness centrality mediate or control the export and import of faux fur, and if it's intermediary item, conduct of reworking process is a high possibility [29], given the highly likely condition of influencing the trade flow within the network [35]. The results of measuring out-degree centrality, in-degree centrality, and betweenness centrality of the main countries exporting and importing faux fur are shown in Tables 5 and 6.

**Table 5.** Top 10 countries exporting faux fur by out-degree centrality.

2009			2014			2019		
Country	Out-C <sub>d</sub> <sup>a</sup>	C <sub>b</sub> <sup>b</sup>	Country	Out-C <sub>d</sub>	C <sub>b</sub>	Country	Out-C <sub>d</sub>	C <sub>b</sub>
China	0.61	4645.08	China	0.61	4717.54	China	0.74	8575.62
Germany	0.54	2976.93	Italy	0.53	3229.60	Italy	0.51	2116.15
Italy	0.37	1097.34	Germany	0.48	2716.09	Germany	0.40	1028.67
Spain	0.36	1142.75	Thailand	0.47	3396.28	Poland	0.39	1716.72
Denmark	0.33	1081.76	USA	0.33	2761.25	France	0.37	1487.91
France	0.28	429.22	Netherlands	0.22	365.60	Thailand	0.36	3634.84
Belgium	0.20	175.15	Viet Nam	0.17	135.59	Denmark	0.30	1106.37
Other Asia	0.16	427.19	Other Asia	0.08	70.37	Spain	0.30	983.89
USA	0.15	593.84	Singapore	0.08	342.62	Netherlands	0.26	791.53
Viet Nam	0.08	407.69	Malaysia	0.03	47.36	USA	0.21	2811.24

a. Out-degree centrality, b. Betweenness centrality.

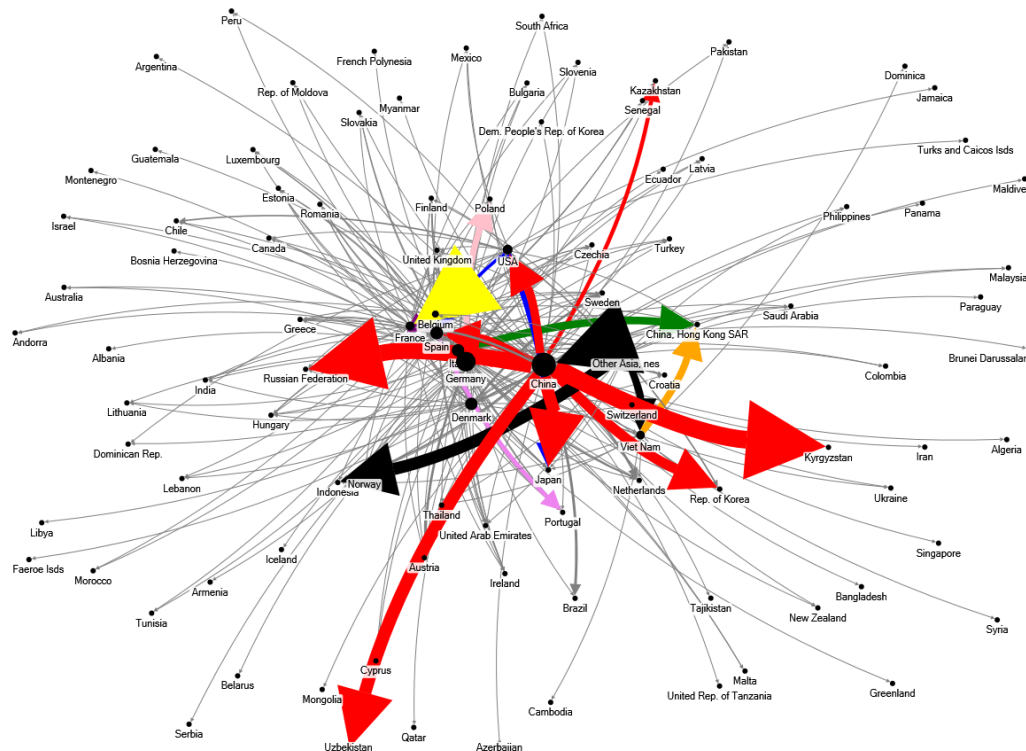
**Table 6.** Top 10 countries importing faux fur by in-degree centrality.

2009			2014			2019		
Country	In- $C_d^a$	$C_b^b$	Country	In- $C_d$	$C_b$	Country	In- $C_d$	$C_b$
Italy	0.36	970.55	France	0.45	829.94	France	0.56	1325.32
Belgium	0.30	734.71	Italy	0.41	833.41	Netherlands	0.51	1051.20
USA	0.30	570.26	China	0.39	997.96	Germany	0.42	499.51
China	0.30	510.79	Germany	0.39	521.10	Italy	0.41	982.91
Germany	0.30	270.05	USA	0.38	727.19	UK	0.41	680.56
Viet Nam	0.27	514.18	Russia	0.33	518.28	USA	0.36	598.04
France	0.27	355.63	Viet Nam	0.32	482.71	Russia	0.30	493.17
UK	0.27	286.63	UK	0.30	444.06	Rep. of Korea	0.30	424.32
Rep. of Korea	0.14	171.84	Belgium	0.18	141.57	Viet Nam	0.22	272.72
Saudi Arabia	0.11	255.47	Saudi Arabia	0.06	258.00	Saudi Arabia	0.11	428.50

a. In-degree centrality, b. Betweenness centrality.

#### 4.2.1. Analysis of Trade Network of the Major Countries Exporting Faux Fur

In 2009, China had the highest export of faux fur, along with the highest value of out-degree centrality ( $C_d = 0.61$ ) and betweenness centrality ( $C_b = 4645.08$ ) in the trading network of faux fur exportation. On this basis, in the faux fur trading market in 2009, China exported faux fur to the highest number of countries and played roles in mediating and controlling the exportation of faux fur. China was globally the most influential country in the export of faux fur in 2014 ( $C_d = 0.61$ ,  $C_b = 4717.54$ ) and 2019 ( $C_d = 0.74$ ,  $C_b = 8575.62$ ), with out-degree centrality and betweenness centrality being the highest. When visualizing this in the network Figures 2–4, the red arrow shows the exporting direction of China outstandingly within the entire trading network.



**Figure 2.** 2009 export network.

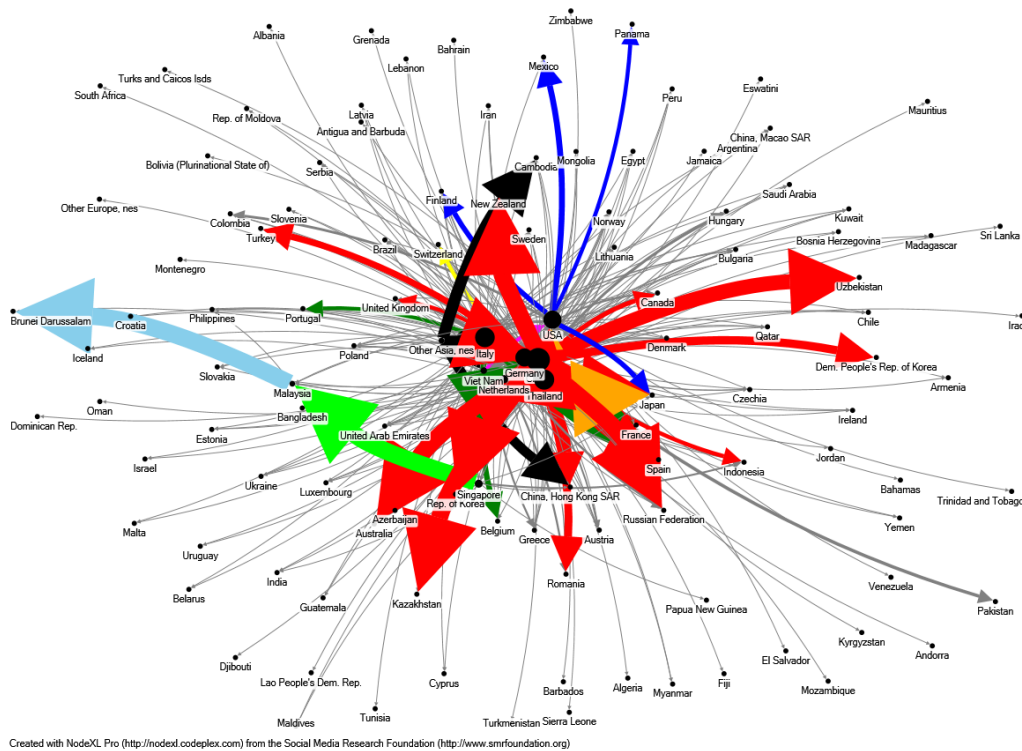


Figure 3. 2014 export network.

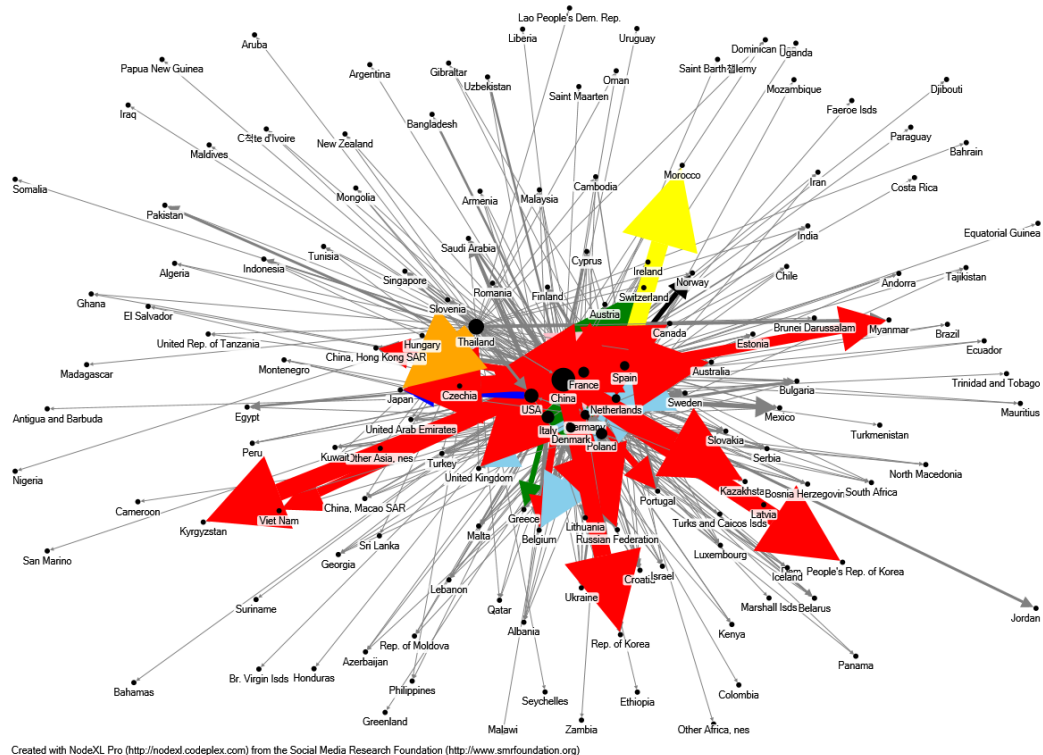


Figure 4. 2019 export network of faux fur trade.

In the case of other Asian countries, it was the region with the highest amount of export of faux fur, only next to China, in 2009, 2014, and 2019, but the value of out-degree centrality and betweenness centrality have declined continuously over 2009 ( $C_d = 0.16$ ,  $C_b = 427.19$ ), 2014 ( $C_d = 0.08$ ,  $C_b = 70.37$ ), and 2019. Such results indicate that the export of faux

fur by other Asian countries was definitely higher than other countries, but the exportation process relied on several countries. Further, the influence of other Asian countries in faux fur export is seen to be decreasing overtime.

Meanwhile, higher betweenness centrality than out-degree centrality indicates that such countries are not exporting faux fur to various countries but have a greater influence within the trading network as mediating powers of exportation. In 2009, Vietnam ( $C_d = 0.08$ ,  $C_b = 407.69$ ) and the United States ( $C_d = 0.15$ ,  $C_b = 593.84$ ) showed a higher betweenness centrality than out-degree centrality in the trading network of exporting faux fur, indicating their important role as mediating powers. For the United States, the betweenness centrality was higher than out-degree centrality both in 2014 ( $C_d = 0.33$ ,  $C_b = 2761.25$ ) and 2019 ( $C_d = 0.21$ ,  $C_b = 2811.24$ ), revealing it to be a country with a greater influence as a mediating power in the exportation of faux fur. In the case of Thailand as well, the betweenness centrality was higher than out-degree centrality in 2014 ( $C_d = 0.47$ ,  $C_b = 3396.28$ ) and 2019 ( $C_d = 0.36$ ,  $C_b = 3634.84$ ), indicating that they too are a country playing the role of a hub and as a mediating power in the exportation.

#### 4.2.2. Analysis of Trade Network of Major Countries Importing Faux Fur

Analysis of faux fur import network showed that in-degree centrality in all countries was lower than 0.60, and consequently that the import of faux fur was exclusively for fewer countries, compared to its export. The proportion of China (red arrow), which stood out in the faux fur export network, was visibly reduced in the faux fur import network, confirming visually that various countries participated in the import of faux fur (Figures 5–7).

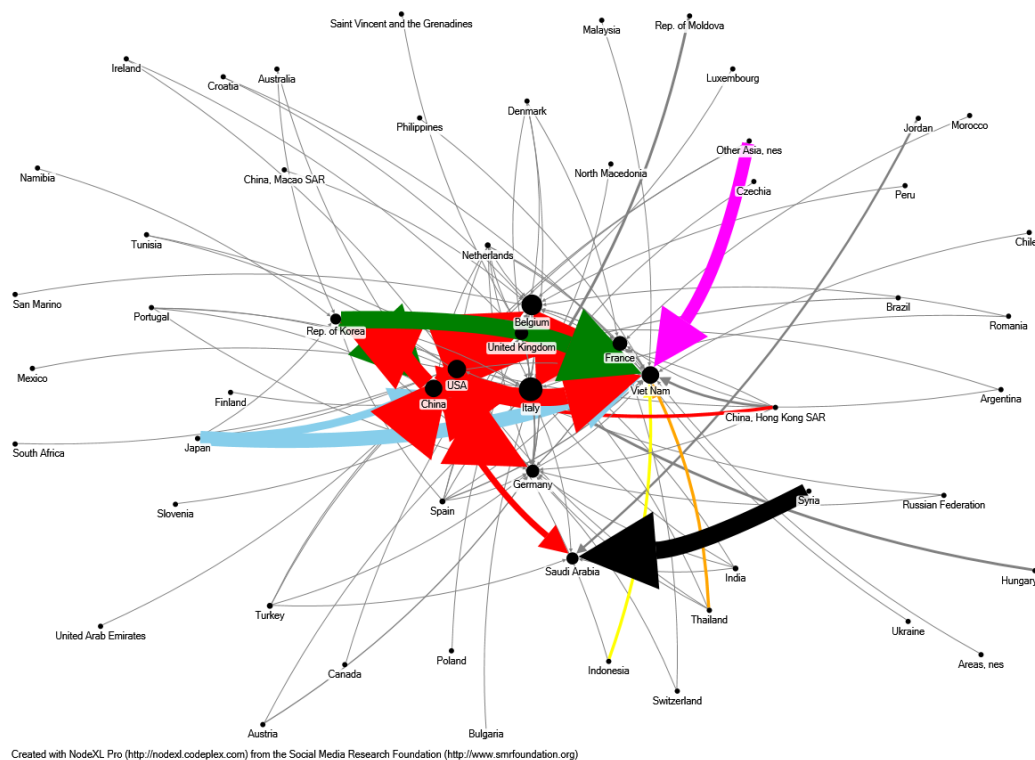


Figure 5. 2009 import network.

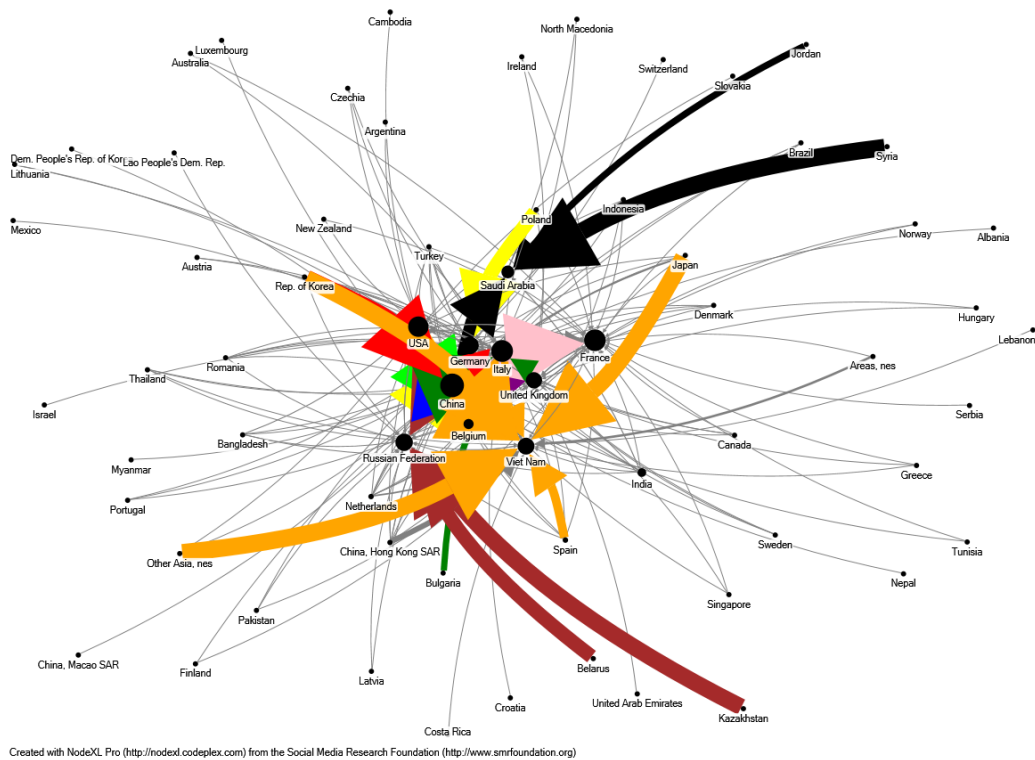


Figure 6. 2014 import network.

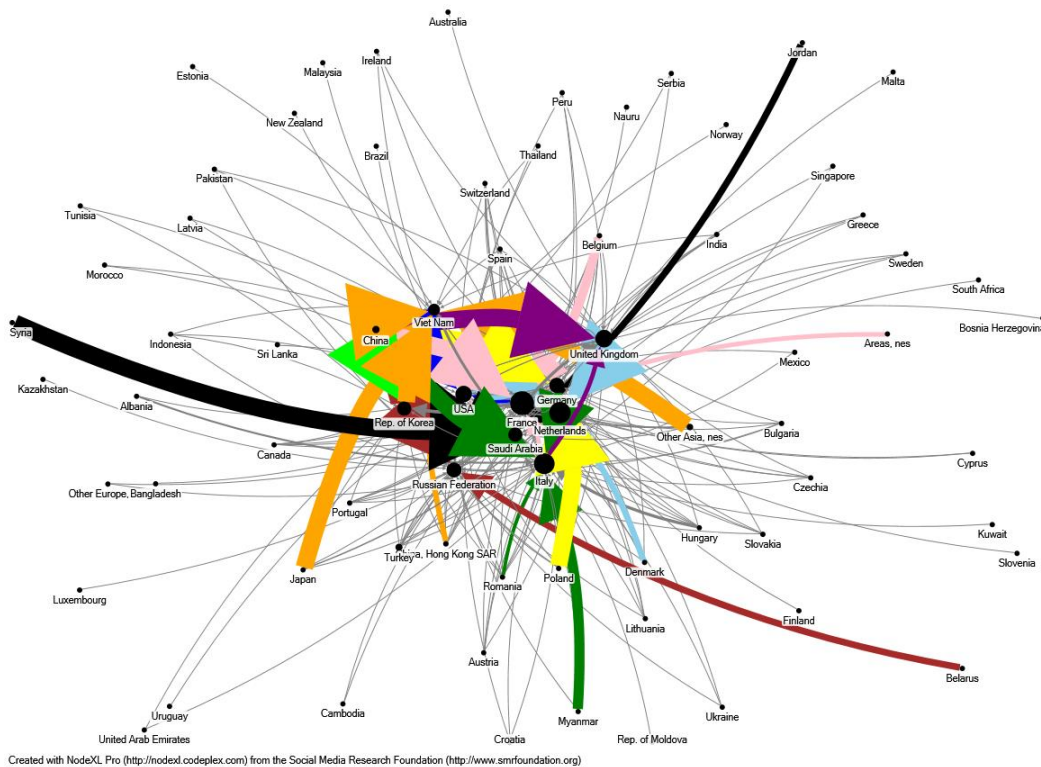


Figure 7. 2019 import network of faux fur trade.

In the faux fur import network, Italy ranked top in both in-degree centrality ( $C_d = 0.36$ ) and betweenness centrality ( $C_b = 2695.97$ ) in 2009, 2014 ( $C_d = 0.45$ ,  $C_b = 829.94$ ), and 2019 ( $C_d = 0.56$ ,  $C_b = 1325.32$ ). Italy's in-degree centrality and betweenness centrality were also high. Based on this, it is shown that Italy imports faux fur

from various countries and has a greater influence as a middle country in the faux fur import network. Similarly, France showed a significant increase in in-degree centrality in 2014 ( $C_d = 0.45$ ) and 2019 ( $C_d = 0.56$ ) compared to 2009 ( $C_d = 0.27$ ), gradually increasing its faux fur import from various countries over time. Based on the betweenness centrality, France ranked in the median among major importers of faux fur in 2009 ( $C_b = 355.63$ ), but the betweenness centrality increased over 2014 ( $C_b = 829.94$ ) and 2019 ( $C_b = 1325.32$ ). Overall, it could be seen that the influence of Italy and France in the import of faux fur has greatly increased.

Vietnam was the country with the highest total import of faux fur in 2009, 2014, and 2019, but compared to the total, in-degree centrality and betweenness centrality were relatively low. Based on in-degree centrality, Vietnam was recorded middle-low among the 10 major countries in terms of total import value in 2009 ( $C_d = 0.27$ ), 2014 ( $C_d = 0.32$ ), and 2019 ( $C_d = 0.22$ ). This implies that Vietnam's faux fur imports are being made exclusively from several countries. It also showed that Vietnam's betweenness centrality decreased over the years 2009, 2014, and 2019, indicating that fewer countries are going through Vietnam in the import of faux fur; this could be interpreted as a decrease in Vietnam's influence as a mediating power in the import of faux fur.

On the other hand, countries with higher betweenness centrality than in-degree centrality do not import faux fur from various countries but have a greater influence as mediating power in the trade network. Saudi Arabia was found to have higher betweenness centrality than in-degree centrality in 2009 ( $C_d = 0.11$ ,  $C_b = 225.47$ ), 2014 ( $C_d = 0.06$ ,  $C_b = 258.00$ ), and 2019 ( $C_d = 0.11$ ,  $C_b = 428.5$ ). Based on this, it was confirmed that Saudi Arabia does not import faux fur from various countries, compared to other major importers, but it serves as a hub or intermediary country that mediates imports.

## 5. Conclusions

With the increase in consumers' ethical awareness, faux fur is receiving greater attention than animal fur products, which are often produced through unethical production processes. In the backdrop of such social phenomenon, this study investigated the trade flow and network of faux fur. For this process, the data on faux fur (HS 4304), animal materials (HS 0505), and the total amount of export and import were collected and changes in values of exports and imports for the years 2009, 2014, and 2019 were compared in this study. By identifying the location of the main trader within the net-work, the trade flow of faux fur was analyzed. A brief summary of the research findings are as follows:

Globally, the export of faux fur is increasing over the years, especially from 2014 to 2019 when the increase was significant. The top 10 countries in terms of export volume showed an oligopoly in faux fur market. In particular, China and Italy emerged as the largest exporters of faux fur, while other Asian countries and Vietnam exhibited a decrease in export. This phenomenon could be attributed to China and Italy having high quality faux fur producing facilities and skills. Vietnam and other Asian countries seem to have fallen behind in the faux fur market because of their manufacturing industries' focus on sewing.

The total import of faux fur has also been increasing, with Vietnam being the largest importer up to 2019. However, the share of Vietnam in global imports has been decreasing. Of course, several countries still rely on Vietnam for faux fur products, but with many developed countries expanding their domestic production, countries of origin of faux fur have been diverse.

On the other hand, the export of animal materials from China and other Asian countries has decreased. Given that they are the main manufacturers for the fashion industry, it indicates that the demand and preference for animal materials has decreased and the fashion industry reflects the need for ethical consumption in clothing. However, there are still shades of animal material consumption. Though the consumption of faux fur has expanded, it has not replaced the consumption of animal materials completely. In the case of China, Vietnam, and Italy, the total import of animal materials have rather increased. These

countries have the characteristics of manufacturing, producing, or trading fashion products in general, irrespective of whether they are animal materials or non-animal materials.

The results of trade network analysis of faux fur are as follows: China turned out to be the largest exporter of faux fur and exports to the highest number of countries, and it is the largest country with the role of intermediary and control over the export of faux fur. Other Asian countries were relying on several countries to export faux fur, and within the export network, their influence has declined over time. Vietnam and the United States have been shown to play prominent roles as mediating powers in the faux fur export network.

Unlike the export network monopolized by China, many countries were participating in the faux fur import network. Italy and France showed the greatest impact in importing faux fur, while Vietnam's impact on the trade network has decreased over time, compared to its total import costs. Saudi Arabia does not import faux fur from various countries, compared to other major importers of faux fur, but has served as a hub-intermediary country that mediates imports.

This study captured the industrial movement in ethical fashion by highlighting the increasing amount of faux fur trade, from imports and exports to intermediary trade. The most important thing is that this study quantitatively confirmed that animal rights are being considered at both national and global levels. Of course, the growth of faux fur trade could be a result of improved competitiveness in faux fur trading market. As the consumers have changed their original consumption habit to a more ethical one, they would just find a new profitable market to follow up this trend. Thus, it is a possible opinion that the trade flow does not reflect their perception of animal rights. However, it is obvious that the production process of faux fur causes no harm to animals. No matter to what extent faux fur production is related to ethical consumption behavior, the drive for participating in ethical consumption and production is growing. In addition, the growing trade flow shows that animal rights drive including faux fur is a mainstream in textile and fashion industry. Therefore, the results of this study can offer possible answers to the question as to which country is leading the way in ethical fashion. It also has a managerial implication that faux fur producers could establish proper manufacturing planning based on this result.

As consumers' ethical consciousness improves over time, vegan fashion is proposed as the way forward in ethical practice. This ethical phenomenon has led to an increase in interest in vegan materials like faux fur and faux leather, which are now being recognized as alternative materials to animal fur and leather [39]. In addition, its popularity can be expected to increase in the near future, as the millennial consumers who aim for being ethical consumers are also making their presence felt as ethically demanding consumers [40].

Global trade is an inter-dependent and a complex network, and analyzing market, industrial, and economic systems based on network analysis techniques has become increasingly acceptable among economists in recent years [34]. In this study, by applying these techniques to faux fur trade, it will be meaningful as a composite study of informatics, clothing and textiles, and trading.

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