# Smart Cities: Review and Bibliometric Study

**Everton Dias de Oliveira**[(1)], **Caroline Kühl Gennaro**[(2)], **Daniel René Tasé Velázquez**[(3)], **Lorena Hernández Mastrapa**[(4)], **Desiree Baldin Damame** [(5)], **Ângela Alves Dos Santos**[(6),] **Mariana Dias de Oliveira**[(7)] (1, 2, 3 and 4) PhD Student in Production Engineering, Methodist University of Piracicaba (UNIMEP),everton_deoliveira20@hotmail.com; (5) PhD Student in Energy Systems Planning, State University of Campinas (UNICAMP), desireedamame@yahoo.com.br; (6) Electrical Engineer, Researcher of the Renato Archer Information Technology Center (CTI-CAMPINAS),angela.aads@gmail.com; (7) Graduate Student in Production Engineering, University Center Our Lady of Patronage (CEUNSP). everton_deoliveira20@hotmail.com.

## Introduction

"Smart Cities" concept is developed based on the integration of various information centralized in a data communication network and combined with several types of sensors and technologies in order to make decisions based on the data provided by its users, whether they are residents of homes or even businesses [1].

In this way, the motivation to build these types of cities is given to the fact of seeing improvements in people's urban daily life, such as optimizing the use of natural resources, energy efficiency of equipment, optimization of urban traffic routes, decision making in relation to safety of individuals through the monitoring of public roads [2].

The demand for more and more researching and development of solutions that can be integrated to the platforms of processing and data management for smart cities is rising at every time. The academic scenario has expressivity to respond these demands through its publications of works in diverse areas directed to this new follow-up of the technology [3].

The present work aims to present a bibliometric literature review on the theme of smart cities.

## Method and Materials

The methodology of this work was conceived in a brief literature review directed to the theme of smart cities, where the data were later treated in the software for bibliometric analysis of the international journals scientific database Scopus.

## Results

The results of this work come from the methodology described in the previous section. Were specified the following parameters in the Scopus database:
- ✓ Keyword: Smart cities;
- ✓ Period of publication: all articles published in the last 10 years (2007 - 2017);
- ✓ Selection of journal types: all types in the database.

The theme was searched with just one keyword, precisely to identify in a broad way everything that has been published about subject in question. In order to identify the profile of publications during the investigation period, 11,450 documents were published in the last 10 years.

Figure 1 illustrates, in line chart format, the publications curve on the topic during the period searched.
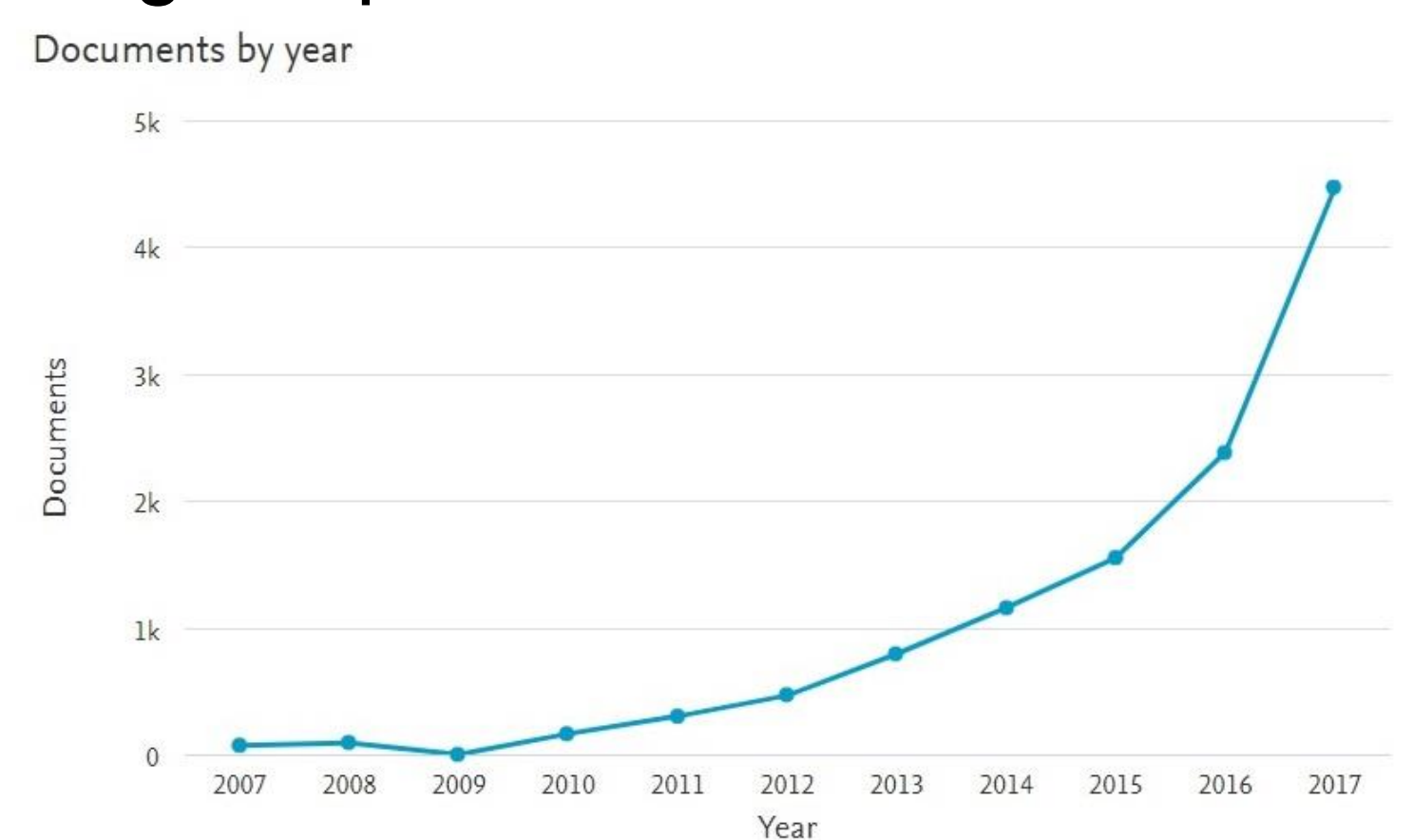


Fig 1 - Graph with the distribution of published articles, on the theme Smart Cities in the period of 2007 - 2017.

The graph in Figure 1 shows that the theme Intelligent Cities is growing in publications with its highest peak in 2017 with approximately 4,500 published documents.

Another data processed in this work were the main journals with publications on the subject, which in this case were identified 5 journals, presented in Figure 2.
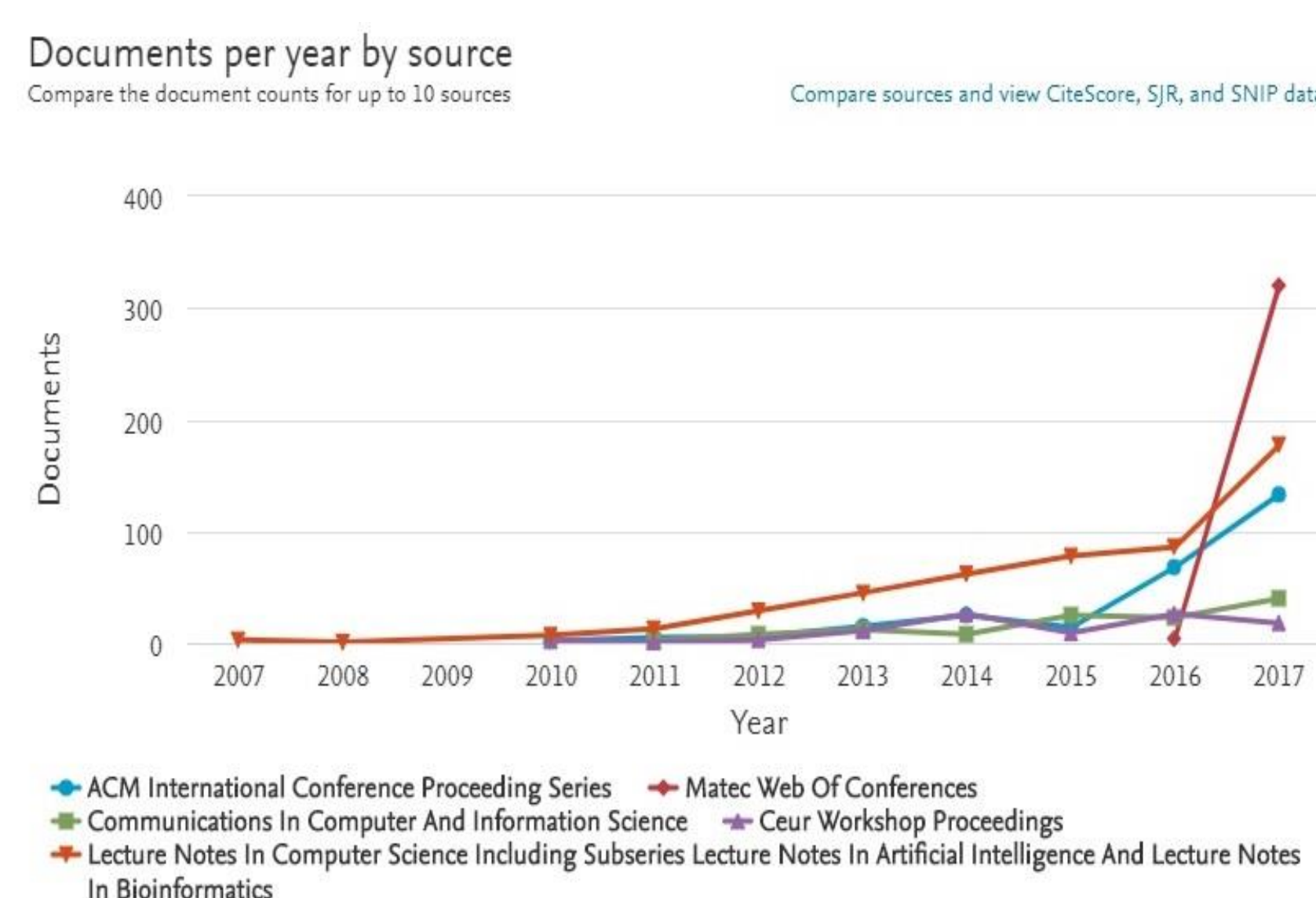


Fig 2 - Main journals in volume of publications on the theme Smart Cities.

In this scenario presented in Figure 2, the most outstanding journal was: Matec Web Of Conferences with more than 300 published documents on the subject.

Another compiled data was the identification of the main institutions with volume of publications around the world as shown in the graph in Figure 3.
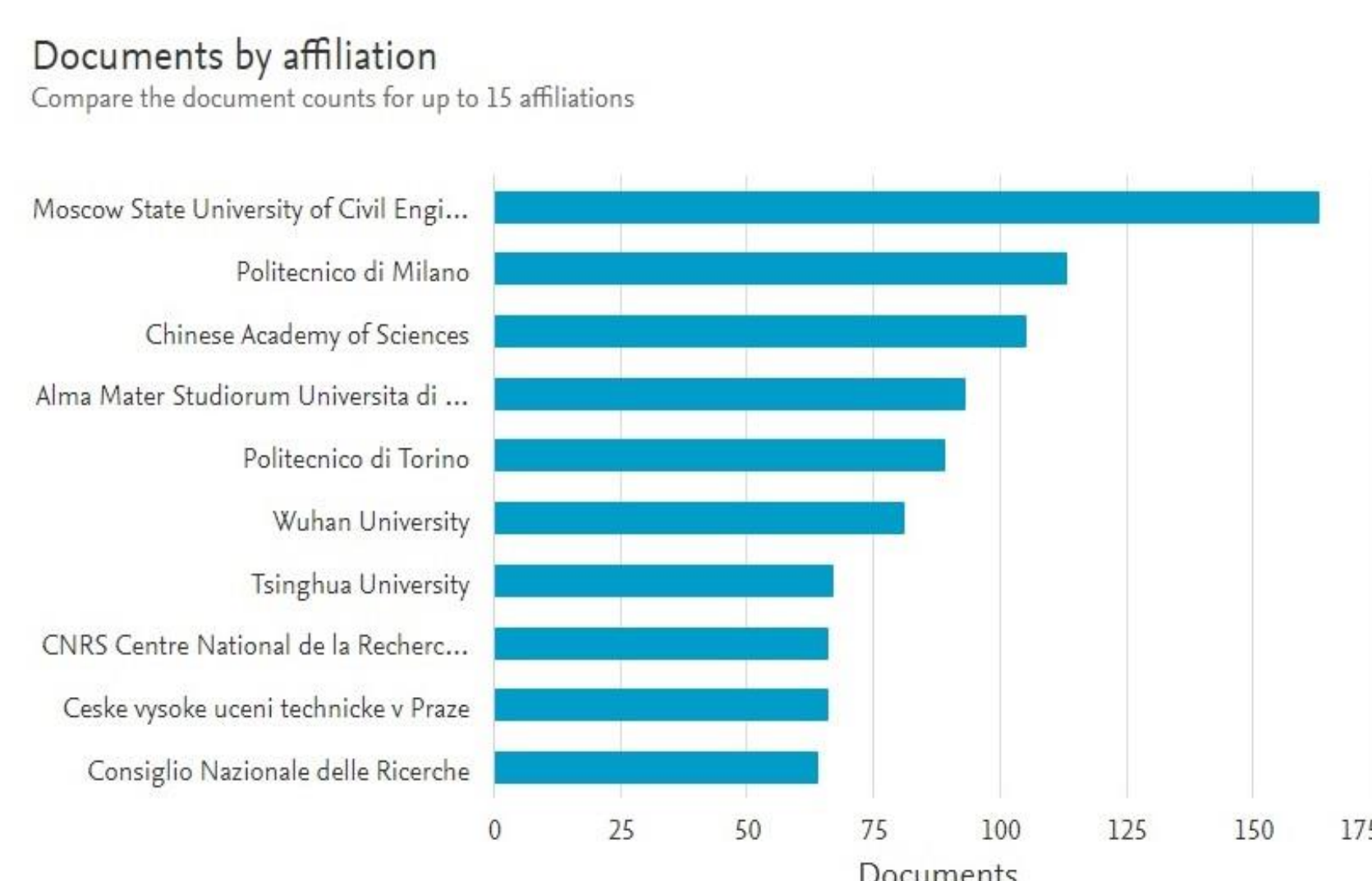


Fig 3 - Ranking with 10 institutions in volume of publications.

The top 10 institutions in volume of publications on Smart Cities is the Moscow State University of Civil Engineering. Then in Figure 4, it contains a chart with the ranking of the 10 main countries that develop research on the researched topic.
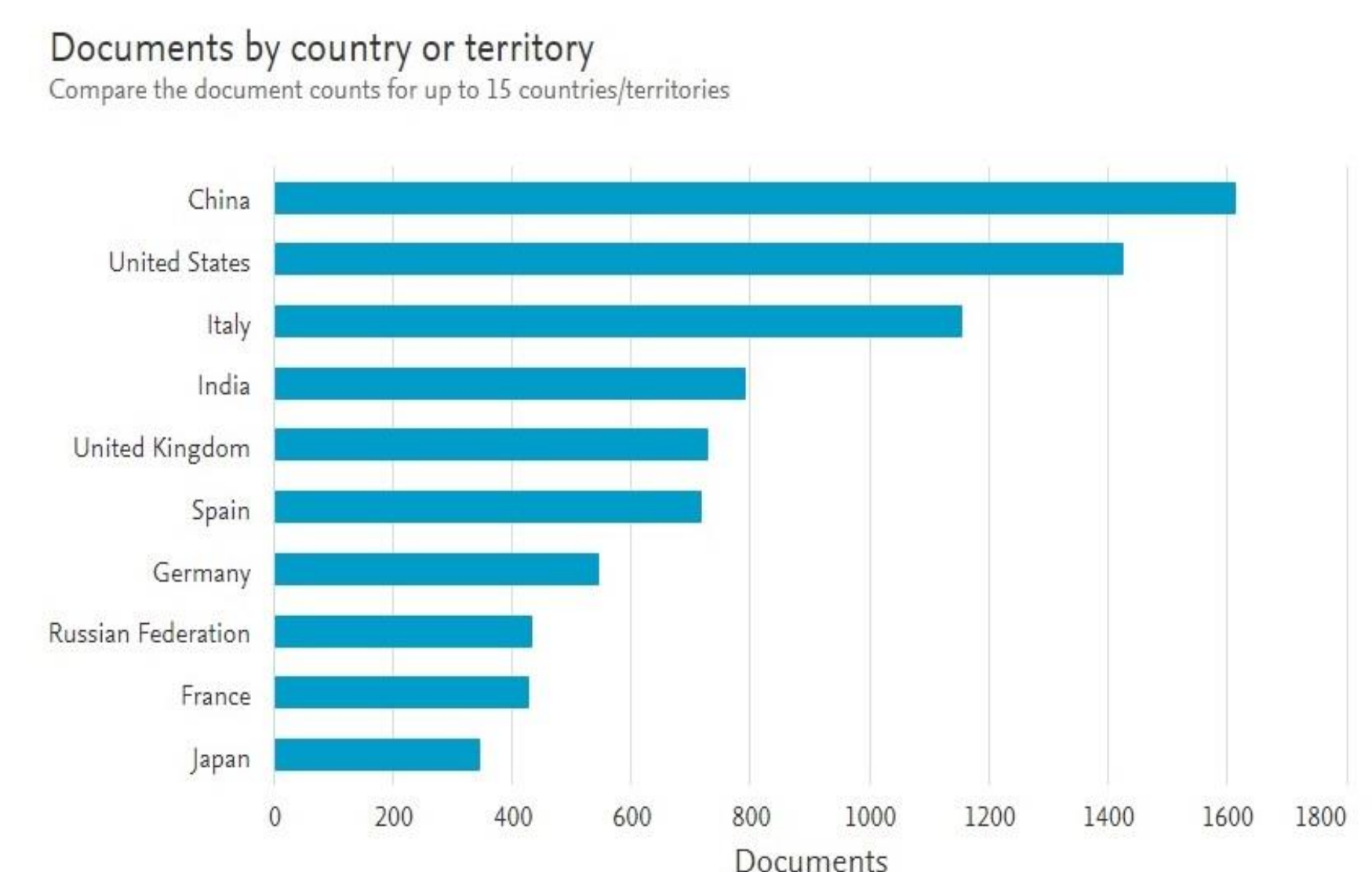


Fig 4 - Ranking with the 10 main countries that publish works on the theme Smart Cities.

The ranking of Figure 4 is led by China with 1800 articles published, second with United States in just over 1400 publications, thirdly Italy with approximately 1200 publications and the last country to compose this ranking of 10 countries is the Japan with just over 300 published articles on the subject.

Another point counted were the areas of publications, presented in the pie chart of Figure 5.
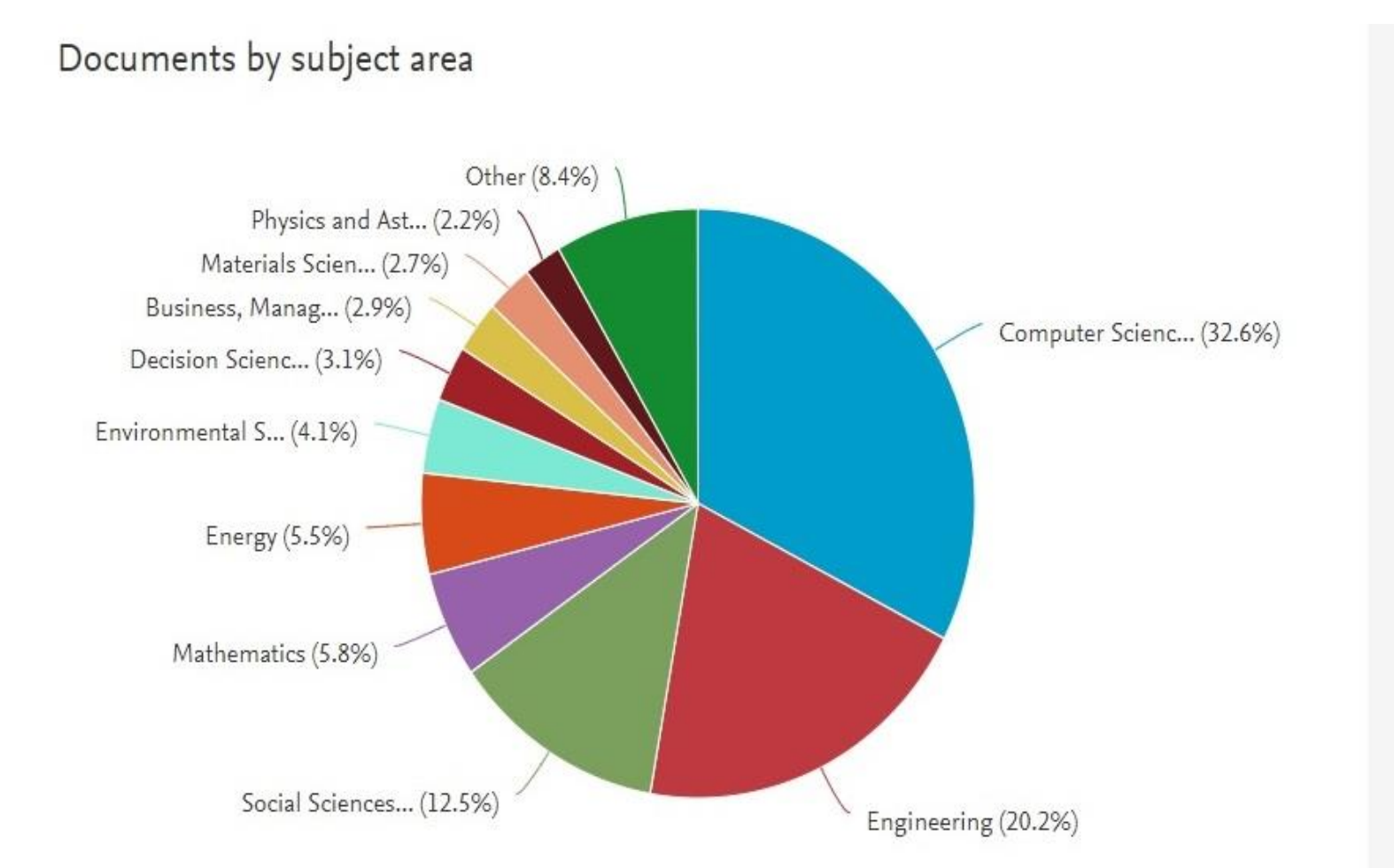


Fig 5 - Publications by areas, related to the theme Smart Cities.

The main area that stands out is Computer Science with 32.6% of publications, in second place comes Engineering with 20.2%, followed by Social Sciences with 12.5% and the area with less expressiveness is Physiscs with 2.2 % of publications.

## Conclusions

Through the analysis carried out in this work, it was possible to conclude that the topic Smart Cities, has been investigated and developed increasingly in recent years tending to continue growing.

Thus demonstrating the interest of the academic community to continue developing research in the area, and with perspective of rapid implementation of technologies mainly in large cities around the world.

## References

1. Kolokotsa, D. (2016). The role of smart grids in the building sector. Energy and Buildings, 116, 703-708.
2. Emeakaroha, A., Ang, C. S., Yan, Y., & Hopthrow, T. (2014). A persuasive feedback support system for energy conservation and carbon emission reduction in campus residential buildings. Energy and Buildings, 82, 719-732.
3. Calvillo, C. F., Sánchez-Miralles, A., & Villar, J. (2016). Energy management and planning in smart cities. Renewable and Sustainable Energy Reviews, 55, 273-287.

## Acknowledgements