

A preliminary study of the research production in Saudi universities

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Abstract— Objectives: To examine the current status of research production in the public Saudi universities. Methods/Statistical analysis: A special digital library, founded and established by the respective research institution in the country (King Abdul-Aziz City for Science and Technology or KACST), was available at the time. This source was devoted and available to the most important public Saudi universities and only for applied sciences. The origin of the data goes back forty years. Findings: The results clearly prove the constantly growing tendency for research production that this country experienced despite two highly downgraded years. Nevertheless, and as it was revealed, production of research papers written in the English language was the main outcome through the years and only three Saudi universities can be considered as the most influential education institutions in article production terms. Finally, it reveals, much as expected, that those significant public institutions are physically located in three geographic areas, indeed the big urban centers of Riyadh, Jeddah and Dammam.

Keywords—Public Universities, Research Production, Saudi Arabia

I. INTRODUCTION

THE primary objective of all higher education Universities all over the world is to disseminate knowledge and promote intellectual creation and innovation environments in an effort to measure and evaluate intellectual property. Such a mission can be found in many Universities' guidelines and a common definition of intellectual property could be "any form of knowledge or expression created with one's intellect" [1]. However, this is not always easy, to say the least, since many faculties worldwide struggle to produce research work while under pressure for their teaching and other duties [2].

The articles produced by the scholars constitute an important part of intellectual property that belongs to their educational institute and should be conceived as part of the intangible assets or intellectual capital of the respective universities [3]. Producing and increasing the intellectual capital through intellectual productivity is considered as a pivotal point that ensures sustainable growth of higher education institutes [4]. Therefore, adopting a procedure that monitors these intangible assets proves to be even more necessary for the higher education institutes especially as a result of the increasing demand of the universities 'stakeholders for transparency and a greater autonomy inside a very competitive environment where knowledge is the main output and input product [5].

There is, however, a certain conflict between the different factors of intellectual capital and their contribution to the final credit value of Universities investments on human capital. It is

clearly observed for many Universities that their authorities set a priority on production following their research activity as the main factor of their overall intellectual production [6]. In the case of the public universities the main focus is to take the competitive advantage over those of the private sector aiming to ensure a sustainable growth and raise of their reputation [7].

In Saudi Arabia, which experienced huge investments in the higher education sector, such efforts are intensified. Local public institutions are well in the process of aligning and participating in this ongoing intellectual productivity race, as one of their intellectual assets, following a period of heavy investment on creating appropriate educational infrastructure creation, which is still in progress [8]. Despite various obstacles and weaknesses of the local educational system there is a widespread feeling among the local academics of the necessity to fund research [9]. The technology and applied sciences field at the King Abdulaziz City of Science and Technology (KACST from now on) holds a prominent position having a great influence in the overall effort of the country to be transformed from a resource based to a knowledge driven economy [10].

Posing the basic question of this research, the authors attempt to measure the level of intellectual production in Saudi Arabia investigating at first the respective volumes of Saudi academia.

II. AIMS AND OBJECTIVES REVIEW STAGE

Determining the intellectual productivity in Saudi Universities is the basic aim of this study paper. The objectives were sought to

- Examine the status of public Saudi academia intellectual property in terms of published articles production,
- Compare the English and Arabic intellectual production volumes through the years and as a percentage of the total production,
- Investigate possible milestones regarding the intellectual production volume fluctuations of the academia in public Saudi Universities.

III. BACKGROUND

Aiming to better monitor and manage this academic process, universities in many countries adopted an incentive system directly connected to indicators of scientific overall productivity [10-13]. They proposed that the universities be ranked according to their total faculties' publications in addition to other measures related with other quality elements. As a consequence of this trending policy higher education institutions stakeholders (public or not) are seeking intensively increasing information over the intellectual capital that their

institutions hold, a kind of disclosure of academic and professional qualifications of the teaching and the research staff overall that they regard as crucial. For example, in their study Ramírez, Tejada and Gordillo concluded that the annual account reports on intellectual capital must be extended to more intensive quantifications on research productivity due to educational stakeholders' interest [14]. Another study on the public universities of Taiwan focused on the used progressive Data Envelopment Analyses (DEA) model, to evaluate the teaching and research efficiency towards quantitative and cost effective measures of academic papers [15].

These studies can be thought of as important tools in the hands of educational administrators for redirecting resources of their institutions towards institutions that favor the production of serious scientific papers [16].

Since the number of articles published remains in the center of every productivity measurement model for higher education it is of critical importance to ensure some incentives for greater performance argued that eventually any increase in research productivity and other similar academic activities must target to the dissemination of knowledge [17]. Anyway, counting published articles could be a critical measure of evaluating research productivity in academia, although it is not the only one [18].

Gulf area countries have demonstrated, over the last couple of decades, an increasing interest and focus on their education sector realizing the need to rely less on their fossil fuel resources and more on building their knowledge economies with the aid of foreign high skilled experts. As a consequence, the local governments saw the need to depend more on the local workforce thus encouraging, if not enforcing, more training of their citizens in an effort to develop their human capital. The Kingdom of Saudi Arabia stands out as a leading educational hub due to its large population, high GDP per capita and huge spending on its education system [19].

This policy of heavy spending in education indicates the strong engagement of Saudi Arabia for national development and progress and explains its special commitment to scientific research [20].

There is no doubt that the authorities in the Kingdom are dedicated to achieve a deep transformation to a knowledge-based society [21]. However, results show that the competition of the local universities for better world ranking has, until now, only a relatively low impact in articles' productivity when compared to the huge investments made in the educational sector of this country [22].

IV. METHODOLOGY

This is probably among the very few studies to measure the research production in Saudi Arabia. In order to accomplish such a task an initial discussion was sought with the stakeholders in the country to investigate the possibility of finding reliable and convenient electronic resources containing data related to publications from the local public academic institutions. After considering the reliability, effectiveness and

legalities it seemed quite safe to utilize these digital repositories [23].

The main interest was in the applied sciences and the technology field on which the clear majority of research production relies. The result of this quest was online digital repository of published articles created by a very respectable and overfunded research institute in Saudi Arabia called KACST using the DSpace software [24]. The data in the authors' disposal was limited to a catalog of published articles from the most significant public higher education institutes in the country.

The data was received as a log file in mid-October of 2014. At that time, the public universities included in this sample data were King Saud University (KSU), King Faisal University (KFU), Taibah University, King Fahd University of Petroleum and Minerals (KFUPM), King Abdulaziz University (KAU), Umm al Qura University (UQU) and King Khalid University (KKU). Later, after 2015, this intellectual production project was transferred to the King Fahd National Library as a signed Agreement between the King Abdulaziz City for Science and Technology and the King Fahd National Library [24].

After the extraction and collection of this catalogue of articles some refining actions were applied on the data that were necessary for validation reasons so as to improve their quality and reliability. The full co-operation of those in charge of this digital library was provided to the researchers. This process included the exclusion of the data from 2014 because they were quite incomplete, the elimination of duplicate records, the correction of misspelled elements, some translation especially of titles in Arabic and a couple of technical issues. It should be noted that data directly associated with KACST was also excluded, as this organization is a research institution with no clear public character since it attracts funding from the public as well as the private sector.

The data was extending four decades to the past starting in the 1970's, when the deployment of heavy investments in educating Saudis was initiated. In the next phase, that of manipulating the data, the use of Arc-GIS package proved to be adequate as a tool for implementing a geospatial analysis and presenting the sample in such a way as to derive some useful geo-information capable of serving in the deduction phase. A map of Saudi Arabia was designed with the data represented in bar charts in Fig. 1. In the second phase, the research focused on the creation of fluctuation charts accompanied by a tendency line. MS Excel was used to produce in simple graphs the aggregate results of the data analysis.

The first three charts illustrate the data concerning the three leading and most important public universities in terms of research production in Fig. 2, 3, 4. They compare the total production of published papers in English, in Arabic and in both. The next chart focuses in the research production of the public universities of the sample as a whole in Fig. 5. Finally, a spider chart was used to illustrate the change of the same data in terms of decades in Fig. 6.

V. FINDINGS

The starting point and milestone one could say, was the year 1975 when a special ministry for higher education was established. Another milestone was the year 1999 when a dedicated research center on higher education was initiated. Finally, year 2005 was when the Ministry of higher education decided to triple the investments on education for the next five years from 18 billion dollars to 54 billion dollars [25].

A. Mapping the major public universities in Saudi Arabia

Fig. 1 illustrates the geographical map of the major public universities in Saudi Arabia together with their student bodies' sizes and the representation of the percentage of the research outputs in English, Arabic and combined.

Three out of seven universities have a significant production of published articles (KAU, KSU and KFUPM) and of those KSU has a much smaller student body size than the others. Those three universities produce mostly articles written in English language with KFUPM contributing less. KAU and KSU are located in the big port in the western part of the country, Jeddah, and the capital Riyadh which are the most populated cities in the country and KFUPM together with KFUPM can be considered as representatives of the largest in size Ash Sharqiyah region with the biggest oil drilled fields in the Gulf Cooperation Council Countries area (GCC from now on) [25, 26]. Additionally, KSU in the capital area of Riyadh appears to have by far the biggest production of published articles written in Arabic language.

The rest of the public universities studied, i.e. UQU, KKU and Taibah, have much smaller research production that makes it not worth the effort for further analysis even though in the cases of UQU and Taibah their locations in the famous cities of Mecca and Medina would lead to the assumption of a completely different picture.

B. Annual research production in Saudi Arabia

The KFUPM university (Fig. 2) appeared to have no articles productivity in the Arabic section. All of them are written in English and the relevant survey shows a general steady increase in the production over the past 35 years. The general characteristic in this case is the quite abrupt fluctuation of this general pattern. More specifically the university experienced serious production uptakes many times having its first significant peak in 1982 with 50 articles. After that in 1990, 1994, 1997, and 2008-2010 it reached other peaks of 70 articles each time. The most important down fall was on 2003 when the production of articles fell to just 23.

In the case of KSU (Fig. 3) its academic staff were able to produce articles written both in Arabic and English languages but the latter were, by far, many more than the former. Starting the production of English articles in 1975 like in the previous University, KSU showed even more extreme fluctuations in production reporting 0 articles in 1984 and in the period 1986-1988. On the other hand, the peaks in published production volumes were more now. Particularly, in 1990, 1994, 1996, 2002 and 2004 peaks reached the number of 62-68 published

articles.

This struggle to keep up with a steady production of research papers appears, also, to be true for KAU. In this case, however, the fluctuation line (Fig. 4) starting from 1988 displays less sudden changes through the years. The university experienced its first peak in 1990 publishing 72 articles. In 1999 KAU reached another peak of 96 articles and in 2003 one of its lowest production years yielding 32 articles. The next years proved to be very prospering passing the limit of 100 in 2008 and reaching 119 in 2012.

Generally speaking these sudden changes were the main pattern in every public university studied (even for those not shown in separate charts because of their very limited productions).

C. Annual production of articles

Fig. 5 illustrates the continuous effort, as reported in the KACST log file data, of research production from a language angle.

More specifically the chart clearly indicates that the English production line of articles dominates the overall production in Saudi Arabia. Furthermore, it shows that the production of articles written in Arabic follows relatively the same pattern (and fluctuations) as that of those written in English. Another interesting point is the later start, i.e. after 7 years in 1982 and the small volume of Arabic articles publications.

The whole period could be divided into 5 distinct parts as clearly shown in the chart (Fig. 5). In the first period, i.e. between 1975 and 1985, the production was generally very low and, on average around 50 articles. During the next period and from 1986 to 1990 research output more than doubled, almost tripled to around 210 papers. The production was generally stable with the exception of 2003 when total production fell below 150 articles in the third period (1991-2006). There is a second sudden explosion of research production after 2007 and, finally, during the last period (since 2009) there seems to be a dramatic fall of research in the country.

D. The research production through the past decades

Fig. 6 illustrates the fluctuation of research production in the different decades starting from 1970 until 2013, both in English and in Arabic.

There are a couple of points worth noting when looking at this chart. The first is that, rather surprisingly, initially the publications in the local public universities were almost entirely written in English as if there was no culture and academic ground for articles written in Arabic. The Arabic section in the report was initiated in the 1980s counting only 4 articles when at the same time the English section in the report was numbering 636 articles from about 166 in the beginning of the report section.

The second is that despite the fact that the number of articles reported in the English section of the log files in the next decade was, more or less, tripled the Arabic section only contributed a small amount of 100 articles. Furthermore, after

the year 2000 and until 2009, the number of articles in the English section of the report passed the 2000 milestone with the Arabic section being, again, steady and low almost stalled.

The dawn of the 2010s (actually 2010-2013) found the research production totaling only 584 articles having gone through a deep drop leaving a lot of room for negative projections for a difficult decade especially for the articles written in English. As for those written in Arabic there is a long distance to be covered before production reaches even the lower levels of those in English.

VI. DISCUSSION AND CONCLUSION

There are about 25 public universities in Saudi Arabia and more are built every year to facilitate the growing population of the youngsters in the country. Together with eLearning [27] and social media [28] use the expansion of higher education in the country are amongst the hottest trends in the local society. Despite the number of these institutions the authors are comfortable that the universities selected amongst the oldest and largest in students' population are more than enough to lead to safe conclusion in regard with the research production.

The first conclusion of this preliminary study on public universities research production in applied science and technology articles was that the total production of the country is depended mostly on articles written in English language. Furthermore, only a few of the Saudi public universities seem to bear the responsibility of producing published articles. However, it is more than obvious that the authorities of the other public universities are also, or at least should be, responsible for forming and applying policies that will raise their research production as well since this is one of the main objectives of an international academic institution.

The second conclusion is that the study revealed a serious fluctuation in the research production of even the best research universities in the country (KAU, KSU and KFUPM) demonstrating a rather unstable progress over the years. KSU and KAU seemed to have more similar research output than KFUPM. There is a need to sustain a steady production of research papers, if not a steady growth of such a production, which is, anyway, the education policy adopted from the higher education ministry in the country. Evidently, there is a positive attitude from the local academia towards this goal which is demonstrated by the overall increase in the published articles production, written both in English and in Arabic, but this effort must be both consistent and productive at the same time ensuring the absence of such production yield like in the years of 1986 and 2013 spoiling positive increasing tendency overall.

As seen in the analysis of the research production based on the decades in a previous section it would be safe to say that

the 1990s and 2000s where the best decades that had the local academia and higher institutions raise the total number of articles published having a pick in 2009. The results imply that the establishment of a dedicated ministry for higher education in 1999 proved to be influential and beneficial enough towards articles production which, along with the huge increase of education investment announced in 2005, gave a great boost on articles' productivity leading to the pick of 2009 with the total number passing the milestone of 2000 publicized articles (2059).

Finally, the mapping of Saudi research production in public universities indicated that the contribution on published articles relies mostly on 3 main public universities, i.e. KAU, KSU and KFUPM. These institutions are located in the 3 main urban centers of the country namely the capital Riyadh (KSU), the big port Jeddah in the west of the country (KAU) and the region full of gas and oil fields close to (KFUPM). Another university, the KFU, close to KFUPM, has a small but visible contribution on articles' production. Additionally, UQU located in the city of Mecca in the historical capital of Al Makkah province and the religious capital of Islam, just next to Jeddah is also "in this map".

The general conclusion of this study would be that there is a lot of ground to be covered towards further seriously raising research production in the country despite the heavy investments in higher education. Should the higher education stakeholders aim for the public institutions to carry on safely on this positive and promising plan they are bound to provide more incentives for research to more public Universities and, generally, to more academia faculty in Saudi Arabia including other significant provinces of the country and their institutions.

One recommendation is the formulation of a policy and mechanism to monitor such an effort formally reported by the public universities in a consistent and regular manner. Such a policy could be accompanied by a certain set of incentives, both for the natives and the expats in the country, to produce more and better research promoting all aspects of academia in the country and not just a small number of fields in the arts and sciences.

This research study can be thought of as a preliminary and earlier stage of a wider research effort, trying to reveal new perceptions of research production in Saudi Arabia public universities. More detailed analysis on all possible aspects need to be made acknowledging the contribution of authors and subject areas of published articles as well.

APPENDIX

A. Aggregate research production per year in the major institutions in Saudi Arabia (Source: KACST)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013						
Total	31	30	29	41	35	64	43	89	59	43	56	40	49	64	130	214	183	169	154	200	186	189	193	198	209	171	189	178	134	201	217	192	213	263	301	249	150	146	39						
KAU (E)														11	34	72	65	62	54	57	46	54	56	64	96	48	68	53	35	65	77	72	88	102	101	121	125	119	14						
KFUPM (E)	14	23	20	13	17	20	31	50	35	43	40	40	49	52	59	69	55	60	38	73	64	53	74	67	57	47	53	30	23	24	42	37	46	71	72	69									
KSU (E)	17	7	9	28	18	44	12	38	24	0	16	0	0	0	31	63	56	40	57	61	59	63	51	53	39	49	37	62	41	62	53	20	21	32	68	28	9	16	10						
KFU (E)																										11	14	8	17	21	17	20	23	19	10										
UQU (E)														1	2	0	0	2	1	0	5	9	0	0	0	0	0	0	0	0	0	0	8	7	0	11	19	2							
KKU (E)																													1	3	5	4	6	4	4										
Taibah (E)																																	8	7	16	11									
KSU (A)															3	5	5	5	2	6	8	6	9	9	11	10	4	17	5	15	10	8	10	9	7	6	2	7	14						
KAU (A)															1	4	2	0	2	3	1	0	0	1	2	2	8	3	5	2	3	9	2	5	6	3	11	4	1						
KFU (A)																					2	4	3	4	4	4	5	5	7	7	10	6	3	4	7	3									
UQU (A)							1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	4	0	1							
KKU (A)																																													

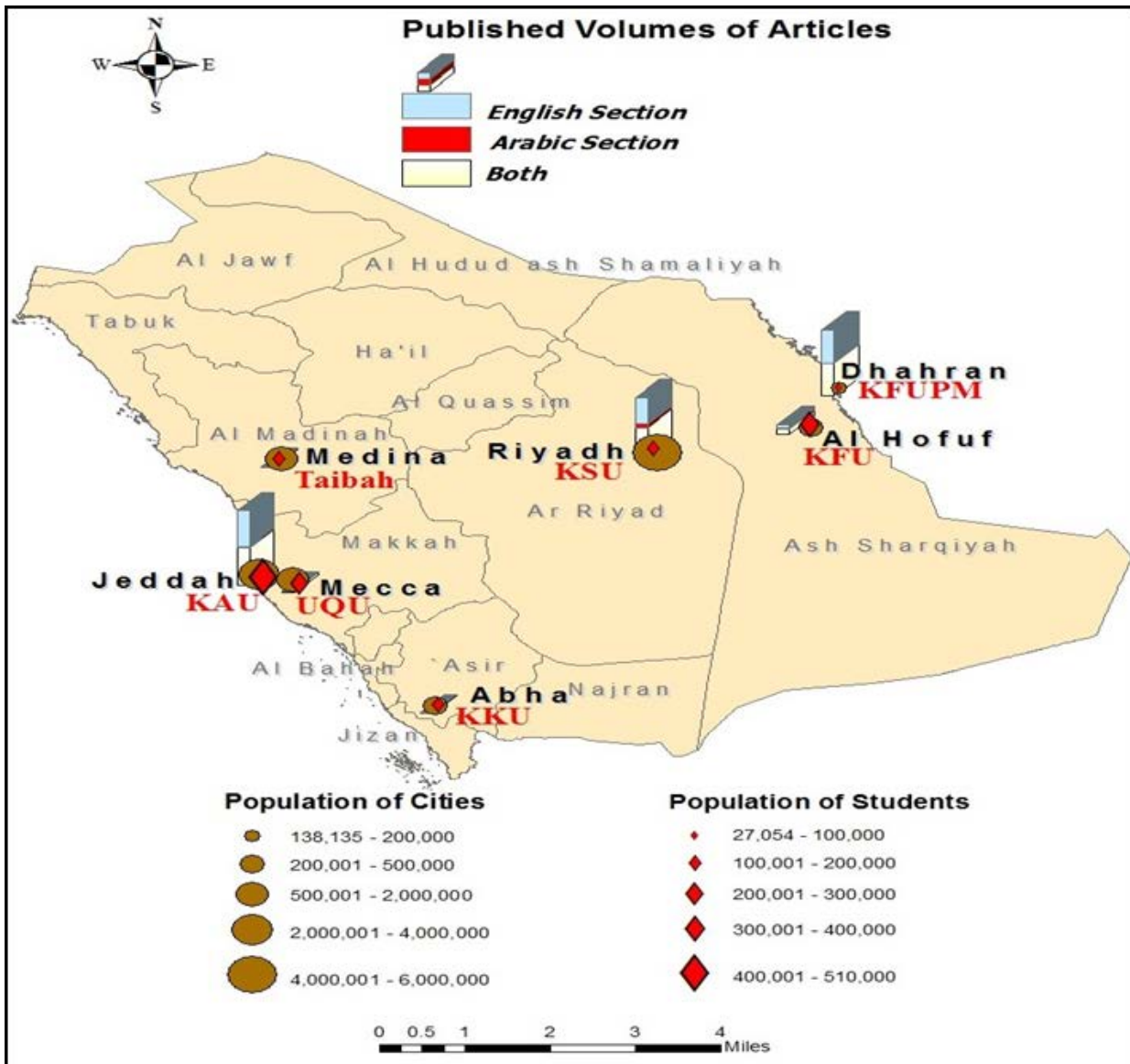


Fig. 1: Geo-representation of published articles per language

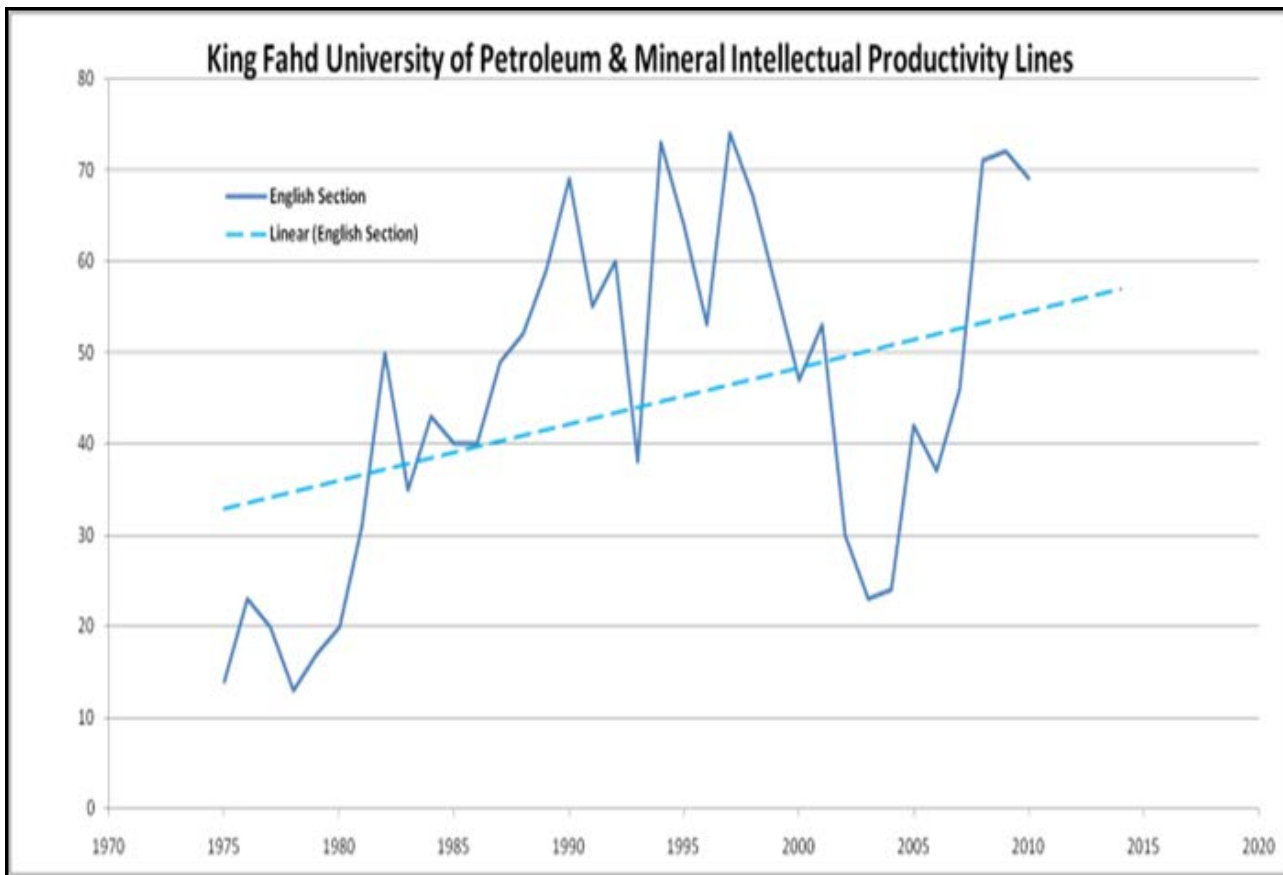


Fig. 2: KFUPM Fluctuation and tendency lines of published articles

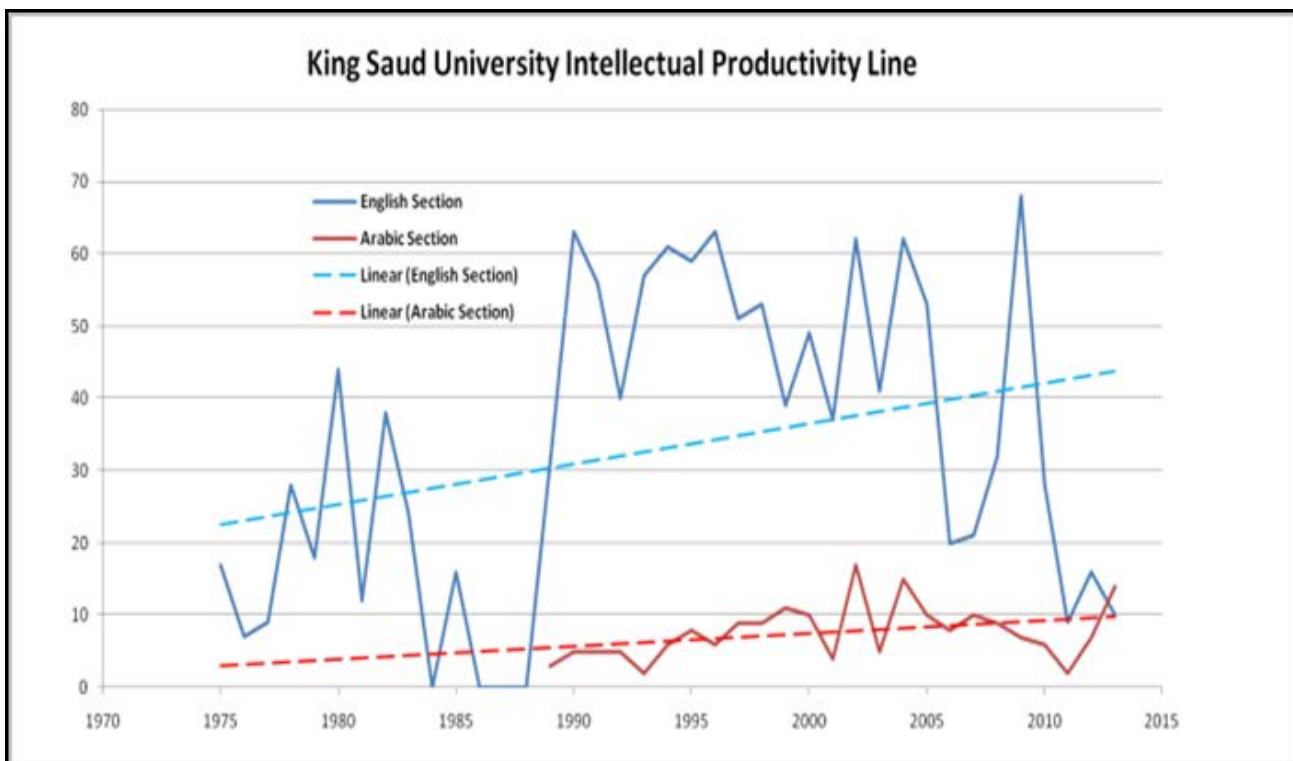


Fig. 3: KSU Fluctuation and tendency lines of published articles

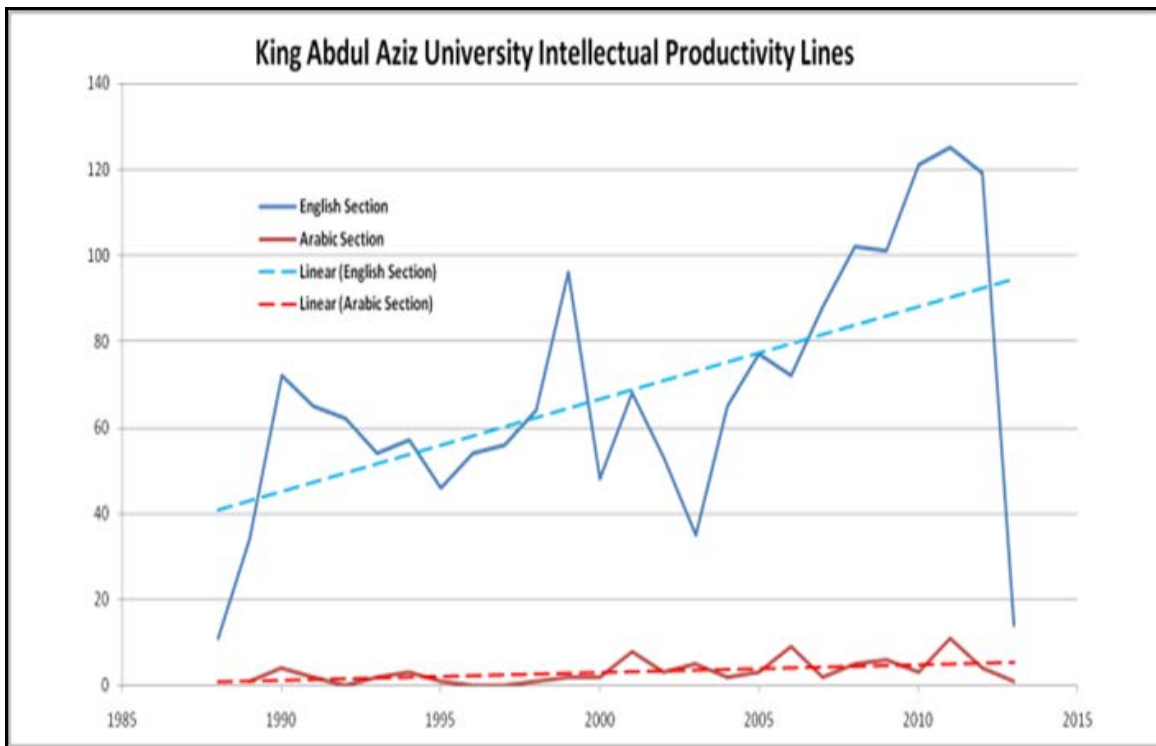


Fig. 4: KAU Fluctuation and tendency lines of published articles

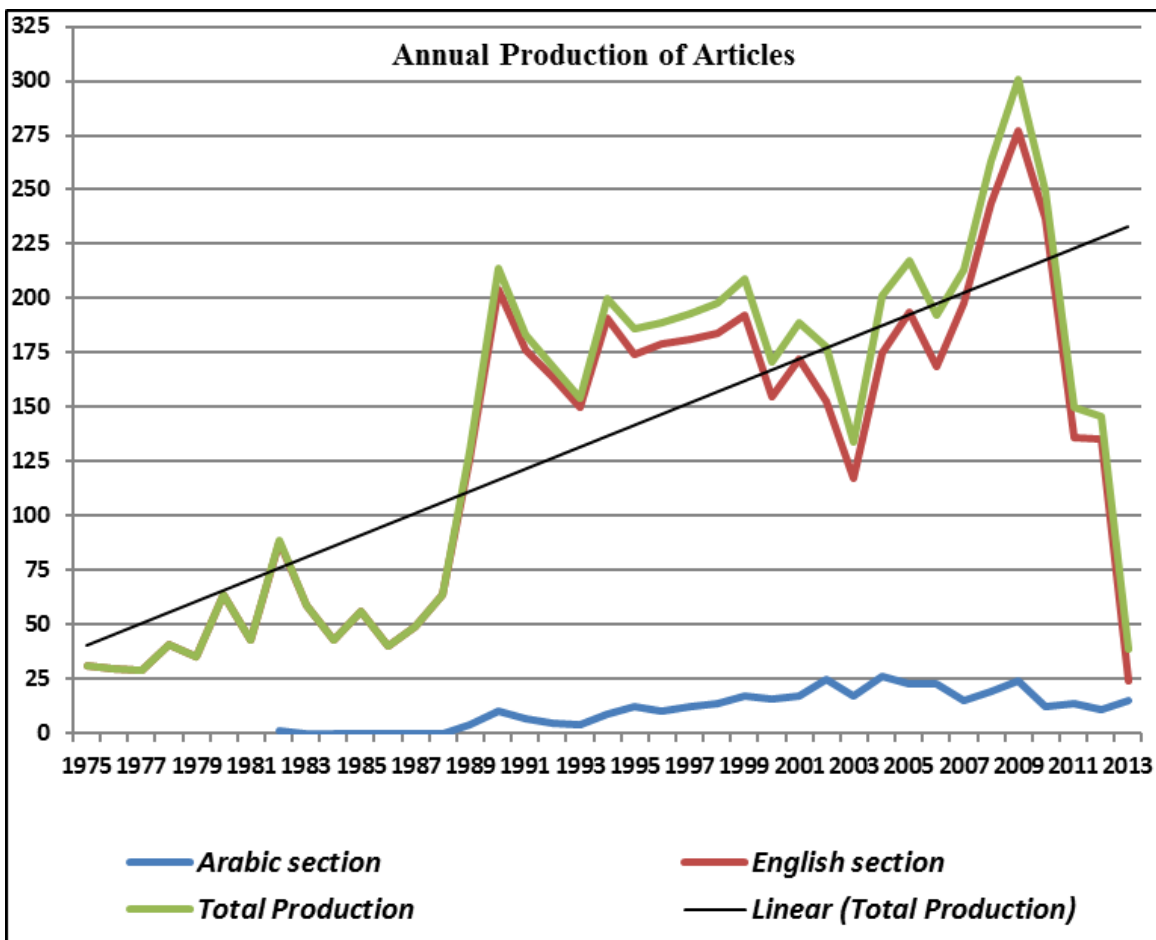


Fig. 5: Annual research production in Saudi Arabia

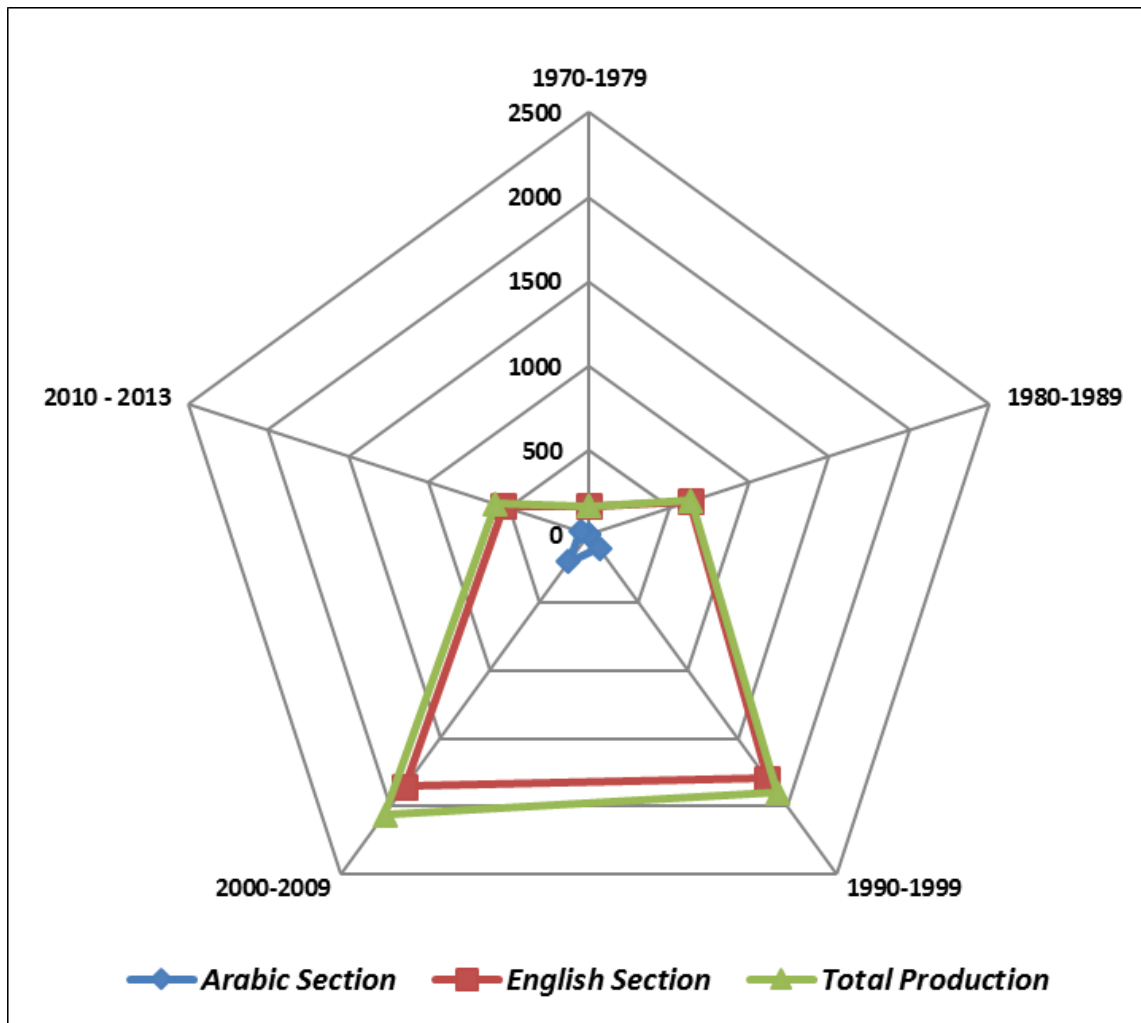


Fig. 6: Research production in Saudi Arabia through the decades

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