



## Scientific Research in Saudi Universities: Science Thrives in the Desert

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### Abstract

**Objective:** This study aims to analyze the research publications in 25 Saudi public universities for the past 6 years and to identify the areas of strength. This study also aims to investigate the trend of research publications in Saudi Arabia for the past 25 years.

**Materials and Methods:** Research productivity of 25 public Saudi universities was analyzed from 2008 to 2013. Total number of publications and average number of publications per year were calculated for each university. The general trend of publications in Saudi Arabia was analyzed for the past 25 years (1988-2013) and research areas of strength (2008-2013) were also obtained.

**Results:** A total of 42936 documents published by the 25 Saudi universities during the last 6 years were retrieved. Two groups of universities were identified. The first group consists of six universities with total number of publications 35058 papers and accounted of 82%. The second group includes 19 universities with total number of 7878 papers published and accounted for almost 18%. The highest number of publications of 15044 (35%) was produced by KSU (3009 papers /year). However, SEU had the lowest average number of publications of 2 papers per year. The present study showed that strong research areas in Saudi universities for the past 6 years are engineering, medicine and physics and astronomy. Meanwhile, the research publication trend in Saudi Arabia for the past 25 years (1988-2013) was slow and lagging from 1988 until 2008 and had remarkable increase thereafter (exponential regression model  $R^2=0.851$ ).

**Conclusion:** Research publications in Saudi Arabia are obviously increasing with remarkable role of the top universities. Engineering, physics and astronomy and medicine were identified as the areas of strength in Saudi.

**Keywords:** Saudi Arabia, Scopus, Research, Productivity

### Introduction

The improvement of the scientific research is the reliable measurement for any country development as it is also associated with remarkable growth in economic, technology and the quality of residents' life at the end. During the last century, the world witnessed outstanding progress in various fields of science. Currently, most people in the world have fully understood that investment in scientific research is necessary for developing science and technology which of course will be reflected on the quality of human being life [1]. Kingdom of Saudi Arabia is a member of the Gulf Corporation Council and has high gross domestic product (GDP) of 25136 US\$ in 2012 [2]. In the last two decades, the Kingdom of Saudi Arabia (KSA) underwent through comprehensive development in the different aspects of science, technology, commerce, agriculture and industry [3]. The current trend of Saudi government is to enhance the scientific research in different sectors as more than new 20 universities were established since 2000 [4]. According to International Association of Universities statistics updated on October 2013, the total number of public and private universities in Saudi Arabia is 47 [5]. This enables Saudi researchers to be well known regionally and internationally especially in medical and biomedical fields [3]. Therefore, Saudi Arabia presented in the top rank not only among the Gulf Corporation Council countries but also among other Arab countries [6].

Although with significant development in scientific research in Saudi Arabia, it is still hard to compete with other non-Arab Asian countries [7]. Prior to suggesting any improvement plans and programs to enhance the scientific research in Saudi Arabia, it is important to evaluate the current status of research in Saudi Arabia and identify the deficiency areas needed to be acted on. There are few studies which aimed to analyze the scientific production in Saudi Arabia mostly in medical and biomedical areas. Most of these studies analyze the medical research in the entire country without specific analysis of the contribution of each academic institution. Thus, there is a knowledge gap on the current productivity of the Saudi universities and how far they walk in the research way. The present study aims to analyze the productivity of 25 Saudi universities in the scientific research publications based on the last 6 years data (2008-2013). This will help the Saudi researchers, authorities as well as decision makers to develop the research quality and quantity in the future.

### Materials and Methods

All data collection and analysis were conducted in Biology Department, Faculty of Science, University of Tabuk (Saudi Arabia). Twenty five public Saudi universities were included in this analytical and comparative study. The scientific publication of each university was calculated for 6 years from 2008 to 2013 with identification of the top three subject areas based on Scopus categorization. The average number of publications produced by each university was also calculated. The full and correct spelling of the names as well as further information on the selected universities was obtained from the website of Saudi Ministry of Higher Educations (MOHE) [4]. Broad online search was conducted using Scopus database [8] which is renowned as a reliable abstract and citation search engine worldwide [8,9]. For total number of documents we used the terms "Kingdom of Saudi Arabia" OR "Saudi Arabia" OR "KSA" while search online in Scopus to ensure covering all papers published in Saudi Arabia. The total number of publication for the past 25 years

(1988-2013) was also obtained online from Scopus website. The trend of publications in Saudi Arabia was calculated based on exponential regression equation and regression coefficient ( $R^2$ ) was also calculated.

## Results

Publications of 25 public Saudi universities were analyzed in this study for a period of 6 years (2008-2013). A total of 42936 documents published in different fields of sciences by the 25 Saudi universities during the last 6 years were retrieved using Scopus with average number of 7156 paper/year. The findings of the present studies showed that there were two groups of universities. The first group consists of six universities (KSU, KAU, KFUPM, KFU, KKU and KAUST) with publications more than 1500 paper during the last 6 years (2008-2013) as illustrated in Figure 1. The research productivity of these 6 universities in the past 6 years accounted for almost 82% of the total publications analyzed in this study. The highest number of publications of 15044 (accounted for approximately 35%) was brought by KSU with average number of 2507 papers per year. However, the lowest number of publications of 1926 was found in KKU with average number of 321 papers per year.

The second group consisted of 19 universities as presented in Figure 2 and Figure 3. The highest number of papers produced (1405) was recorded from TU with average number of 234 papers per year. Other universities in this group showed almost similar trends. Few universities in this group were newly established and no sufficient data is available in the last 6 years. Hence, the average number of publications per year was used as an indicator in this group. The universities that have research production of less than 20 papers per year are SEU, PNBAU, MU and NBU (Figure 2). Despite that, some newly established universities are starting in a good trend. For instance, SBAU had only available data for 3 years (2011-2013) and the total number of publications was 204 and the average per year was 34 (Figure 2 and Figure 3).

Based on the obtained data and analysis, the present study showed that strong research areas for the past 6 years in Saudi universities are engineering, physics and astronomy and medicine (Figure 4). Despite that, the research area of chemistry and biochemistry, genetics and molecular biology can be ranked in the fourth place equally as shown in Figure 4.

Figure 5 shows the research publication trend in Saudi Arabia for the past 25 years (1988-2013). It is clear that trend was slow and lagging from 1988 until 2008. Afterward, there was a significant increase in the number of publication in Saudi Arabia. The publication trend fits the exponential model ( $R^2=0.851$ ). The total number of papers published by Saudi researchers in 2013 was 14057 compared to 11809 and 9331 papers in 2012 and 2011, respectively.

## Discussion

Twenty five public universities were analyzed for their research publication during the last 6 years (2008-2013). The present study showed that Saudi universities varied in the scientific production and can be visually identified into two groups. The first group comprised six universities which the production is more than 1500 papers during the last 6 years. The second group consists of 19 universities which the number of papers produced in each university for the last 6 years was less than 1500.

This considerably high number of publications is expected as previous studies addressed significant increase in number of research papers from Saudi Arabia especially in biomedical and medical fields [3,10]. In his earlier report, Al-Khader [10] found that Saudi Arabia and Egypt had the highest number of publications accounting for almost 58 % of the Arab world publications.

Generally, the research production trend of Saudi Arabia during the past 25 years (1988-2013) showed exponential increase. In the period from 1988 until 2008, the research production was low and fluctuated in a narrow range. In the period from 2008 to 2013, the number of published papers increased sharply to reach the peak in 2013 with a total number of 14057 papers. This trend indicates that the research production in Saudi increased approximately 8 times in 2013 compared to 1988.

Although this trend reflects remarkable development in the research quality in Saudi Arabia, other countries in the Middle East including Turkey, Israel and Iran still leading the research publication in this region [11]. On the other hand, this indication is still very promising as research plays a vital role in leading the economic growth where the scientific knowledge is the corner stone. Such cases are experienced in few Asian countries as they were transferred from agricultural- or natural resources-based countries into knowledge-based economy [9, 12, 13].

Among the studied universities, KSU scored the high number of publications during the past 6 years. This is anticipated as KSU is 57 years old (established in 1957) and is considered as the first public university in Saudi Arabia with high research productivity as found previously by Tadmouri and Tadmouri [3]. Other younger yet productive universities such as KAUST is expected to have high ranking in the next decade as it is supported by huge funding resources and attracted renowned researchers from various parts of the world [14].

### Research areas of strength in Saudi universities

In the present study, three areas of strength were identified in Saudi universities; engineering, physics and astronomy and medicine. The research in mathematics declined in Saudi universities as Adam et al. [15] identified engineering, mathematics and medicine as the areas of research strength in Saudi Arabia based on papers indexed in *Thomson Reuters Web of Knowledge*<sup>SM</sup> from 2000 to 2009. Thus, introduction of physics and astronomy research area in Saudi Arabia is considerably new yet; it succeeds to compete with mathematics and chemistry.

### Strength and limitation of the present study

One strength points of the present study is that 20 public universities were included in this analysis. This will give a clear indication about contribution of each university to the general production. Interestingly, the present analysis is considered as the first study reporting the general outline of scientific production in Saudi Arabia with remarkable highlight on the strength research areas.

Although the present study design is relatively simple, we have encountered few obstacles. One of these pitfalls is the affiliation or city incorrect spelling (e.g. University of Tabuk /University of Tabouk, Hail Univerity/Hai'l University). Another limitation of the study is that high number of peer-reviewed papers published by Saudi researchers affiliated with research institution rather than universities was not included. This may include King Abdulaziz City for Science and Technology (KACST) and King Fahd Medical City (KFMC) and King Abdulaziz Medical City (KAMC). Although there are 47 public and private universities in Saudi Arabia, the present study included only the public universities. It is acceptable fact that some papers were published by researchers in Saudi private universities. Furthermore, some good-quality published papers in either local and regional journals that are not indexed in Scopus were not included in this analysis. Thus, this analysis may not give the exact presentation of the research production in Saudi Arabia. We can overcome these impediments by extending the search criteria to include other research institutions as well as private universities in the future.

## Conclusion

The present study is considered as the first effort to update the research productivity of public Saudi universities with clear identification of the research areas of strength. Generally, number of publications in Saudi Arabia that indexed in Scopus increased tremendously especially during the last 6 years. For the last 6 years (2008-2013), the first 6 top universities (KSU, KAU, KFUPM, KFU, KAU and KAUST) contributed almost 82 % of the total research productions; meanwhile other 19 universities contributed only 18 % of the total publications. KSU had the lion share with 15044 papers published in the past 6 years which accounted for approximately 35 % of the total publications. The three strong research areas in Saudi universities are engineering, physics and astronomy and medicine. On the other hand, it is recommended that further in-deep analyses should be conducted in future to involve other medical and scientific research institutions in Saudi to draw a comprehensive conclusion about the status of scientific research in this country. Furthermore, the present findings would be helpful for decision makers in Saudi to plan a future strategy to enhance the research in less-productive fields such as agricultural and biological sciences and computer science.

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## Author contribution

SAA conceived and design the study. SAA and KAA analyzed the data and wrote the manuscript.

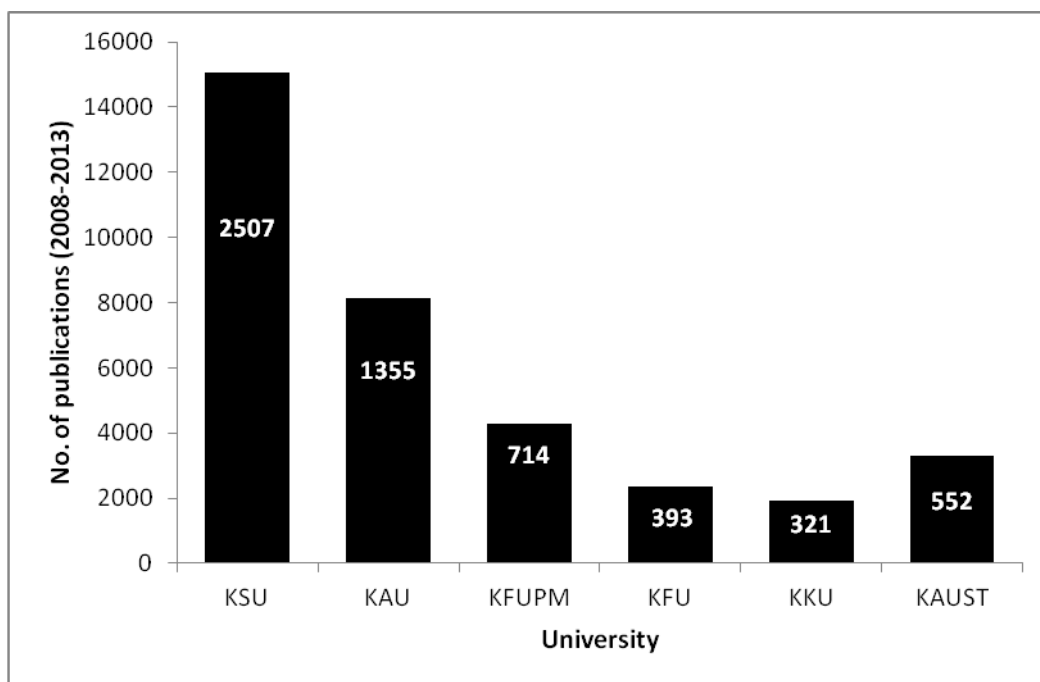
## Competing interests

The authors declare that they have no competing interests.

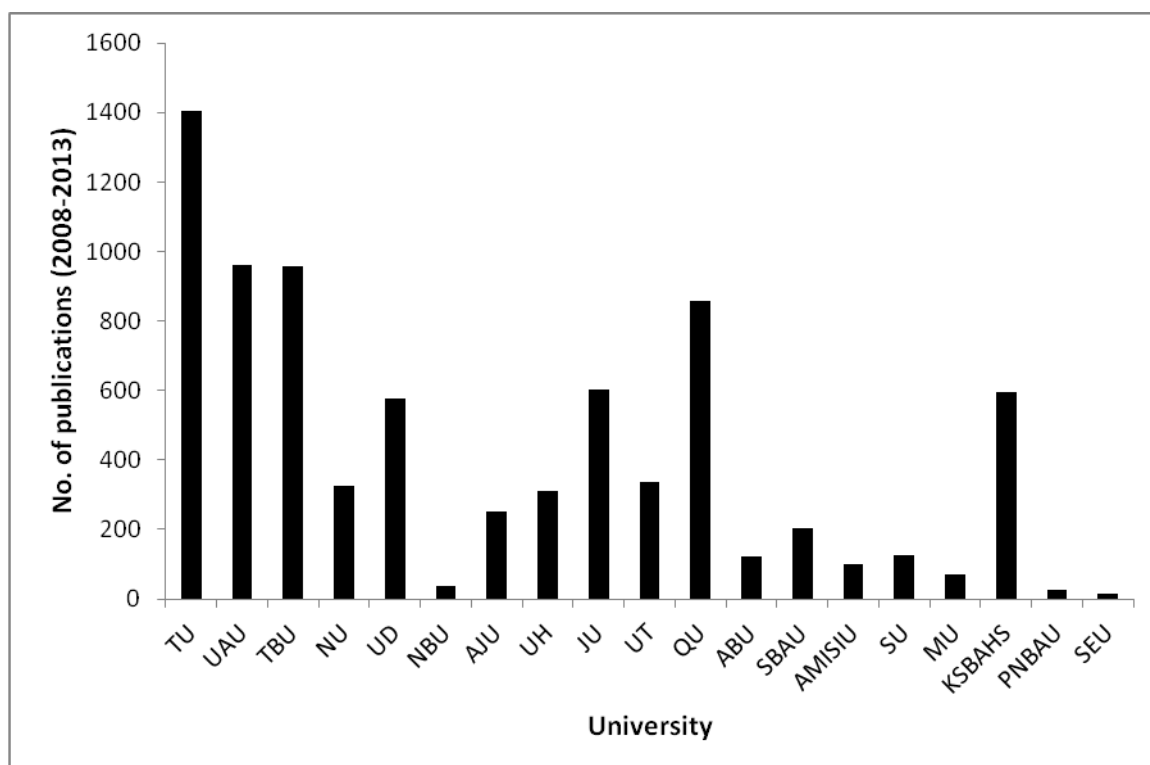
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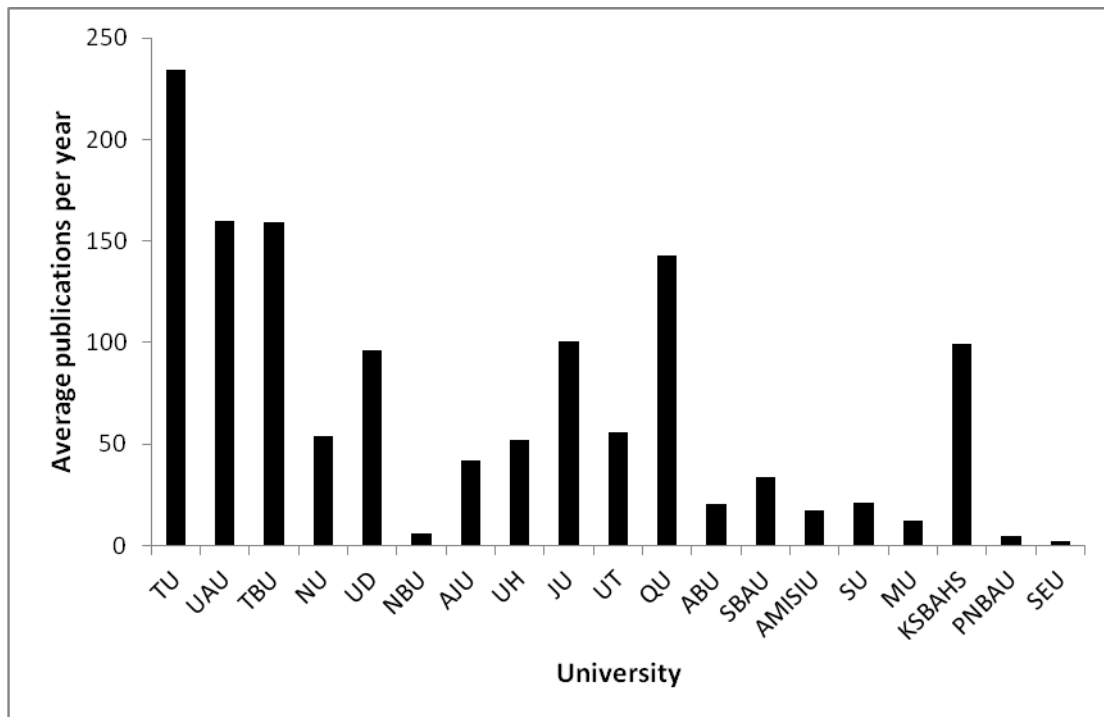
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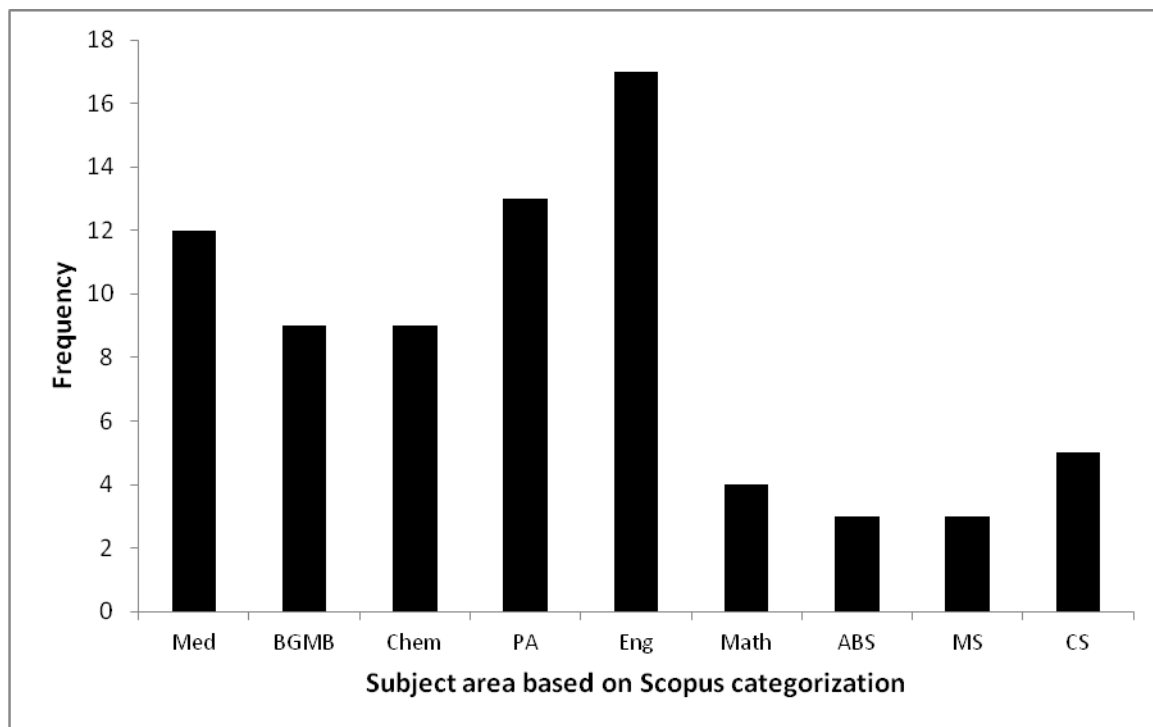
**Figure 1.** Total number of publications based on Scopus index from 2008 to 2013 in top Saudi universities. **KSA:** King Saud University (established in 1957), **KAU:** King Abdulaziz University (established in 1967), **KFUPM:** King Fahd University of Petroleum and Minerals (established in 1963), **KFU:** King Faisal University (established in 1975), **KKU:** King Khalid University (established in 1999), **KAUST:** King Abdullah University of Science and Technology (established in 2009). The numbers inside the bars indicate the average number of publications per year.



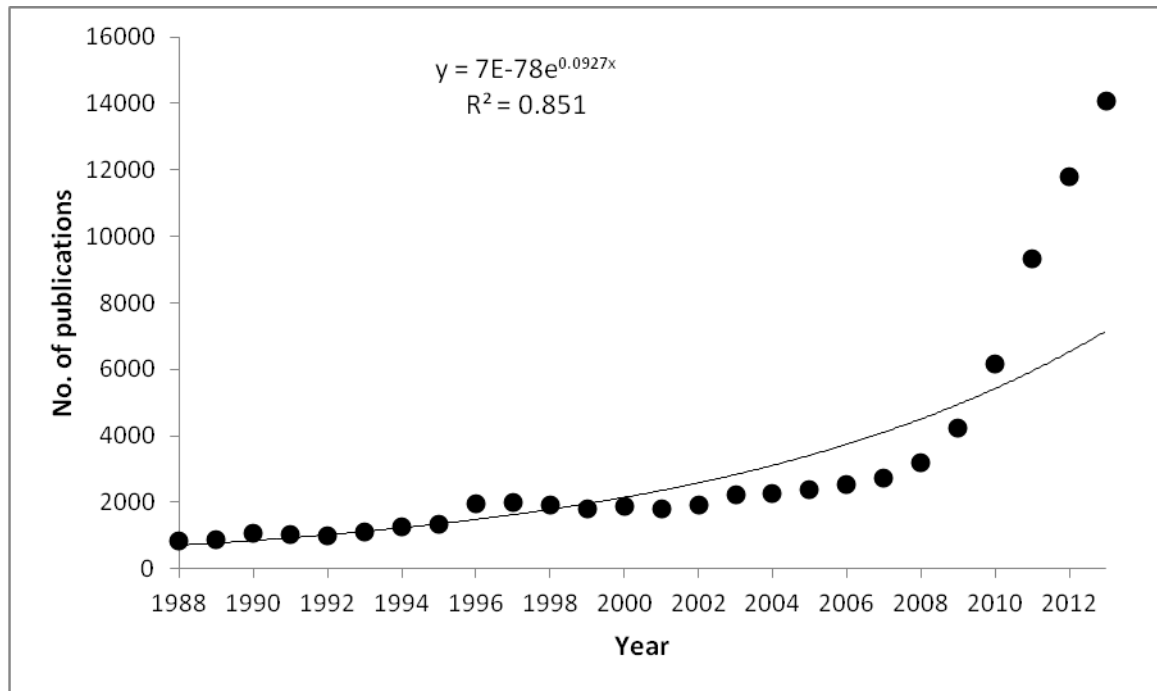
**Figure 2.** Total number of publications based on Scopus index from 2008 to 2013 in Saudi universities. **TU:** Taif University (established in 2003) , **UAU:** Umm Al-Qura University (established in 1949), **TBU:** Taibah University (established in 2003), **NU:** Najran University (established in 2006), **UD:** University of Dammam (established in 2009), **NBU:** North Borders University (established in 2007), **AJU:** Al Jouf University (established in 2005), **UH:** University of Hail (established in 2005), **UT:** University of Tabuk (established in 2006), **QU:** Qassim University (established in 2004), **ABU:** Al Baha University (established in 2006), **SBAU:** Salman Bin Abdulaziz University (established in 2009), **AMISIU:** Al-Imam Mohammad Ibn Saud Islamic University (established in 1953), **SU:** Shaqra University (established in 2008), **MU:** Majmaah University (established in 2009), **KSBAUHS:** King Saud Bin Abdulaziz University of Health Sciences (established in 2005), **PNBAU:** Princess Nora Bint Abdulrahman University (established in 2008), **SEU:** Saudi Electronic University (established in 2011).



**Figure 3.** Average number of publications per year in Saudi Universities based on data from 2008-2013. For acronyms please refer to Figure 2.



**Figure 4.** Frequency of research areas in 25 Saudi universities from 2008-2013. **Med:** Medicine, **BGMB:** Biochemistry, Genetics and Molecular Biology, **Chem:** Chemistry, **PA:** Physics and Astronomy, **Eng:** Engineering, **Math:** Mathematics, **ABS:** Agricultural and Biological Science, **MS:** Materials Science, **CS:** Computer Science, **SC:** Social Science.



**Figure 5.** The trend of publications in Saudi Arabia for the past 25 years (1988-2013). The regression model fits the exponential equation model.