

Executive Summary

Cyber Security is a distinct domain that pertains to and is a component of new technologies such as artificial intelligence, the internet of things, big data, advanced mobile computing, cloud computing, e-commerce and other developing technologies. Because vast volumes of data have been kept on computers and other devices by financial, government, military, medical and corporate or other institutions in the digital era, it is critical. Hence this study has been undertaken to explore the publication pattern in the field of cybersecurity with special reference to India's status, with the following specific objectives:

- To examine the status of global S&T in the field of cyber security.
- To identify the size and growth of publication output in the field cyber security.
- To measure the publication quality
- To assess the status of India's contribution and compare it with selected countries using publication and citation metrics.
- To examine the prolific authors as well institutions in the field of cyber security in terms of publication output.
- To rank the Indian institutions in terms of publication output.
- To analyze the publications according to the following different perspectives: security component, application domain, objective and intervention level.

To achieve the above objectives, the present study uses the publication data from various databases such as Web of Science, Scopus, Indian Citation Index, and Indian Science Abstracts. To provide a recent trend, the study covers publications up to 2020,

as suggested by Local Project Advisory Committee. The project has been carried out in a phased manner.

In the first phase, delineation of keywords has been undertaken. Available keywords have been collected manually from the existing literature, thesaurus (IEEE Thesaurus and WordNet) and international standards organization (NIST, Glossaries of British Standards Institution, and the National Initiative for Cyber Security Careers and Studies). Among the sources, WordNet has been suggested by the expert committee during the review meeting held on 13.09.2019 @ CEPT University, Ahmadabad. Clustering of the collected keywords has been made and the unrelated or unwanted keywords have been discarded. For example, the keyword “*voting system*” is not directly related to cybersecurity. Finally, potential keywords have been sent to the subject experts and after getting the suggestions and opinions, the following keywords have been identified: “Cybersecurity” OR “Cyber Security” OR “Cyber-Security” OR “Cyber crisis management” OR “Cyber incident management” OR “Cyber threat management” OR “Cyber Safety” OR “Cybersafety” OR “Cyber defense”. The procedure followed in this phase has been documented and presented in a conference.

In the second phase, three pilot studies have been undertaken to understand the publication structure: top-cited publications, role of cybersecurity in smart grid and India’s contribution to cybersecurity. These studies help us to narrow down the research further.

In the final phase, data collection and analysis have been undertaken.

Major findings of this study are:

- India is ranked 4th in terms of number of publications behind the USA, the UK and China.
- Indian researchers have been publishing on this topic since 2004, six years after global researchers who began in 1998. It clearly evidences that it takes six years to raise awareness among the Indian researchers.
- Fifty-four percent of the global research output has been published in the recent three years (2018-2020) where as it is 67% for the Indian output, which reveals that Indian researchers recognized this topic very recently.
- In India, 46% publications were in the form of conference papers, which is relatively low compared to the global trend.
- The value of the collaboration index (CI) for Indian publications is greater than the value for global output, indicating that Indian researchers prefer to do research in groups.
- In the global environment, the USA was the most productive country as well as the most preferred partner country for international collaboration by Indian researchers.
- In terms of citation impact, Indian publications received 5.66 citations per paper on average, which is somewhat lower than the global output. It is mostly due to research findings being published in the non-standard sources. For example, almost one-third of the most preferred sources by Indian researchers have been discontinued its coverage by Scopus.

- Indian researchers commonly collaborate within institutions, as seen by research teams made up of Indian researchers.
- The focus of Indian researchers has shifted from data-related issues to smart grid and emerging technologies, to AI-related technologies.
- Indian institutions having centers of excellence in cybersecurity produces more publications than others.

Based on the data analysis and interpretation, the following suggestions have been made:

- It is suggested to create centers of excellence in all the universities and higher educational institutions in order to active participation in research in the field of cybersecurity.
- It is recommended to establish a national level center for creating the awareness about predatory journals as well as providing training in doing the high quality research.
- It is strongly recommended to concentrate on the application of emerging technologies into cybersecurity.
- More research must be carried out on the smart grid cybersecurity as well as the role of cybersecurity in the energy sector.
- A database has been created with the classification of publications based on the cybersecurity taxonomy: research domains, technology & use cases, and sector, which needs follow-up action.

- Only publications indexed in Scopus, Web of Science, Indian Citation Index and Indian Science Abstracts were used in this study. An exclusive study of non-indexed publications could be undertaken.
- Compared to other topics, there are only few publications by Indian researchers. In this regard, an awareness program is needed.