Preliminary study of intellectual productivity in Public Universities of Saudi Arabia

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Abstract: The primary goal of this study was to determine the current status in article production terms after decades of evolving for public Saudi Universities. The basic direction of the research focused on separating all intellectual work in two broad language sectors. Furthermore and based on these two sectors perform a geostatistical and other analysis to deliver enough information in order to open a discussion on intellectual property issues regarding the public Universities of Saudi Arabia. The data in this research were retrieved from a special digital library devoted to Saudi Universities, carrying the intellectual property of the most significant educational institutions for science and technology of this country valid until 2013. The outcome of this research highlighted the constantly fourteen years growing tendency of intellectual production in Saudi Universities despite two highly downgraded years. Nevertheless the data illustrated that English language section is mostly responsible for this long and almost steady uptake through years of intellectual production and displayed three Saudi Universities as being the most influential education institutions for this growth. Finally the mapping analysis revealed that every significant public institution as far as articles' production concerns resides on a prospering (from publication of articles point of view) straight geographically line from Jeddah to Dammam including the capital of the country Riyadh.

Key-Words: - Intellectual Property, Intellectual Capital, Public Universities, Saudi Arabia Higher Education;

1 Introduction

There is no doubt that all Universities of higher education are institutions which must aim to disseminate knowledge and promote intellectual creation and innovation environments, trying to capture as much as possible intellectual property for evaluation. Even more, intellectual property is "any form of knowledge or expression created with one's intellect" as it is defined likewise in many Universities' guidelines [1].

One important facet of intellectual property is the produced articles prepared by the academia faculty of Universities. But on the other hand the relationships and organizational routines between researchers and students can prove to be of the same importance for knowledge output proliferation in Universities environment. As a consequence, these two resources can be received as the intangible assets or intellectual capital of Universities [2].

Therefore intellectual productivity analysis as part of the intellectual property of Universities is considered to be one of the core factors in estimating the intellectual capital and as such can contribute a lot to the management of value creation in those higher education institutes [3].

Lately more and more higher education institutes realize as a necessity the adoption of monitoring systems for their intangible assets due to increasing stakeholders demand for transparency and greater autonomy inside a very competitive environment where the knowledge is the main output and input product [4].

Nevertheless there is a certain conflict among different factors of intellectual capital and their real significance in the final credit value of Universities investments on human capital. But what is clearly observed is that many Universities actually offer a presentence on inspecting articles production on their research activity as the main factor of their overall intellectual production [5].

As it seems, during the last decades 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 [6].

The last decades Gulf area and especially Saudi Arabia experienced huge investments in higher education with an ultimate goal to improve their education product. Saudi Universities' current reality indicates that they are in the process of aligning and participating in this ongoing intellectual productivity race after a heavy investment period on educational infrastructure creation which is still in progress [7]. Specifically in the technology and applied sciences field King Abdulaziz City of Science and Technology (KACST from now on) posses 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.

But besides KACST what is the status of intellectual productivity regarding the best public higher education institutes as a measure of their intellectual value added outputs;

Posing the basic question of this research the authors were attempting to perform a consistent endeavor to describe the status of intellectual production creativity in Saudi Arabia.

2 Aims and Objectives

Actually this study represents a preliminary stage of an overall research concerning the intellectual productivity of Saudi Public Universities and was decided to meet t h e following objectives:

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

3 Background

The current reality in Saudi universities clearly indicates that there is some short of production grow racing engagement, due to the fact that in most cases article publications count as a critical factor of their overall quality picture and can influence significantly the ranking up level efforts of all higher educational institutions [8]. In addition, publications with high SCI (Science Citation Index) can add significantly more value in Universities global ranking effort evaluations. But this global game of publications and ranking is actually limited to a small but important minority of academic institutions in every country [9].

Even more, in Czech Republic nowadays, the Universities governmental funding system is close related to an official methodology of scientific research output evaluation as an incentive for more publications. Their methodology is strongly correlated with indicators of scientific overall productivity. Arguing, in his paper Dalibor Fiala highlighted the importance of four successive official research assessment reports that analyze the overall productivity numbers of Czech Universities. By this way he gave a thorough conclusive report about the current state of productivity scene for this country [10].

There have been many studies on analyzing various facets of Universities' productivity but not so much focused on public institutional level. One of those facets was examined in detail by Robert K. Toutkoushian at all paper where the significance of faculty productivity in terms of article production and in educational institution level was highlighted strongly. They basically 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 [11].

Later efforts focused this time more in the annual faculty research productivity volumes of Universities, as part of an overall intellectual capital assessment, pointed out the growing demand of all institution stakeholders for proper information as far as their intellectual capital concerns. Notably, these stakeholders regarded as crucial the disclosure of academic and professional qualifications of teaching and research staff on the overall. Criticizing this evolving information reality and conducting a research over the information model of Spanish higher and public education institutions, Ramírez, Tejada and Gordillo concluded that the annual account reports on intellectual capital must be extended to more intensive quantifications on research productivity [12].

Another study, addressing the productivity of public sector Universities performance, this time focused on Taiwan, emerged the necessity of targeting on their scholars teaching and research experience. In this research paper Wen-Min Lu highlighted the significance of teaching and research efficiency using a progressive DEA (Data Envelopment Analyses) model. He illustrated that academic papers needs to be improved in quantitative and cost efficiency measures. Screening the current status of Taiwan public Universities, the author's two stage analysis demonstrated the important role of teaching and research efficiency in intellectual capital performance estimations, handing a thorough report to policy makers in public education sector for better decision making effectiveness [13].

All these studies focused on the factors affecting the faculty intellectual productivity of Universities in higher education continued examining various and different

aspects. But in any case scientific productivity volumes by themselves were counting 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 categorized publications in high significance journals [14].

A close and more attentive look to article publication volumes origins can depict detailed reports for directing resource allocation decisions made by policy makers. In other words, those kinds of reports can provide more tools to administrators for monitoring and improving their educational institution's performance by favoring the production of scientific articles and thus be more accountable for private or public investments. (15)

As counts of publications remain in the core course of every productivity measurement procedure of higher education, it is critical to ensure some incentives for greater performance. By no doubt research productivity has received the last decades a great deal of attention especially in higher education institutes. Halil Dundar and Darrell R. Lewis argued that all the important factors, related with the increment of research and other academic activities must be devoted to an ultimate dissemination of knowledge target that can be delivered with the proliferation of academic performance of human capital [16].

If experts do not take into account as many as possible aspects on publication productivity counts, then bias effects might most probably compromise their results and drive them to non valid conclusions. Whatsoever article publications counting can engine the whole evaluation procedure of intellectual capital in educational institutions and become not the only one but a critical measure of evaluating productivity performance in academic societies [17].

Returning in the Gulf area, monitoring the productivity performance in academic societies has not been a strong case. In 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 for more research efforts sustained in the region [18].

4 Methodology

Saudi Arabia is the geographical scope of this first intellectual property exploratory effort, aiming to enlighten current intellectual property production aspects in higher Saudi academic society.

Proceeding to the first phase of this paper an opening of discussion circles around the topic of intellectual property in Saudi Arabia with high standing stakeholders in the public education field was initiated so to investigate the possibility of finding a reliable and convenient electronic resource or resources containing published articles data. The main focus was to hold on data until recent years and to have a representative sample referring to the basic and most important public Universities of the country. In the same time researchers were interested only in applied science and technology field where the vast majority of articles production relies.

It was found that KACST institution created lately an online digital repository of research articles using the DSpace software which holds the intellectual article production of best Saudi Universities [19]. This web site's great task is limited to the representation of catalogues of published articles, concerning the most significant public higher education institutes of Saudi Arabia. All those public Universities participating in this digital repository are King Saud University (KSU from now on), King Faisal University (KFU from now on), 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) along with KACST institute production of articles.

This sample source and its data were decided by the researchers and after a thorough investigation to be the basic raw data for manipulation. They were found to be appropriate for analysis and capable of aligning in the aims and objectives of this paper. So this research relied on them to engine a highly promising effort describing and investigating on the current reality of Saudi education intellectual production, highlighting additional aspects like authorship and subject of published articles catalogues.

The data were received in a log file in the middle of October of 2014, a year that was excluded from the data for validity reasons (missing data). A refining procedure on the data was necessary and was applied to improve their quality and trustworthiness with the full co-operation of those in charge of this digital library. Like for example the elimination of duplicate records, the correction of misspelled elements, translation actions or the resolving of technical issues which reformed the database in a proper manner for further analysis steps, avoiding as much as possible invalid or accuracy problems.

After proceeding to the next stage of this research, KACST was decided to be excluded from the data due to the fact that it is a dedicated research institute with high investment rates and not actually a Public University, seeking collaboration with both private and public sector.

But the rest of the data covering the seven most important Public Universities of Saudi Arabia [20] were accepted as an appropriate and representative sample for the creation, after thorough enough analysis, of descriptive and deductive information which can illustrate the current reality of Saudi public higher education system in terms of articles publication volumes and only as the beginning of a greater research effort. The time range extent of the taken data was four decades starting from 1970's when the deployment of heavy investments in educating Saudis was initiated, till nowadays.

The manipulating phase of the data followed with the use of Arc-GIS package as a tool for implementing a geospatial analysis to present the sample and to derive some useful geo-information capable of serving in the deduction phase of this paper. In this phase the data were represented on a Saudi map with bar charts for every University depicting the English and Arabic published articles' sector volumes separately and as a percentage of the whole production.

Subsequently and with the contribution of Excel package analysis, fluctuation charts escorted with a tendency line, were produced and illustrated in one graph giving the opportunity to the authors of this paper to make some analytical comments on published article volumes' annually development, comparing the total productions of English section (articles published in English language), Arabic section (articles published in Arabic language) and both sections.

Completing the aims and objectives of this paper, the analysis continued with the creation of a radar graph concerning the illustration of the same type of data as they change through decades starting again from 1970s when a first public investment boost in education sector was experienced in the country entering an era of rapid development. The time milestones taken into account was the 1975 when a special ministry for higher education was established, the 1999 when a dedicated research center on higher education was initiated and 2005 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 [20].

Finally in the conclusions section of this paper a discussion on findings performed and a reference on further analysis steps apposed, as a continuance on the overall research that has just initiated.
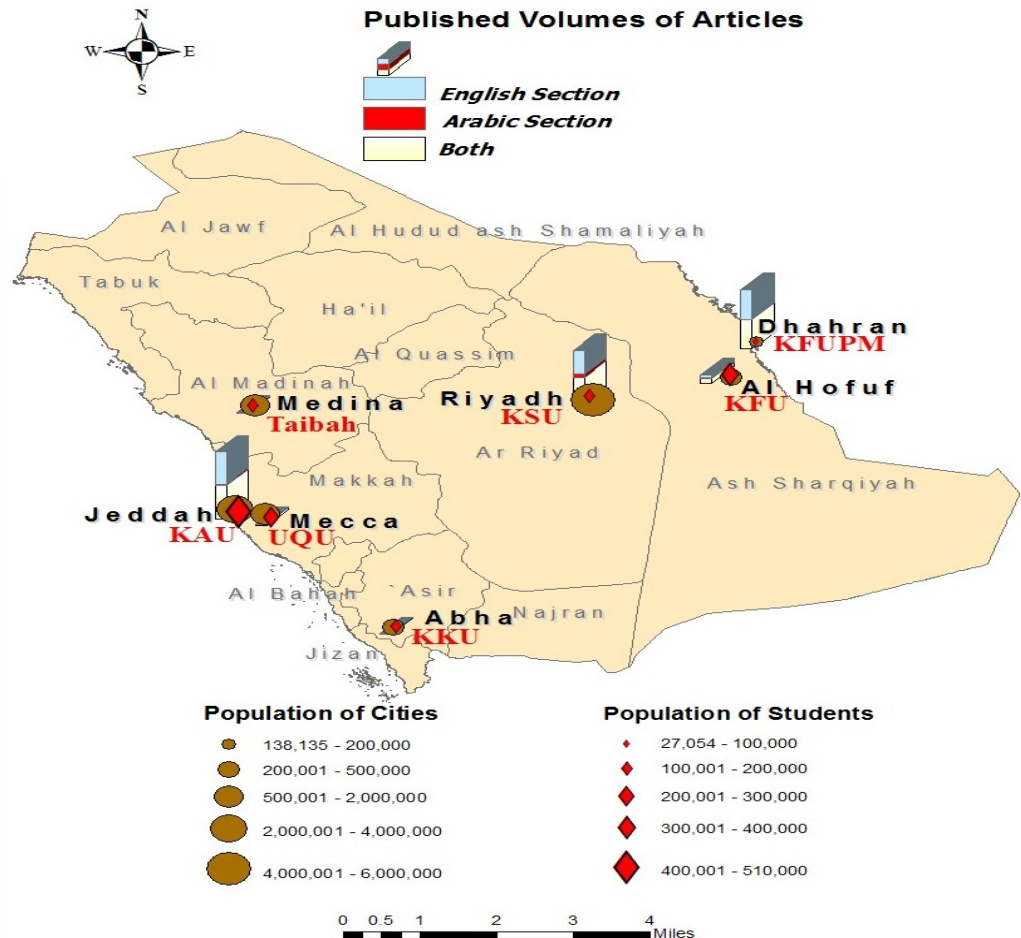

Fig.1: Geo representation of sample's published article totals per language section

5 Findings

5.1 Mapping the most important Public Universities in Saudi Arabia

Beginning the description of the data using mapping capabilities of Arc-GIS a geographical representation map of the sample was produced, illustrating not only the position of chosen public Universities in Saudi Arabia Territory but also presenting segmented aspects of the data as well. (Fig. 1)

Regarding the above map visualization only three out of seven Universities has a significant production of published articles (KAU, KSU and KFUPM) even if KSU holds much less students attending their educational programs. Those three Universities display mostly English language articles productivity with KFU showing a small contribution on this aspect. KAU and KSU resides in Jeddah and Riyadh (capital of Saudi Arabia) which are the most populated cities in this country and KFUPM along

with KFU can considered as representatives of the largest in size Ash Sharqiyah county having the biggest oil drilled fields in the Gulf Council Countries area (GCC from now on [21]. Additionally KSU of Riyadh capital illustrates by far the biggest production of published articles in Arabic language.

The rest of the public Universities' (UQU, KKU and Taibah) figures in total production seems very small to be worthy of further analysis even if UQU and Taibah reside in the most know cities in Islam Mecca and Medina respectively.

5.2 Annual presentation of published articles production per language section

The following chart displays the continuing efforts in analyzing KACST log file data, segmenting the whole production in language sections.

More specifically Fig.2 clearly indicates that the English production line of articles dominates upon the overall production in Saudi Arabia which presents almost the same annual fluctuation line. Two main reasons explaining this result is the later start (after 7 years, 1982) and the small volumes of Arabic articles publications which proves to be 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.

According to this result the commenting efforts from now on would have the same impact on English section when referring to total production count numbers. Therefore and what either English section or Total count line indicates is a small reaction on publication totals from 1975 until 1985 which were doubled during 1986 till 1990. From 1991 and until 2006 the total numbers of published articles where fluctuating from 200 and something to 200 below something per year, downgraded considerably only in 2003 below 150 published articles.

But after 2006 the country experienced another great growth in publication per year numbers reaching the 300
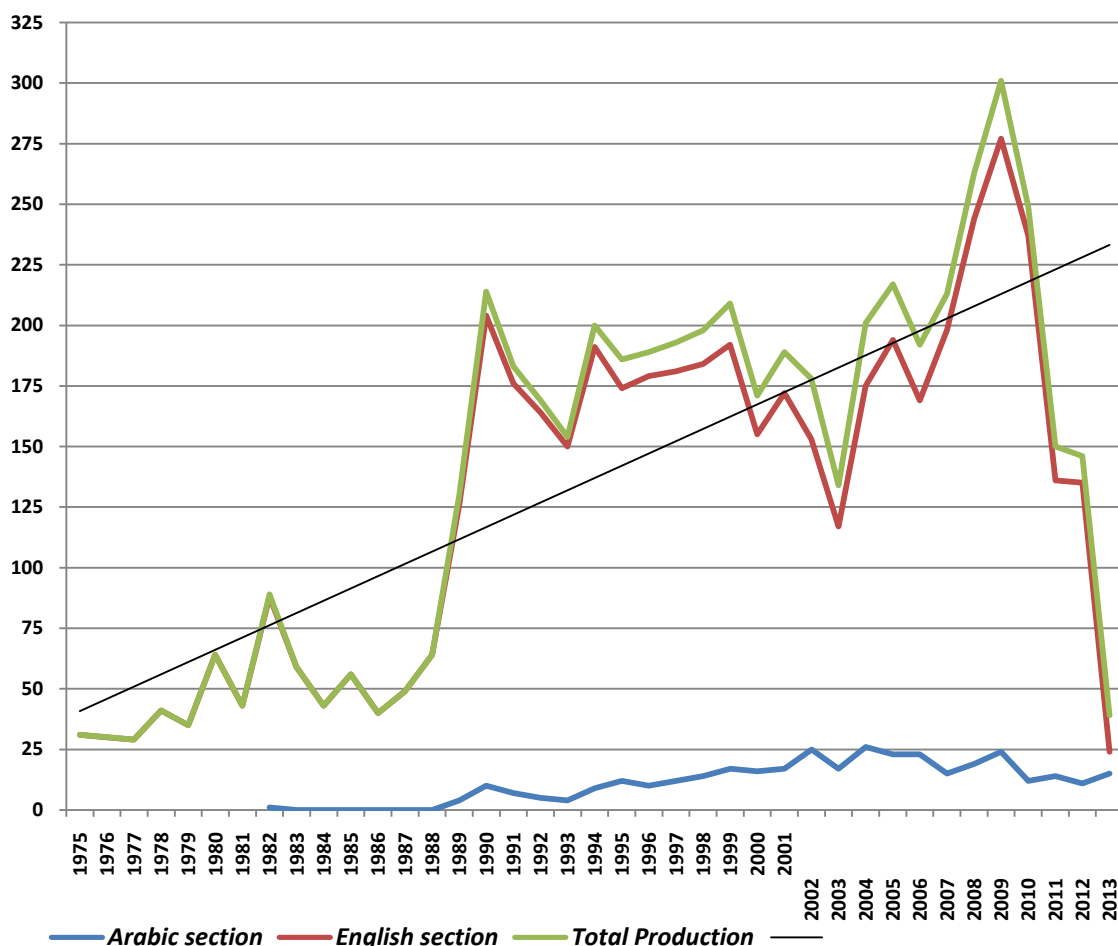
Annual Production of Articles

Fig.2: Published articles volumes of language segments production per year in Saudi Arabia

threshold in 2009.

For the next three years followed (2010 until 2013) the production diminishing can be commented as quite important. Still though, the tendency line kept going up, highlighting the general up take, as far as articles published numbers concern, that Saudi Arabia public education sector experienced all these years. Stronger and more convincing evidence on this paragraph argument can be found to the next section's analysis.

5.1 Visualization of published articles volumes through decades

Even more and following the methodology of this paper, the researchers produced a new visualization graph (Fig.3) of the data which was designed to present them in a different manner capable of commenting in accordance to the objectives of this paper.

So and as it was designed to be, the next radar chart presents the fluctuation of Arabic, English and total

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Jeddah) where KFUPM resides on a territory full of gas and oil fields. There exists also and close to KFUPM, the KFU University having a small but significant contribution on articles production totals. Additionally UQU University is located in Mecca city (the historical capital of Al Makkah province and the religious capital of Islam) next to Jeddah. All these Universities together form on the map an imaginary horizontal and straight line that can be visualized on the center of this country where the majority of students, great cities' populations and most significant Universities abide. Thus the production of published articles in the field of applied technology sciences concerning the Public Universities of Saudi Arabia is concentrate in a geographically visualized straight line starting from Jeddah and ending at Dammam area with only few Public Universities participating seriously in this research field.

So it could be concluded that there is a lot of ground to be covered despite heavy investments; and if higher education stakeholders want for public sector to carry on safely this up rising course, as far as intellectual production concerns, they might be bounden to provide more incentives in research field to more public Universities and generally speaking to more academia faculty in Saudi Arabia favoring also other significant provinces of the country.

Even better a certain consistent and detailed monitoring system, reporting on public Universities articles productivity, along with focused incentives on research active scholar faculty might be the case for more improvements on articles publication volumes.

Nevertheless, all this evidences persuaded the authors to carry on to the next step of this initiated research, to pay a closer look to these intellectual production data and to perform this time an analysis concentrated on the intellectual production of each and every University.

So this initial paper research can be thought of as a preliminary and earlier stage of a wider research effort, trying to reveal new perceptions of intellectual production in Saudi Arabia public Universities, by contacting a more detailed analysis on all possible aspects, acknowledging the contribution of authors and subject areas of published articles as well.

More analytical information on the findings can be searched in the extended version.

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