

Publication Productivity in Science and Technology at Saudi Arabia Universities' journals

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مستخلص الدراسة:

تمثل هذه الدراسة المرحلة الثانية من الدراسة البحثية للكشف عن المزيد من جوانب الإنتاج العلمي في الجامعات الحكومية في المملكة العربية السعودية، حيث تضمنت الدراسة سبع جامعات لديها أبحاث ونشر علمي في العلوم والتقنية. حصرت الدراسة ما تم نشره في تلك الجامعات على مدار السنوات الـ 40 الماضية أو نحو ذلك. وقد تم الحصول على البيانات المتعلقة بالدراسة من مشروع المكتبة الرقمية للإنتاج الفكري الوطني والذي تم تنفيذه من قبل مدينة الملك عبدالعزيز للعلوم والتقنية وحصرت جميع ما نشر لدى تلك الجامعات في العلوم والتقنية وحتى عام 2013م. بعد إجراء التحليلات الإحصائية على البيانات المشتقة من المكتبة الرقمية، وجد أن أبرز إسهام في إجمالي النشر العلمي في العلوم والتقنية كان من نصيب ثلاثة جامعات حكومية، إضافة إلى ملاحظة تصاعد معدل النشر العلمي السنوي لتلك الجامعات. كما وجد أن إجمالي الأبحاث المنشورة بمجهود مؤلف واحد كان كبيرا وملفتا للانتباه، الأمر الذي يمكن تفسيره بنقص وضعف في الحوافز المقدمة لأعضاء هيئة التدريس في دعمهم لمواصلة النشر والبحث العلمي.

الكلمات المفتاحية:

الإنتاج الفكري، البحث العلمي، العلوم والتقنية، الجامعات السعودية، التأليف.

Abstract:

This paper represents the second step of a consecutive research effort to determine and reveal more aspects of the current status of scientific publication productivity in Public Universities of Saudi Arabia. Seven universities were included since they represent the one with scientific publication and had the most suitable sample to extract relative information on behalf of all Public Education sector. Along with an authorship statistical aspect of them the authors managed to derive

valuable conclusions on the authorship scene over the last 40 years or so. The data in this research were retrieved from a special digital library devoted to Saudi Universities and carrying the intellectual property of the most important educational institutions for science and technology of this country valid until 2013. After some statistical analysis that was performed on the data the inclusions derived, highlighted that the contribution of three basically Public Universities on the overall articles publication volumes was enormous considering also the high similarities on articles production volumes fluctuations per year.

Additionally the authorship productivity totals aspect per author, illustrated a clear dependency of the overall production on authors who produced 1 article in all these years. This fact along with the small numbers of total production in most cases can be explained as a lack of consistency of Public Universities to follow higher education policies as far as production of articles concern. In general it can be argued that the academic staff of those Universities are short of strong incentives to increase their intellectual productivity.

Key words:

Intellectual productivity, Publication productivity, Science and technology publication, Public Universities, authorship.

i. Introduction:

Public Universities as all other Universities in the world and as institutions of higher education must aim to disseminate knowledge and promote intellectual creation and innovation environments, trying to capture as much as possible intellectual property for evaluation. (Queen's University, 2013)

The proliferation of knowledge as a goal can be implemented successfully only in healthy education environments where the relationships and organizational routines prone for better knowledge dissemination. Intellectual property is one of the basic aspects as knowledge proliferation achievement and along with teaching efficiency can prove to be very important assets for Public Universities. Both constitute the so called intangible assets of all higher education institutes. (Leitner, 2004)

Monitoring on such intangible assets can be challenging but also necessary especially to the management of Public Universities in order to satisfy the on growing demand of education stakeholders for more transparency and autonomy. (Ramirez, 2014)

Lately many University institutions seemed to grant a priority on inspecting their articles production and giving a closer look to their research activities as a main factor of their overall input output knowledge based product. (Victor, 2012)

So more and more Public Universities tend to acquire a growing interest on their intangible assets aiming to give themselves a more comparable, flexible, transparent and competitive advantage over the private sector and at the same time gain a positive impact on their worldwide ranking position. (Paloma, 2006)

Gulf Countries higher education policies are no exception. Neither is Saudi higher Public Sector policy. So and according to this author's overall research, there is no doubt that intellectual productivity of Saudi experiences large increasing rates especially in the last two decades towards the expansion of their intangible assets and the public sector seem to be more coordinated to this policy. (Alali, 2015)

Even more, ongoing massive investments in the education sector are directed to further enhance infrastructure due to increasing numbers of students every year which is the reality of all Gulf countries and in all educational levels. But publication productivity increment still remains one of the basic concerns of all Public Universities in the Gulf area. (Xanthidis, 2014)

More specifically in Saudi Arabia, most of the attention was given to technology and applied sciences fields where King Abdulaziz City of Science and Technology (KACST from now on) possess a prominent position having a great influence in the overall effort of this country to transact from a resource based economy to a knowledge driven economy. (Douglas, 2014)

But except KACST what is the status of intellectual productivity regarding the public universities of Saudi Arabia as a measure of their annually intellectual value added outputs? Is it possible to extract more details from authorship statistical patterns?

The conclusions addressing these question can be very helpful in monitoring a current status over production volumes as part of the overall effort to proliferate knowledge insight Saudi education institutes by assessing a portion of intellectual productivity to reveal the necessity of up taking measures or not.

ii. Aims and objectives:

Aims

Actually this research constitutes the second step taken over a data mining effort on a special data Library for Saudi Public Universities regarding their intellectual productivity and was decided to meet the following.

Objectives:

- Compare the intellectual production volumes as per Public University annually.
- Declare the most important Public University Institutions in terms of articles' productivity.
- Monitor authors productivity volume totals of the Saudi academia.

iii. Background:

Not only in Saudi but all over the world higher education environments are taking part in this rally of ranking uptake, seeking a better position by all means. So, consequently, the managerial level in education sector attempts to enhance the academic staff with more motivation incentives to increase their intellectual appetite for more articles preferably of high quality, in favor of their education institutions and themselves. (Douglas, 2014)

High quality publications for example with high SCI (Science Citation Index) can add significantly more value in Universities global ranking evaluations. But this global game of publications and ranking is actually limited to a small but important minority of academic institutions in every country as Philip Altbach claimed in his study for academic productivity. (Altbach, 2014)

An extra motive for authors to engage in this competition is to benefit from a high collaborative education environment that can prone towards co-operative articles. Of course there are more issues to be

tackled like for example the security procedures of their copyright recognition which can ensure their legal rights over their work and keep them in truck. Therefore legitimacy and credibility seems to be basic concepts in such competitive environments. (Abramo, 2014)

According to Vanz, co-authorship can be declared if two or more scientists share intellectual, economic and physical resources. The result of this sharing can produce co-operative articles which can raise though legal and ethical issues. So a lot of attention and monitoring need to be paid. (Abramo, 2014)

These days most governmental funding practices of higher education are close related to monitoring systems of their intellectual capital. The example of Czech Republic is profound towards this direction. More specifically in his paper Dalibor Fiala highlighted the importance of four successive official research assessment reports that analyze the overall productivity numbers of Czech Universities. (Fiala, 2013)

Many papers have researched the significance of University productivity and how their faculty can be monitored in various ways so to grasp a more vivid aspect of current reality in terms of quantity and quality. One of those papers supported that a quite good method to derive significant conclusions on those authors' productivity is to analyze their article outputs on whether they are full time or part time faculty of an education institute. More specifically Robert K. Toutkoushian at all paper strongly proposed that institutions can be ranked according to their whole faculty's total publication output in comparison with the total publication of their full time faculty. In addition they argued over the relationship of these measures with other selected figures of research resources and institutional quality in general. (Toutkoushian, 2003)

Other papers like the one conceived and performed by (Ramírez, Tejada and Gordillo, 2013), paid a closer attention to monitoring systems claiming that they must be enforced to offer more intensive quantification figures on higher education research productivity for the sake of upper management decision making.

Another research held on public sector universities in Taiwan measured their publication productivity considering two critical intellectual assets of teaching and research experience. In more detail Wen-Min Lu

illustrated in his paper the significance of teaching and research efficiency using a progressive DEA (Data Envelopment Analyses) model. According to him academic papers needs to be improved in quantitative and cost efficiency levels. Finally he managed to screen and to deliver a thorough report to policy makers in public education sector for better decision making effectiveness. (Lu, 2012)

There exist more studies focused on the factors affecting the faculty intellectual productivity of Universities in higher education. But in any case scientific productivity volumes by themselves count a lot in the overall value added prestigious of every University no matter private or public. That's why indexes like Nature index have launched to accomplish the great task of evaluating higher education institutes, depending mostly on their scientific productivity capabilities, by tracking publications in journals of high impact factor. (Campbell, 2014)

All these reports on intellectual productivity can guide resource allocation decisions made by policy makers, providing various visualization tools to Universities' administrators. In turn they can be considered more equipped for improving their institution's performance and announce to the general public their higher education institutes accountability for private or public investments seeking for higher funding possibilities. (Sullivan, 2012)

Thus, academic performance of human capital in higher education institutes should be devoted more on research activities these days due to the importance of better results that Universities must achieve in the global ranking arena. Even if their professional academic staffs are expected to be productive in research, teaching as well as service duties can be stated of high importance. Therefore, a formula should be found that can keep a good priority balance among them in an effort to minimize the possibilities of diminishing the production of published articles. For sure a greater emphasis should be placed on scholarly research so to increase intellectual publication numbers by giving more incentives to articles' producers. (Hardre, 2011)

The accomplishment of the ultimate balance among academic activities insight universities so to achieve greater counts of publications can prove to be very challenging. Nevertheless, counts of publications remain in the core course of every productivity measurement procedure of

higher education and are critical to administrative decisions to reserve more incentives to authors in order to achieve greater performance.

For example, one primary incentive that can be thought of, is the capability of education institutions to gain additional resources so to fund more equipment, reagents and students to conduct laboratory research that indicates a more organized and highly motivated academic environment. (Ferreira, 2012)

By all means research productivity has received the last decades a great deal of attention especially in higher education institutes. (Dundar and Lewis, 1998) argued in their paper that all the important factors, related to the increment of research productivity should be devoted to a greater goal which is the proliferation of academic performance of human capital.

If experts do not take into account as many as possible aspects on publication productivity counts then bias effects might compromise their results and drive them to not valid conclusions. Whatsoever total count of publications can engine the whole evaluation procedure and become not the only one but a critical measure of evaluating productivity performance in academic society. (Conley, 2013)

Nevertheless, all this motivation efforts that can be provided from universities' administration to increase publication productivity may enhance the knowledge dissemination environments inside Academia which in turn and in a long run can enforce innovation which might be valuable enough to be transferred to industry for the development of new technologies. (Closs, 2013)

Returning in the Gulf area, the monitoring of productivity performance in academic societies has not been a strong case. As for the Saudi Arabia and especially the last decade or so the competition of Universities for better world ranking seems to have low impact in articles' productivity terms comparing with the huge investments made in the educational sector of this country. Many barriers exist and incentives are needed for improving intellectual capital performance even though a high priority on better research effort results sustained in the region. (Al-Khalifa, 2014)

Different ways of analyzing different aspects of productivity among scientists can be found in any literature review. But this paper was focused on Public Universities of Saudi trying to interrogate useful information, from a reliable data source, highlighting even more the intellectual productivity reality of this country driving this paper effort to additional conclusions or even verify old ones depending on additional statistical charts and tables.

iv. Methodology

As the aims and objectives of this paper indicated, Saudi Arabia was the geographical scope of this intellectual property exploratory effort, having as a goal to investigate further and project in different ways the current intellectual property production reality of the most significant public education institutes in Saudi academic society.

Being a continuance paper of a first stage research on Saudi intellectual productivity, the methodology was following almost the same steps. At the beginning the authors decided to sustain the circles of discussion around the topic of intellectual property in Saudi Arabia with high standing stakeholders in the public education sector so to investigate how worthy can be to investigate deeper on a reliable and convenient electronic resource or resources containing published articles data.

Even more the researchers were convinced to continue investigating on the same database taken before and keep focusing on applied science and technology as the country's most favored segments of knowledge. So the database that King Abdul Aziz City for Science (KACST from now on) hold in a special website, [19] seemed once more to have the right data to work with. They were data originated from four decades ago on a representative sample concerning Saudi Public Universities.

Until nowadays, the website's basic task is the creation and display of catalogues of published articles made by the main public higher education institutes of Saudi Arabia which are listed below:

- King Saud University (KSU from now on),
- King Faisal University (KFU),
- Taibah University,
- King Fahd University of Petroleum and Minerals (KFUPM from now on),
- King Abdulaziz University (KAU),

- Umm al Qura University (UQU from now on) and
- King Khalid University (KKU from now on).

As was implied in the end of the introduction section KACST data had to be excluded from the ongoing analysis as irrelevant, because KACST is in fact a research institute. As such it is always eligible to be granted with high level governmental funds to continue its dedicated and ongoing research work, seeking for collaboration with and additional funding from private sector.

The raw data were received this second time in February 2015. After applying on them many stages of refinement, some accuracy, duplicate records, misspelled elements, translation mistakes and other technical issues were avoided, improving the quality and trustworthiness of this Saudi scholars published articles database. In addition and because of missing elements the year 2014 was again excluded from the results.

Thus the data were cleaned and ready to use for further analysis. Now and to be more specific the data covering the seven most important Public Universities of Saudi Arabia could be and were accepted as an appropriate and representative sample of total 25 Public Universities covering the whole country.

The time range extent of the retrieved data was more than four decades covering the education development uptake of this country from 1970's when vast investments were firstly deployed until the year of 2013 when the data was still valid.

In the preliminary stage of this research a geospatial presentation was depicted to help the whole research effort in deduction and concluding level. So at that geo-visualization phase the data were represented on a Saudi map in bar charts for every University, segmenting the results in two broad categories: the English and Arabic published articles' sectors. (Alali, 2015)

But this time and in this ongoing effort the authors decided to pay a more dedicated and discrete look to every Public University separately and focused even more on English and most valuable sector with the contribution of Excel package analysis fluctuation charts escorted with tendency lines. Thus a series of such graphs were produced referring to each Public University production volumes which finally were summarized

and illustrated in one graph with seven fluctuation lines for further investigation on different patterns so to depict similarities and disparities useful for thorough consideration and discussion covering the aims and objectives of this paper.

Completing the aims and objectives which serve as a motive for more research on this digital data log file, the analysis continued with the creation of authorship chart bars as totals in the whole production. The immediate next step was the production of a relevant pie chart so to display if the percentage of efforts on producing articles capable for production relies on the most productive or not authors and what this means in terms of productivity for Saudi Public Universities.

Finally and after thoroughly concluding on findings, this paper suggested future steps that should be taken as a continuance of this overall research on Saudi Public Universities intellectual productivity reality illustrations.

Additionally and as a simplified and more focused aspect on English section total productivity volumes, the bar chart of Fig. 1 can claim to be a tool capable of helping authors to drive even more straight forward conclusions.

v. Findings

a. Annually intellectual productivity illustration of most important Saudi Public Universities

Before the beginning of this section and depending on the map chart of Fig.1 and the conclusions of the first phase of this research it can be stated with a lot of confidence that three Universities can take most of the credit for contributing vastly on published articles production amounts.

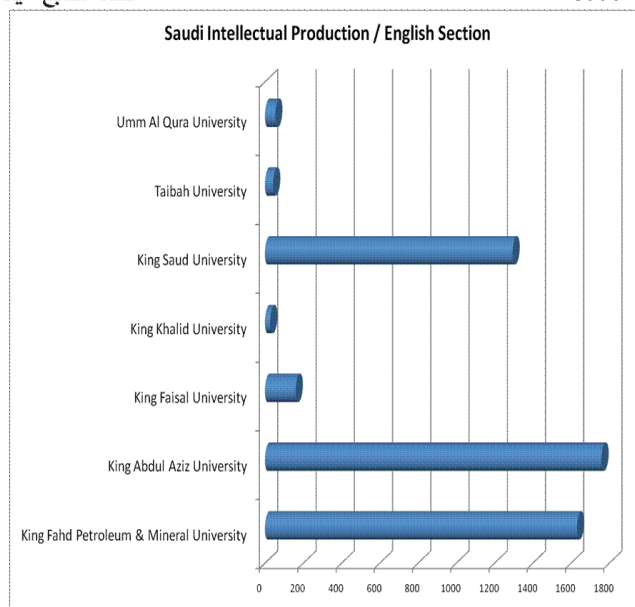


Fig. 1: Bar chart on English section productivity totals per Public University

More specifically and regarding Fig.2 it can be verified that only three out of seven Public Universities had a significant production of published articles: KAU, KSU and KFUPM. The KFU case is showing only a small contribution on this respect which was originated from 2000.

One general statement on these production lines of Fig. 2 can be that they do not show a steady fluctuation over the years. On the contrary they depict an abrupt continuance. The worst cases is that of KSU and between 1980 and 1989 giving sometimes even zero production of articles .

KFUPM and KSU are the oldest Universities starting the production of English articles from 1975. KAU on the other hand which begun producing from 1988, displayed a high production up rise in one year (1990) illustrating a leading trend and (along with KSU and KFUPM) meeting its first pick.

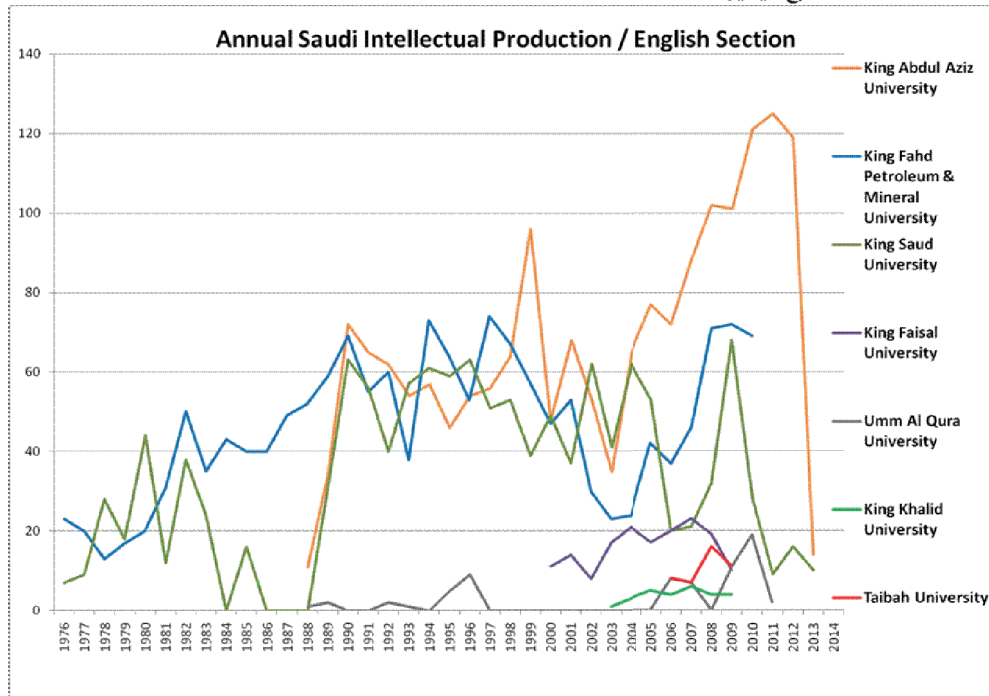


Fig. 2: Annual fluctuation of publicized Articles per University

From 1991 until 2000 the volume picks of those three most important public universities in terms of publicized articles differed. The KSU made its next pick in 1996, the KFUPM in 1997 and the KAU in 1999 showing all these years a less fluctuation intense (so more stability) and thus revealing greater engagement in the policy of higher education for increasing their performance.

After the year of 2000 they illustrated a low pinpoint and in the year of 2003. The continuance behavior of their production lines kept being once again dissimilar regarding the fluctuation of their values. On the hand, the KFU case illustrated a small rising contribution starting from 2000 and ending in 2009.

For the next four years followed (2010 until 2013) the falling of articles' production lines can be commented as quite important. The decline was started in 2011 (0 articles) for KFUPM, in 2012 for KSU and 2013 for KAU highlighting a low interest for producing capable articles for publication. The rest of the Universities (UQU, KKU and Taibah) figures, contributing in articles production totals, are very small to be worthy of

further analysis without implying anything for the significance of those institutes on the overall education reality in Saudi Arabia.

b. Comparison of total production lines before 2000 and after 2000 of all Public Universities

The following chart (Fig.3) displays the continuing efforts of analysis on Intellectual Production Data, segmenting the whole production in two broad time sections: before 2000 and after 2000, as a trend milestone and trying to endorse more conclusions on them if possible.

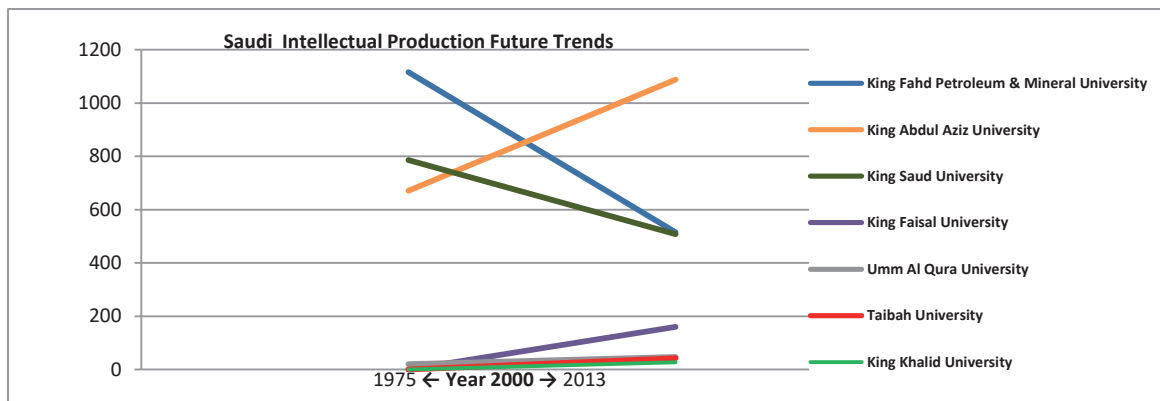


Fig.3: Production of Articles before 2000 and after 2000

Most of the Universities (Taibah, KFU, UQU and KFUPM) illustrate a positive behavior trend towards the production of even more articles. But the volumes they produced are too small to be considered significant.

On the other side from the three great contributors of intellectual productivity only KAU stands positively giving more hope to hold on the course of increasing intellectual productivity.

c. Perform a monitoring on authorship volumes

So the interesting part of the whole data and the one that influenced vastly the whole statistical numbers concluded to be the English section of produced articles. (6) As such the authors decided to take next aspect's data concerning the volumes produced per author only from the English sector .

Starting from the Fig.4 that delivers the best authors in volume terms from 1976 to 2013 the researchers decided what would be the

article counts categories to use for the next table on Authors productivity totals performed on the whole sample of produced articles.

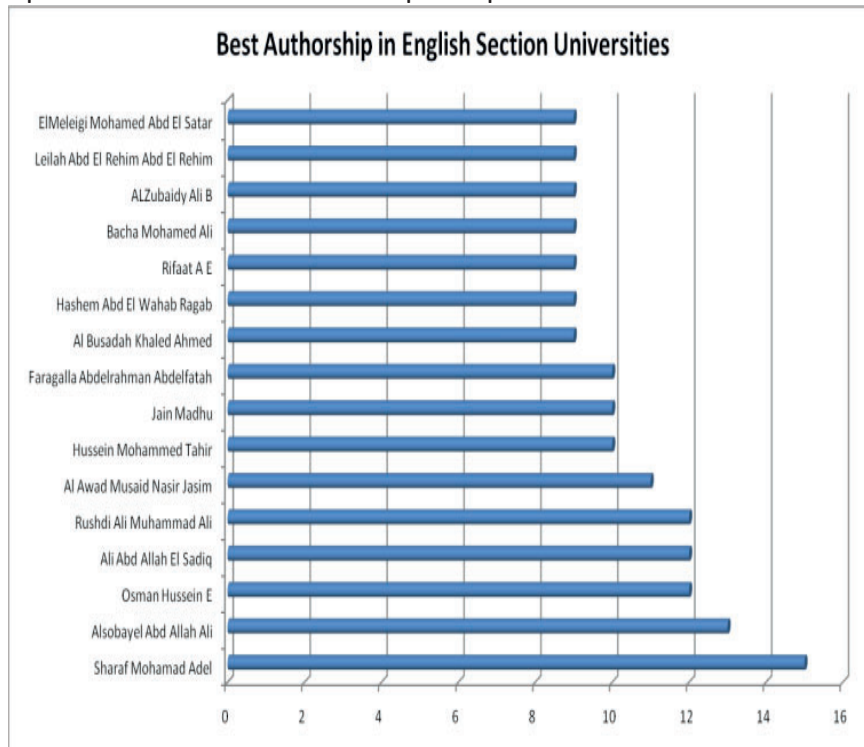


Fig.4: Best English section Production of Articles per Author

So they come up with a spectrum of categories covering 8057 published articles which were summarized appropriately to end up with a table (Aggregation of Authors Productivity) where it is pretty much clear that we have eleven categories of authors that produced 15, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2 and 1 articles respectively through all these years of publication efforts concerning the English section and which in great deal are representing the KAU, KSU and KFUPM Universities.

The next step taken was the creation of a pie chart model presenting the categories of table 1 (Fig.5) in a manner that might provide a new field for discussion by offering more means for justified deductions on intellectual productivity issues in Saudi Public Universities.

The results of this new perspective display showed a huge percentage up to 52% lying on authors who produced 1 article, 20% with 2 articles, 10% with 3 articles, 7% with 4 articles and 4% with 5 articles in

total. The rest 7% belongs to those authors with totals of 6, 7, 8, 9, 10, 11, 12, 13 and 15 published articles.

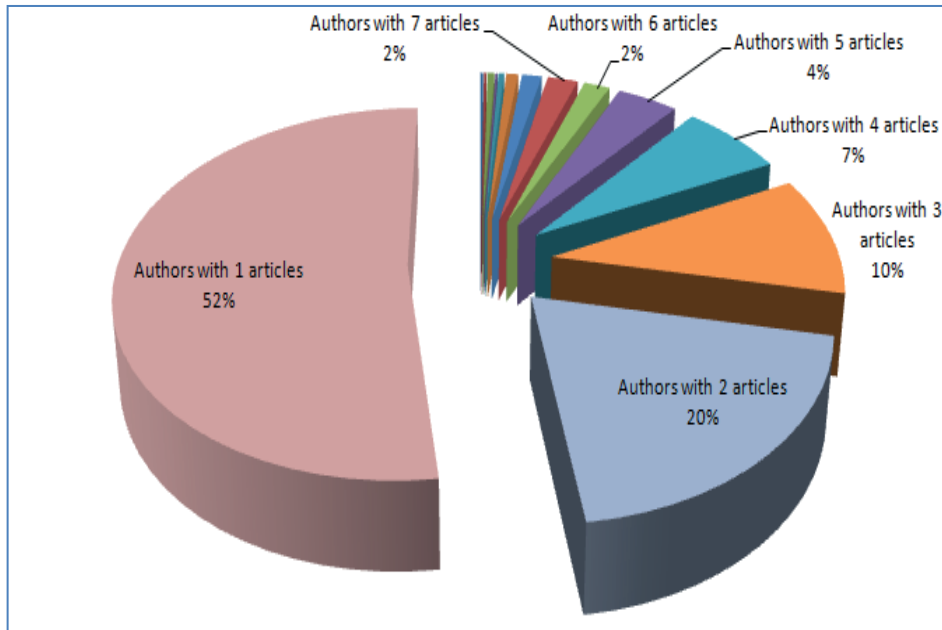


Fig.5: Intellectual Productivity totals per Author volumes of published articles capacity

vi. Discussion and Conclusion

Saudi Arabia has 25 Public Universities fully functional and plans to build even more due to the high rates of student's increment every year. But whatsoever, the sample taken for this research was enough to produce representative conclusions on all of them. [24]

First of all the preliminary stage of this research suggested that we must continue on working with the English section of published articles because of the small production outcome of Arabic section. Thus English production of articles has dominated upon the overall production in Saudi Arabia. Two main reasons can be hold responsible for this outcome; the later start (after 7 years, 1982) and the small volumes of Arabic articles publications, incapable of influencing the overall production line even if, by percentage, they increase more abruptly revealing a positive behavior and

a willingness to follow the general policy of higher education cabinet especially after 1988.

A basic conclusion that could be made on public Universities intellectual production of applied science and Technology articles was, and depending on Fig.2 that there seemed to be a lot of up and downs in volumes of publicized articles through all these 37 years of intellectual production.

Furthermore the few Saudi public Universities which hold the burden of contributing in this publication marathon are not showing the same level of engagement on articles proliferation of production. All this abrupt fluctuations of productivity can illustrate a lack of continuance which can present an insecure capability of following the commitment of higher education ministry to achieve an ongoing up rise of intellectual capital in this country's educational future.

Conjointly the productivity endeavors of public academia have to show more stability in high range volumes through years to adhere with the education policy adopted from the higher education ministry. For sure there is a positive behavior of academia over increasing the published articles production and as a consequence in total numbers but there must be a consistency in up taking course of production and without the very low incidences of 1986 and 2013.

Some thinking on this lack of stability can be made depending on the chart pie of Fig.5 where it was clear that most of the authors (93%) where unable to engage in the education policy of the country for producing large volumes of articles. The rest 7% gave a measurable but not significant amount of articles in a period of 37 years. Thus the total volume of publicized articles where supported mostly by those authors that contributed only with few articles (1-4).

This fact could have only two reasons; the frequent changes of academic staff in Saudi public universities or the misbalance among teaching, researching and serving duties given to academy staff less time for research activities.

Thus and on the overall, public higher education stakeholders are suggested to provide more incentives on capable academic staff to engage in the higher education policy directions towards the enhancement of a competitive and highly productive educational environment. In the same

time they should be very careful in the priorities assigned to academic staff as far as their duties concern .

As a next stage of this research the authors could find important to pay a closer look to authorship and co-authorship patterns to discover more reasons of low and instable productivity where is more than profound the trend per author towards few articles production. This might give more credit to the opinions that arguing for a more motivated educational environment in higher education public universities of Saudi Arabia .

Nevertheless, all this evidences persuaded the authors to keep this research ongoing on these intellectual production data by performing this time an analysis concentrated on the cooperation intense among authors of public universities.

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Abbreviation

*Aggregation of Authors Productivity in Saudi Public Universities

Article Counts	Categories	Authors counts	Productivity totals
15		1	15
13		1	13
12		3	36
11		1	11
10		3	30
9		7	63
8		13	104
7		23	161
6		23	138
5		64	320
4		135	540
3		280	840
2		796	1592
1		4194	4196

