

Cooperation Bibliogram of Bird Flu

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Abstract

The published literature on Bird Flu, now a pandemic animal disease with a possible potential of evolving into a devastating human disease, was analysed primarily with respect of national and international cooperations and networks of authors and countries. The output of research-relevant papers is now around 150 per year and was less than 100 papers per year before 2003. The field is highly cooperative; nearly 90% of the articles have two or more authors. National extramural cooperation is around 50% since 1998, intramural cooperation shows a decreasing tendency and is now about 20%. Between 20% and 30% of the papers have been published in bi- or multinational cooperation. Observed and expected citation rates of international papers are twice as high as the citation rates of national papers.

47 countries are engaged in Bird Flu research, on top USA, followed by PEOPLES R CHINA, UK and JAPAN. These countries are also centers of country networks, but minor centers exist. An Asian local network with strong ties consisting of countries most affected by Bird Flu can be identified. No strong direct connections exist between Europe and Asia; thus it seems necessary to intensify international cooperation.

Author network show interesting cluster structures which must be studied in detail.

1. Introduction

A highly pathogenic subtype of avian influenza virus, H5N1, caused a severe Bird Flu epidemic in several Asian countries in 2004 (Webster et al. [1]). Since 1997, an increasing number of bird-to-human transmissions of the H5N1 and other subtypes, leading to fatal human infection in a considerable number of cases, were reported (Perdue and Swayne [2]). It is of interest to analyse by bibliometric means the response of the world-wide research system to this animal disease and its possible pandemic threat to human health. In this presentation, we focus primarily on cooperation patterns and try to establish a cooperation bibliogram (White [3]) of Bird Flu on the basis of its published literature.

1. Methods

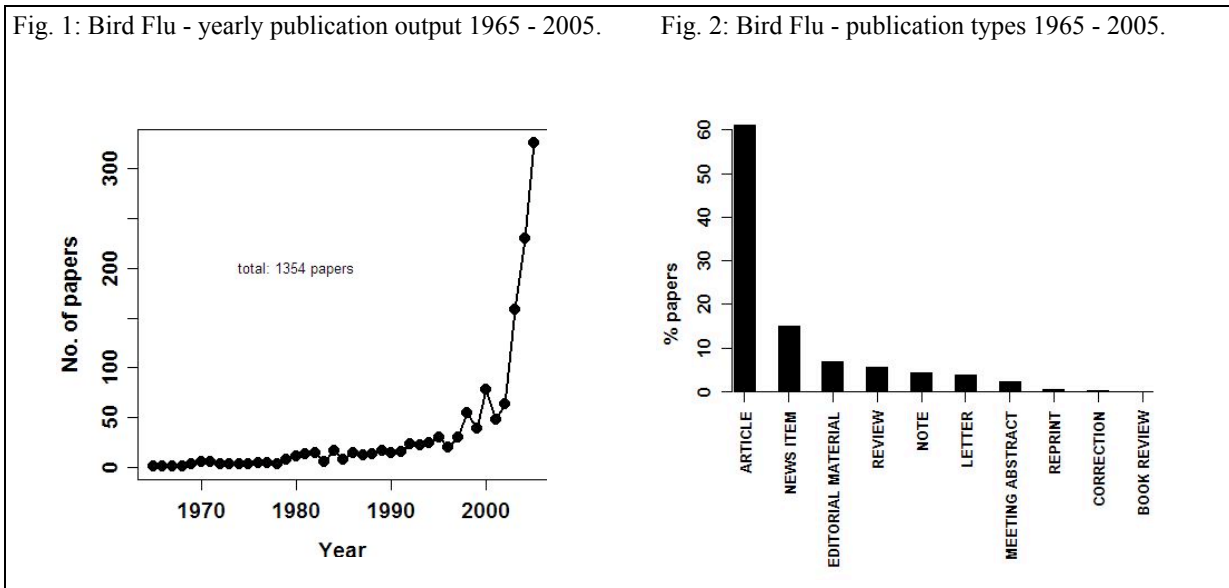
Papers containing the appropriate "Bird Flu" terms ("bird flu OR avian flu OR avian influenza OR bird influenza") were retrieved and downloaded from the Web of Science (WoS) [4] in December 2005. The contents of the appropriate record fields were extracted using perl scripts and subsequently analysed by means of the statistical software package R [5]. For visualisation of connections between

items (authors, countries) R's sna package was used [6]. For calculation of expected citation rates the impact factors of the publishing journals were used, taken from the Journal Citation Reports (JCR) [7] of the corresponding publication years. Only papers published 1995 or later could be included because earlier JCR editions were not available for us. Papers published 2005 were rated with the appropriate journal impact factors of 2004.

2. Results and Discussion

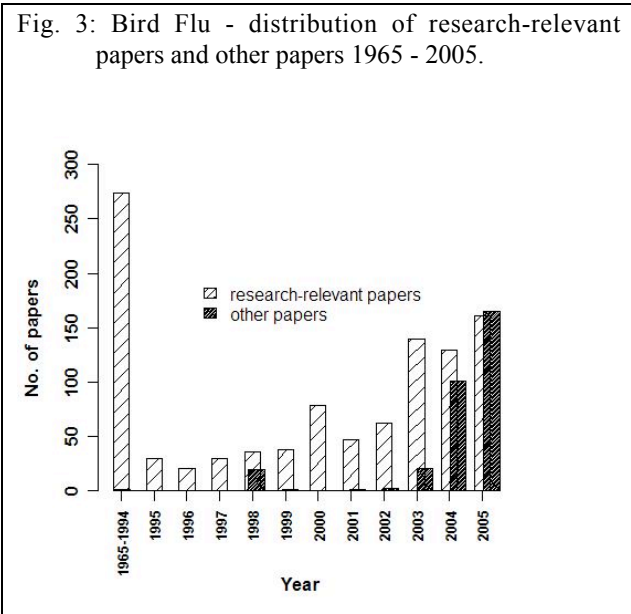
2.1. Papers

Figure 1 shows the development of the yearly publication output dealing with "Bird Flu". Initially, paper production is rather low (less than ten papers per year). In the nineties, a moderate increase of yearly publication numbers can be observed, which is followed by a publication boost starting in 2003 (Figure 1). In total, we retrieved 1354 papers from the WoS using the search terms mentioned above. Please, note that the publication year 2005 is not fully covered because retrieval were performed in December 2005 (see Methods).



More than 60% of the Bird Flu paper are of the publication type "Article"; about 22% are of the types "News Item" and "Editorial Material" (Figure 2). We assigned the different publication types to two groups: "research-relevant papers" with the publication types ("Article", "Review", "Letter", "Note", "Meeting Abstract"), and "other papers", consisting predominantly of "News Items" and "Editorial Material". Displaying both groups by their yearly frequencies reveals an unusually high proportion of "other papers", mainly of the types "News Item" and "Editorial Material" in 2004 and 2005, but also in 1998 (Figure 3). These high fractions of non-research papers certainly reflect ad hoc reactions to (i) the first documented infection of humans by the H5N1 subtype in 1997 in Hong Kong which coincided with an epidemic of severe H5N1 avian influenza in Hong Kong's domestic fowl, and to (ii) the most recent outbreak of H5N1 avian influenza which started in late 2003 and has now become a world-wide pandemic among birds being also the cause of nearly 100 human fatalities [8]. Yang and Yang [9], studying the literature on SARS (severe acute respiratory syndrome), also found a large fraction of news items.

Fig. 3: Bird Flu - distribution of research-relevant papers and other papers 1965 - 2005.



The growth of the research-relevant papers alone is not so pronounced as compared to total papers; however, the number of research-relevant papers published 2003 - 2005 exceeds that of 2000 - 2002 by a factor of 2.3 (Figure 3).

Restricting the analysis to the record types relevant to research (see above) resulted in 1044 papers. 186 of those records do not have a country assignment. Thus, we decided to include in our subsequent analyses the 858 articles with at least one country assignment, covering publication years 1972 - 2005.

2.2. Authors

We count 2178 distinct authors of the 858 papers with an average productivity of 0.4 papers per author; the most prolific author is (co-) author of 92 papers (Figure 4 a). The average number of authors per paper is 2.5; predominant is the class with 3 authors per paper (Figure 4 b). The paper with the highest number of authors (93) is a publication of the World Health Organization (WHO) [10]). Figure 5 shows that research on Bird Flu is highly cooperative, the majority of the papers published every year has two or more authors, but there seems to be a small tendency to single-authored papers in the more recent years (Figure 5). 12% (105 papers) are single-authored considering the whole investigated period.

Fig. 4 a: Bird Flu - classification of the authors of the research-relevant papers

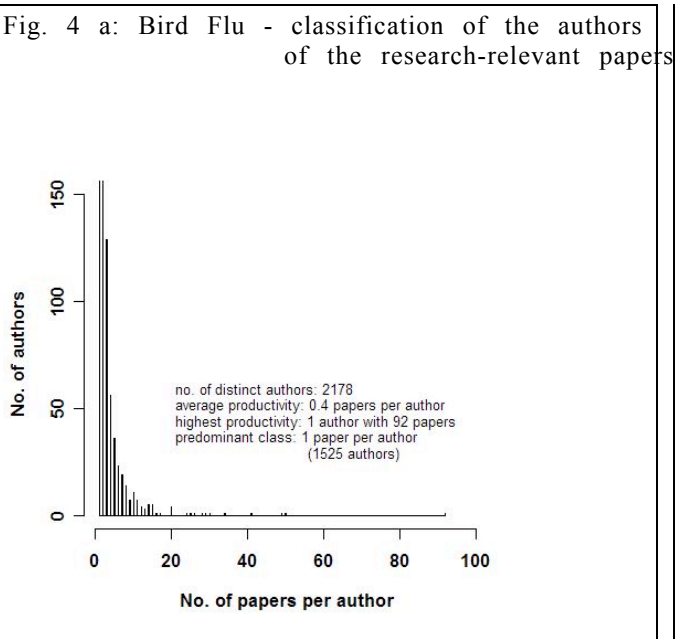
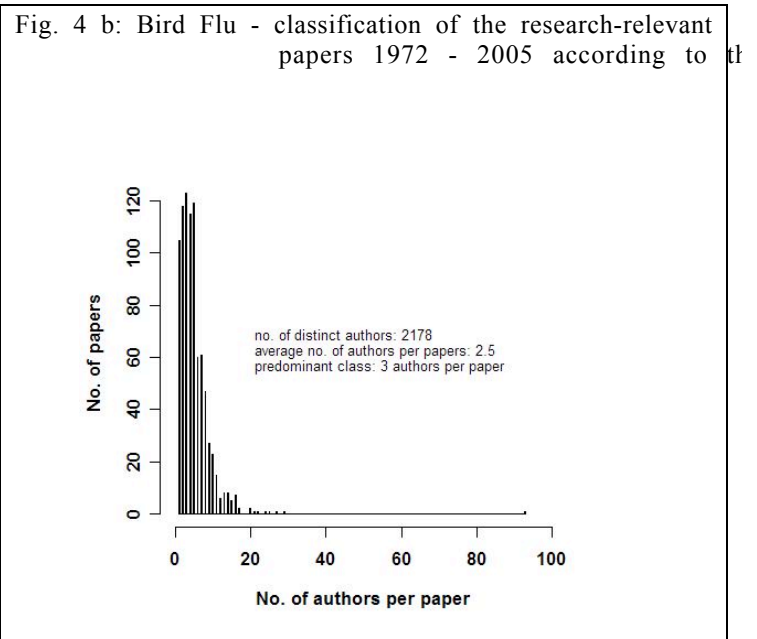
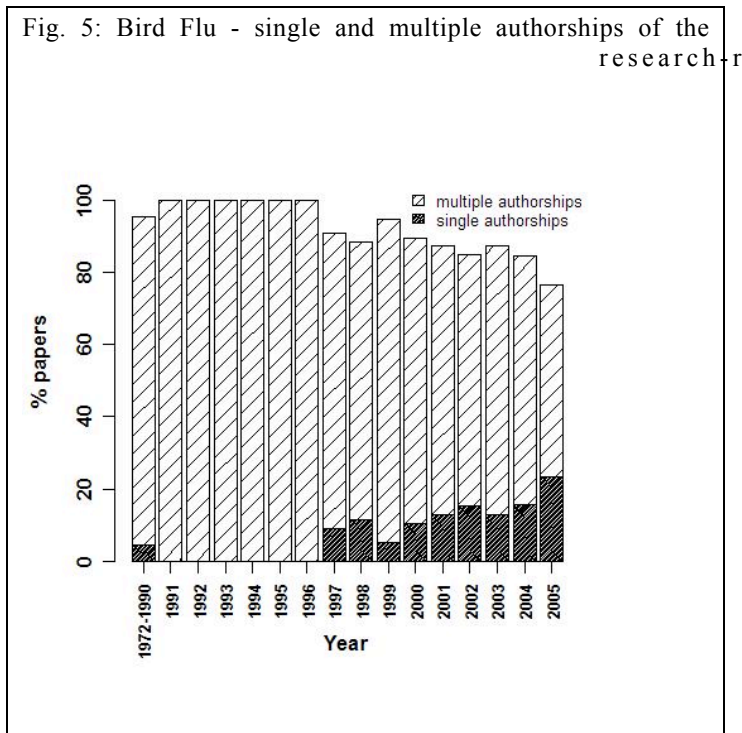


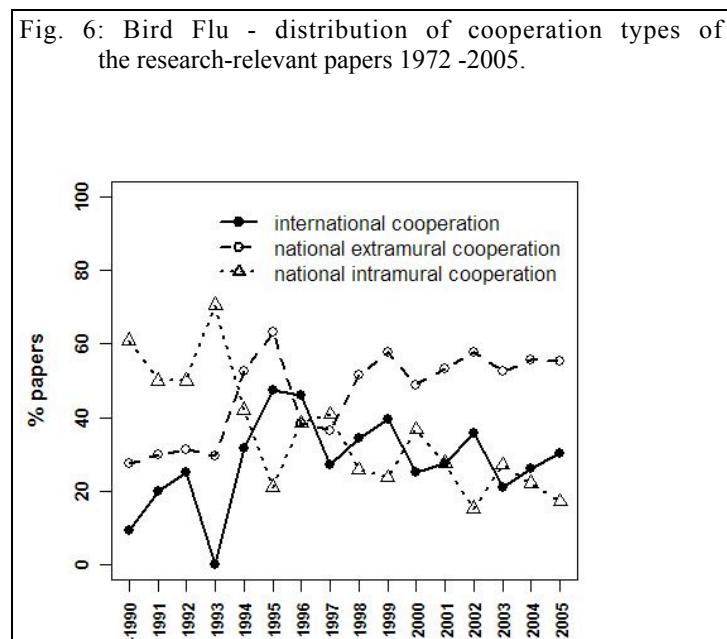
Fig. 4 b: Bird Flu - classification of the research-relevant papers 1972 - 2005 according to





2.3. Cooperation

Next, we analysed the different types of cooperation. In total, 26% of the publications are international papers, i.e. jointly authored by at least two authors from at least two different countries; 50% have been cooperatively published by authors from different institutions within the same country (extramural cooperation), and 30% belong to the type of intramural cooperation, i.e. are co-authored by authors of the same institution. Figure 6 displays the variation in time of these three cooperation types. National extramural cooperation seems to stabilise at slightly above 50% since 1998, intramural cooperation - initially high - shows somewhat decreasing tendency and is around 20% in more recent years.

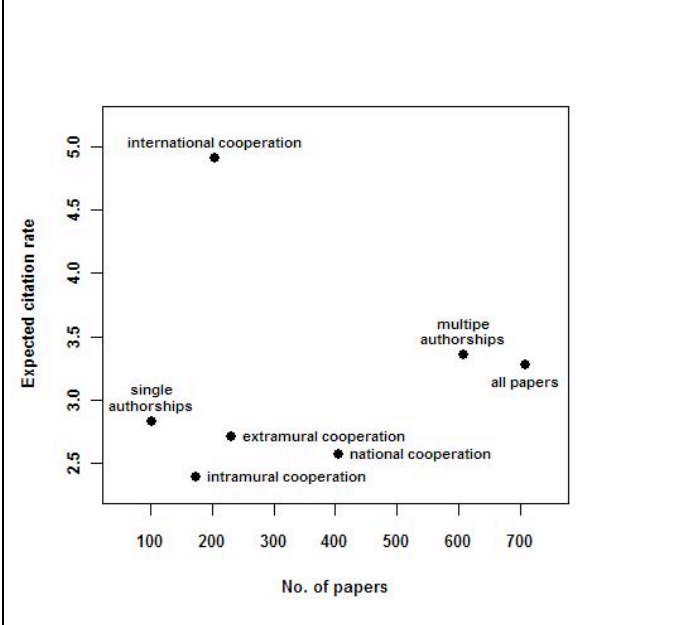


International cooperation - initially low - shows some variation and has values of above 20% to above 30% in more recent years, perhaps with a slightly decreasing tendency (Figure 6).

2.4. Cites

Figure 7 relates the different types of authorship and cooperation with their expected citation rates, as measured according to the impact factors of the publishing journals of the respective publication years (see Methods). Please, note that data cover the years 1995 - 2005 (see Methods). The average expected citation rate is 3.3 (as determined by the spot "all papers" in Figure 7). International papers outperform by far the other categories, a known phenomenon (see, e.g. [11, 12]). Extramural cooperation has a slightly higher expected citation rate than intramural co-authorship but still is well below the average.

Fig. 7: Bird Flu - publication output and expected citation rates of the different types of authorship and cooperation on research-relevant papers 1995 - 2005.



Using observed citation rates on the basis of the "times-cited" field of the WoS records does not change the picture significantly: intra- and extramural cooperation have then almost identical citation rates, and single-authorship papers show the lowest citation performance of all types (not shown).

2.5. Countries

The 858 articles were published by 47 different countries, most of them involved in international cooperation. The USA (co-) authored nearly 50% of the papers, followed by PEOPLES R CHINA, UK and JAPAN. Numerous countries have high fractions (up to 100%) of international papers. This is shown in Figure 8 a which displays for each country its total number of papers (threshold: 3 papers) versus its international papers, the latter measured as percentage of the country's total output. Some countries have a high fraction of international papers or publish always with partners from abroad (Figure 8 a). Countries which are particularly affected by Bird Flu have high and highest citation rates, as INDONESIA, VIETNAM, TAIWAN, THAILAND, and PEOPLES R CHINA (Figure 8 b). The high citation ranking of SWITZERLAND can be explained at least partially by the fact that WHO publications which receive many cites are assigned to this country (Figure 8 b).

Please, note that for better visualisation Figure 8 a displays a semi-, Figure 8 b a double-logarithmic plot.

Fig. 8 a: Bird Flu - country-specific total and international research-relevant papers 1972 - 2005.

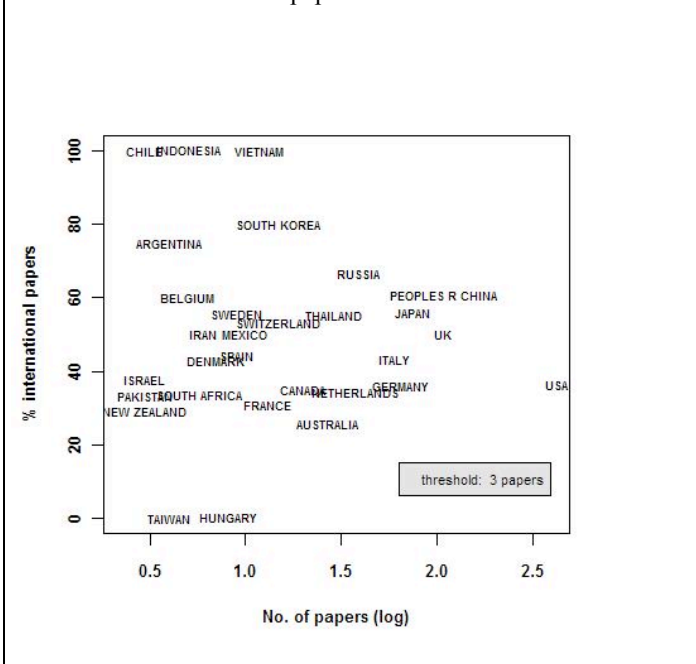
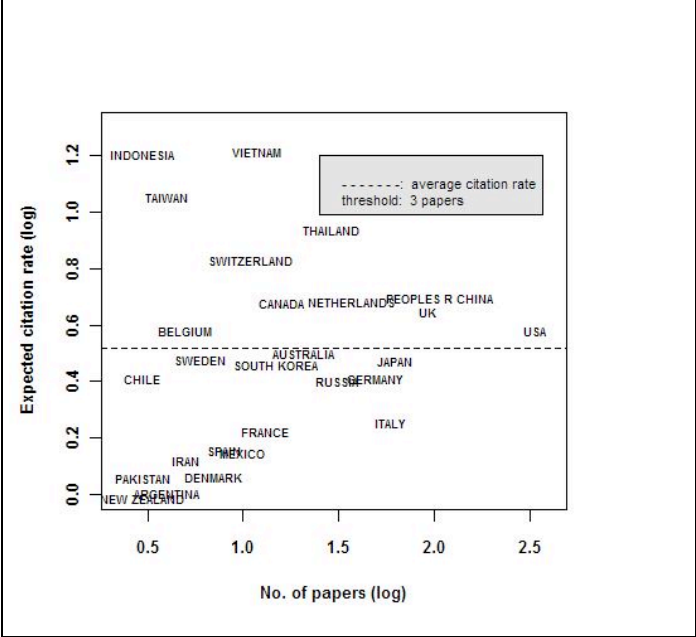


Fig. 8 b: Bird Flu - country-specific publication output and expected citation rates of the research-relevant papers 1995 - 2005.



2.6. Author and country networks

Figures 9, 10, 11 display author and country networks comprising the years 1995 - 2005. The normalised author network (Figure 9) shows closed and interconnected clusters; some authors serve as bridges between otherwise separated clusters. For a detailed evaluation the content of the papers underlying the respective clusters should be analysed.

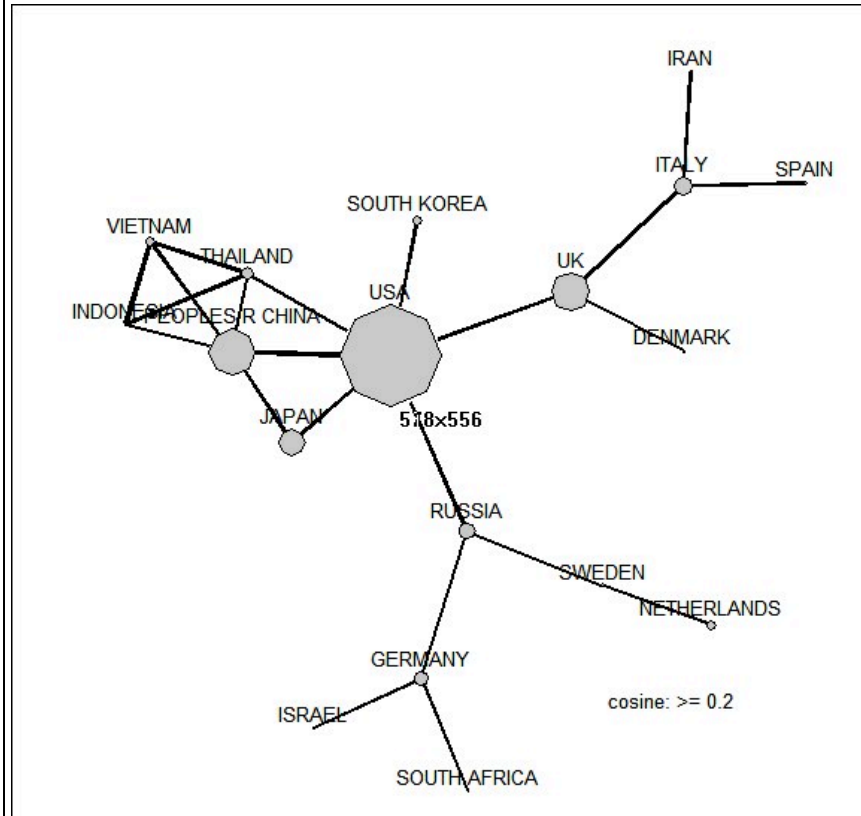
Figure 10 displays the country network, based on raw data, i.e. the number of shared papers. Highly productive countries are also centers of cooperation, the USA, co-authoring more than 50% of the international papers, being in the most central position, followed by PEOPLES R CHINA and UK. The normalised country network shown in Figure 11 reveals that strong ties exist between the countries in the Far East most affected by Bird Flu. It can also be deduced from Figure 11 that obviously no strong direct connections exist between European countries being recently affected by Bird Flu (e.g. GERMANY) and the more developed local Asian network. More direct links from Europe to Asia is certainly necessary in order to combat the disease successfully. Again, for a detailed evaluation of the link structure the content of the corresponding papers must be analysed.

3. Conclusion

The research on Bird Flu is highly cooperative. Almost 90% of the published research-relevant papers are authored by two or more persons. National extramural cooperation is predominant and exceeds collaborations restricted to one institution. International collaboration is important, but in general does not reach the level of its national counterpart. The USA are in the center of the research, but are not the only important collaboration partner. In addition, regional networks of the countries attacked or immediately threatened by the disease play a role. European - Asian connections seem to be undersized and need to be strengthened.

Fig. 11: Bird Flu - normalised country networks of the research-relevant

Vertex size according to total number of cooperatively published papers.
Edge width according to cosine values.



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