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Evaluation of Engineering Research in Arab Countries Using A Bibliometric-Based Approach

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Abstract

This paper presents the results of an evaluation of the research productivity in general, and the engineering research activities in particular, in the Arab countries compared to a selected number of other countries in the world. This study covers the period 2001-2011 and uses the number of publications and the number of citations as a basis for the evaluation. The study shows that, in terms of research productivity, it is a long way ahead for the Arab countries to compete with some of the countries with relatively small number of residents. Moreover, the results show that using English as the medium of instruction in teaching engineering and sciences, as is usually the case in most Arab countries, does not result in higher research productivity and better communication with the rest of the world. The results show that countries, with relatively small number of residents, using national language as medium of instruction are doing much better than Arab countries in terms of research productivity.

Selection and/or peer-review under responsibility of Professor Dr Mohd. Zaidi Omar, Associate Professor Dr Ruhizan Mohammad Yasin, Dr Roszilah Hamid, Dr Norngainy Mohd. Tawil, Associate Professor Dr Wan Kamal Mujani, Associate Professor Dr Effandi Zakaria.

Keywords: Engineering research; research evaluation; research prudctivity.

1. Introduction

At present there is a fierce competition in research among different countries of the world; Arab countries are not exceptions. Unlike the United States of America and European countries, where research evaluation is regularly undertaken for different purposes, it is hard to find any evaluation of the engineering research activities in the Arab countries.

This paper presents an attempt to provide an accurate assessment of the research activities in general, and engineering research activities in particular, in twenty years period; from January 01, 2001 to December 31,

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2011, in the Arab countries and a selected number of countries around the world using a number of quantitative bibliometric indicators which are essential to an evaluation such as this. The evaluation aims at answering the following question: what are the results of the research-related activities of the Arab countries compared to other countries?

2. Research Methodology

The data used in this study was obtained from the ISI Web of Knowledge Essential Science Indicators data base updated in March 01, 2012. The selected types of articles in the ISI data base [1] include scientific journal and conference papers. This study applies four quantitative bibliometric indicators to evaluate country research productivity with particular emphasis on engineering research. The evaluation is based on the total number of published papers, the total number of citations, the average citations per paper and the average number of papers per million of residents. In addition to Arab countries, this study also evaluates the research performance of other countries in the world both in the developed and developing countries. In this regard a selected number of countries will be considered according to the following criteria:

- Neighbour countries; for example Turkey, Occupied Palestine and Iran
- Countries with approximately equal number of population; for example USA compared to all Arabs and Germany compared to Egypt..
- Small countries in terms of the number of residents; for example Norway, Hungary and Singapore.
- Developing countries in Southeast Asia, Africa and Europe; for example South Korea, South Africa, India, Indonesia and Malaysia.
- Developed countries in the world; for example Italy, France, Russia and Japan..
- Countries using the national language as the medium of instruction in their education system including universities; for example Hungary and Norway.
- Muslim countries; for example Malaysia, Indonesia, Nigeria, Pakistan and Bangladesh.

In addition to evaluating the overall engineering research performance of these countries, this study will compare engineering research performance in a selected number of universities in the Arab world and the neighbour countries.

The ultimate goal of this study is to explore where the engineering research in Arab countries stand among countries of the world.

3. Results

From Figures 1 (a) and (b) it appears that Egypt has the largest number of publications among the Arab countries with about 40,000 publications with Saudi Arabia having about 23,000 publications. Inspection of Fig. 1(c) shows that compared with neighbor countries the productivity of Egypt is far below that of Turkey, with around 170,000 publications and Occupied Palestine, with around 120,000 publications. Inspection of Fig. 1(d) shows that compared with some large Muslim countries Egypt has the largest number of publications (40,000) with Malaysia having about 30,000 publications. Inspection of Fig. 1(e) shows that compared with countries with almost the same number of residents, about 90 million, Egypt, with 40,000 publications, is far below Germany, with about 860,000 publications. This means that the number of publications of Egypt is about 5% of the number of publications of Germany. From Fig. 1(f) it appears that comparing All Arab countries with USA, having almost the same number of residents; 300 million, All Arab countries have 200,000 publications while the USA has about 3,300,000 publications. This means that All Arab countries are producing less than 1% of the publications produced by the USA. Figure 1(g) compares the productivity of Egypt (90 million residents) with countries having relatively small number of residents; Hungary (10 million), Singapore (6 million) and Norway

(5 million). Figure 1(g) clearly shows that Egypt, with 40,000 publications, is far below Norway, with 80,000 publications. Finally Fig. 1(h) shows that the number of publications of Egypt, with around 40,000 publications, is far below China and Japan, with around 950,000 and 800,000 publications respectively.

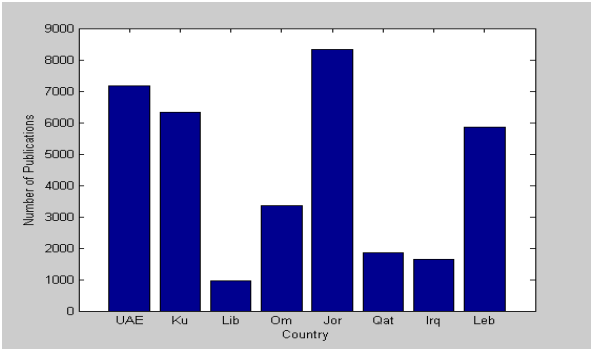

Fig. 1 (a) Number of publications/country (Arab countries)

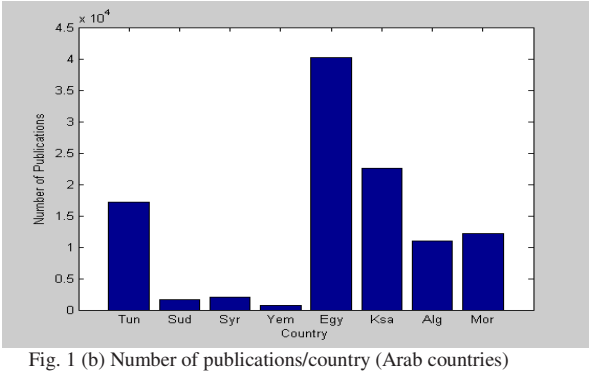

Fig. 1 (b) Number of publications/country (Arab countries)

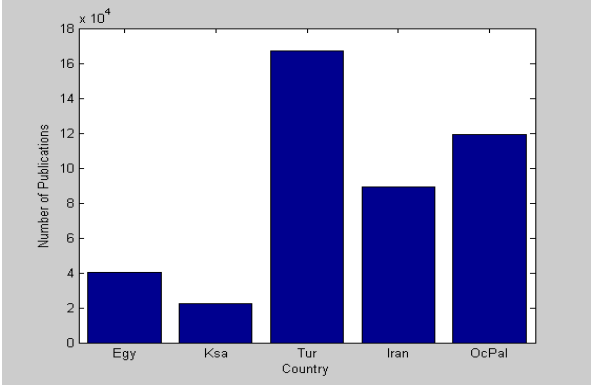

Fig. 1 (c) Number of publications/country (Arab countries and neighbours)

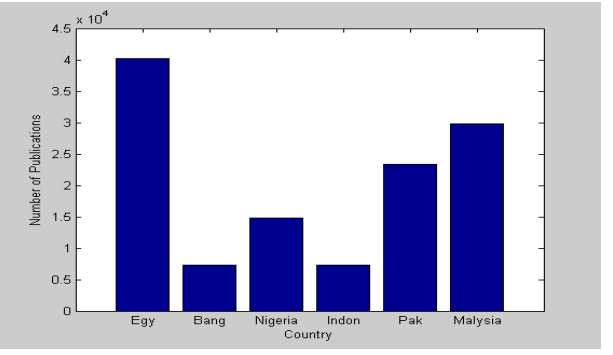

Fig. 1 (d) Number of publications/country (Arab countries and Muslim countries)

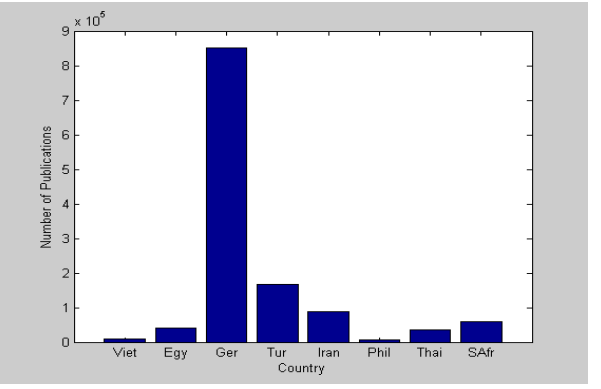

Fig. 1 (e) Number of publications/country (with nearly equal number of residents)

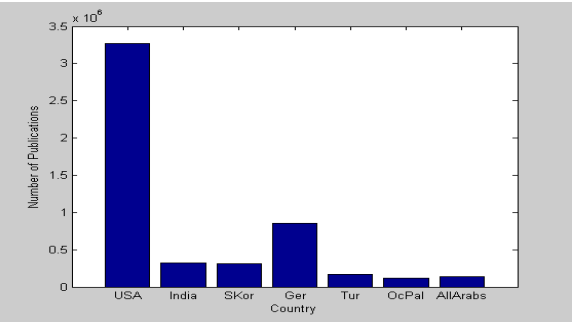

Fig. 1 (f) Number of publications/country (with nearly equal number of residents)

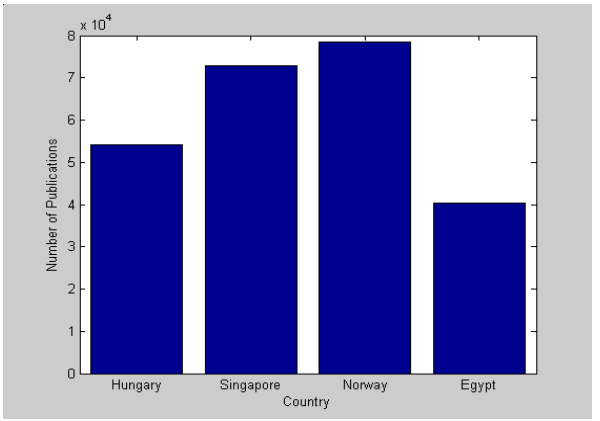

Fig. 1 (g) Number of publications/country (Egypt and countries with small number of residents)

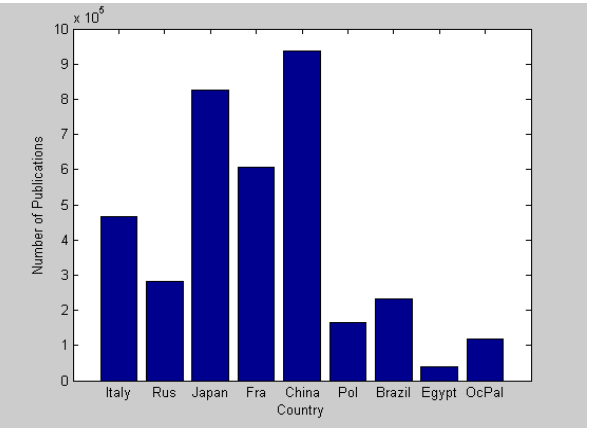

Fig. 1 (h) Number of publications/country (Egypt and different countries)

In order to get an idea about the impact of the published papers, Fig. 2 shows a comparison between countries of the world based on the number of citations per published paper. Figure 2(a) shows that the number of citations/published paper for USA is 16 while that of Egypt and Saudi Arabia is about 5 and 4 respectively. Moreover, the number of citations/paper is 10 for Hungary and Singapore, 12 for Norway and Occupied Palestine and 13 for Germany. A similar pattern can be observed in Fig. 2(b) with France and Italy having around 12 citations/publications. From Fig. 2 it can be concluded that the impact of the publications of Egypt and Saudi Arabia is far below other countries especially those with much smaller number of residents like Norway, Singapore and Hungary.

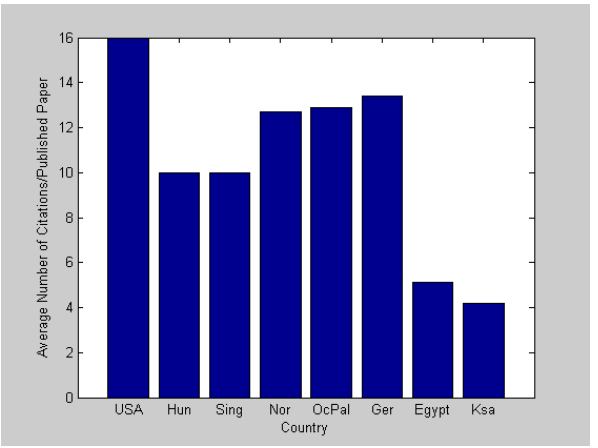

Fig. 2 (a) Number of citations/published paper/country

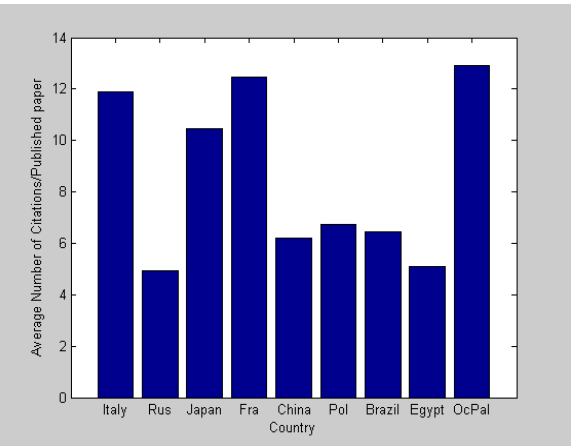

Fig. 2 (b) Number of citations/published paper/country

Figure 1 shows a comparison between different countries in the world based on the absolute number of publications without taking the number of residents into consideration. Figure 3 shows the number of publications/million resident. Inspection of Figs. 3(a) reveals that Norway (with 5 million residents), Singapore

(with 6 million residents) and Occupied Palestine (with 7 million residents) have about 16,000, 14,200 and 15,200 publications/million resident respectively. Figures 3(b),(e) shows that, among the Arab countries, Kuwait has the highest number of publications/million resident; around 2000, while Egypt has around 500 publications/million resident. Inspection of Fig. 3(c) shows that, among the Muslim countries, Turkey has the highest number of publications/million resident; 2300, while Iran and Malaysia has about 1100 and 1000 publications/million resident respectively. Finally Fig. 3(d) shows that France and Italy has around 9000 and 8000 publications/million resident respectively. From Fig. 3 one can, therefore, conclude that the productivity of the Arab countries measured as the number of publications/million resident is far below the productivity of other countries in the world even those with much less number of residents.

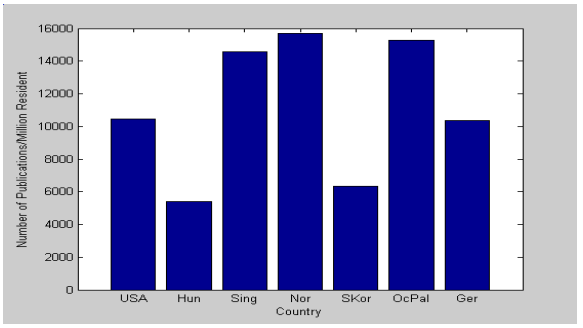

Fig. 3 (a) Number of publications/million resident/country (large and small countries)

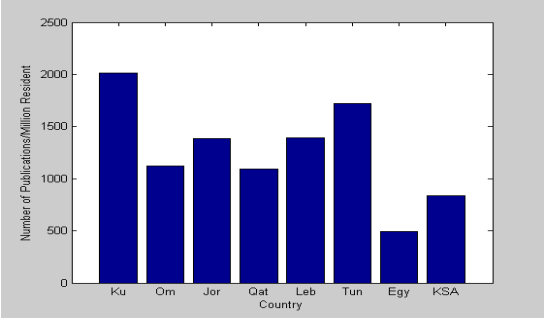

Fig. 3 (b) Number of publications/million resident/country (Arab countries)

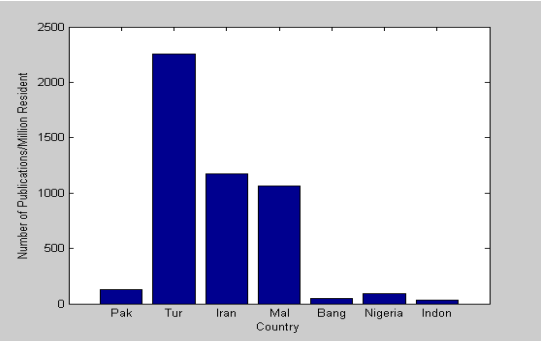

Fig. 3 (c) Number of publications/million resident/country (Muslim countries)

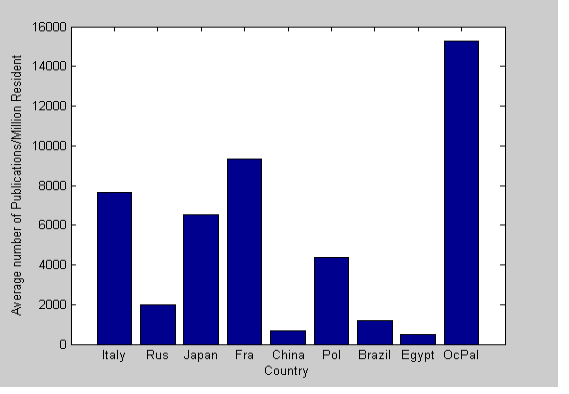

Fig. 3 (d) Number of publications/million resident/country (Egypt and other countries)

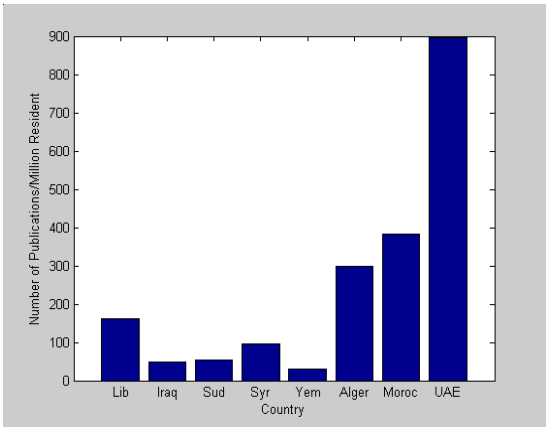

Fig. 3 (e) Number of publications/million resident/country (Arab countries

In order to evaluate engineering research in the Arab countries, Fig. 4 shows comparisons between engineering research productivity in different countries in the world. Figure 4(a) shows that, among the neighbour countries Turkey has the highest number of publications in Engineering; about 18000, with Iran at about 15500, Occupied Palestine at 8000 and Egypt at just below 6000. It is worth mentioning here that the population of Turkey, Iran and Egypt is around 85 million each while the population of Occupied Palestine is about 7 million. Moreover, it is interesting to note that the medium of instruction in Engineering in Turkey, Iran and Occupied Palestine is Turkish, Persian and Hebrew respectively while in Egypt it is English. In other words Turkey, Iran and Occupied Palestine are using their national language in engineering education while Egypt is not using its Arabic national language. This raises a serious question about the wisdom of teaching engineering in almost all Arab Countries in English. In fact one of the justifications used by the opponents of using Arabic Language for teaching engineering in Arab universities is that teaching in English will guarantee that graduates will be able to communicate with the world in English. Considering the fact that ISI data base lists publications only in English means that graduates of neighbour countries using their national languages in teaching engineering are more capable of communicating with the world than graduates of Egypt where English is the medium of instruction in engineering. Thus, the use of English as a medium of instruction for teaching engineering in almost all the Arab countries is not justifiable on the basis of improving the graduates' capabilities for communicating with the rest of the world in terms of the number of publications. In fact similar results, not shown here, were obtained from evaluating research productivity in medical sciences and other branches of science which are taught in English in most of the Arab countries. Inspection of Fig. 4(b) confirms the findings obtained from Fig. 4(a). Again countries teaching engineering in their national language like France, Italy, Poland, Russia, Japan and Brazil are much more productive in engineering research than Egypt which teaches engineering in English. It is worth mentioning here that similar findings were found from considering engineering research productivity in small countries like Hungary and Norway where the national language is the language on instructions in all fields of engineering, medical sciences and sciences.

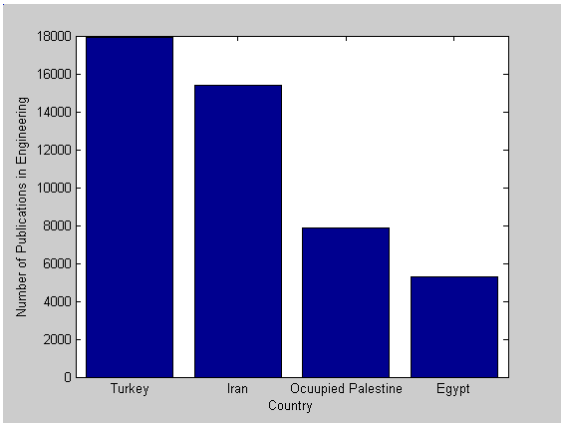

Fig. 4 (a) Number of publications in Engineering/country (Egypt and neighbour countries)

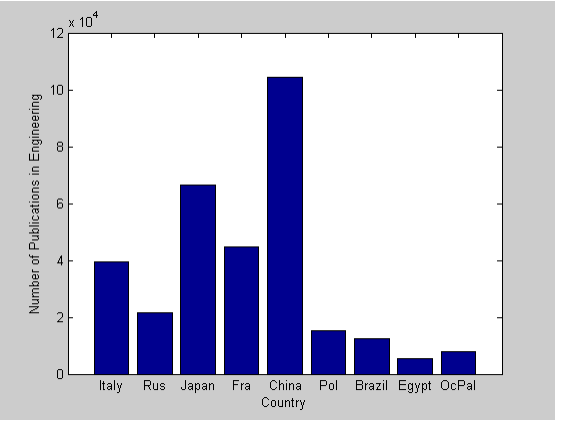

Fig. 4 (b) Number of publications in Engineering/country (Egypt and other countries)

In order to highlight the findings obtained from Figs. 1-4, Fig. 5 shows a comparison between the engineering research productivities of some of the highly reputable universities in the Arab countries and its neighbours. From Fig. 5 it appears that UPM (King Fahd University of Petroleum and Minerals, Saudi Arabia) [2] has 1500 publications, CAU (Cairo University, Egypt) [3] has just about 1000 while KSU (King Saud University, Saudi Arabia) [4] has about 700 and AUB (American University of Beirut, Lebanon) [5] has around 250 publications. The language of engineering instructions in these four highly regarded Arab universities is English. Compared with TIT (Technion Institute of Technology, Occupied Palestine) [6], and TAU (Telaviv University, Occupied Palestine) [7] where Hebrew is the language of instruction in engineering, and other subjects, TIT has around 2700 publications while TAU has around 1700 publications. Both are higher than UPM. A similar pattern can be observed when considering UoT (University of Tehran, Iran) [8], SUT (Sharif University of Technology, Tehran) [9] where the language of instruction in engineering, and other subjects, is Persian. The number of publications in engineering of UoT and SUT is around 2000 for each university which is higher than UPM. From Fig. 5 it is interesting to note that ITU (Istanbul Technical University, Turkey) [10] and MET (Middle East Technical University, Turkey) [11]

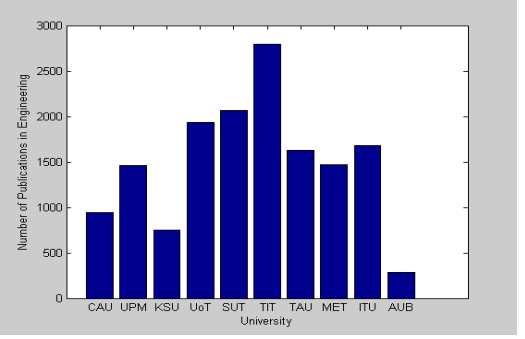

Fig. 5 Number of publications in Engineering/university (selected Arab and neighbour countries)

has around 1700 and 1500 engineering publications respectively. Surprisingly, ITU teaches engineering in Turkish while MET teaches engineering in English. This is a solid evidence that teaching engineering in English

does not guarantee better communication with the rest of the world in terms of engineering research publications. In fact the results clearly supports the opposite argument that teaching engineering, and other subjects, in national language may result in better communication with the rest of the world. In fact, experience shows that teaching engineering, and other subjects, using the national language would result in better digesting of the material and consequently in innovation and development which can be reflected in scientific publications in journals and conferences listed by the ISI data base.

4. Conclusion

Since there is no published reports on the evaluation of research productivity in the Arab countries, the study presented here does provide an attempt to do so. The number of publications and the number of citations were used as the basis for evaluating research productivity of Arab countries and a selected number of countries in the world. In the light of the results it appears that it is a long way ahead for Arab countries to compete with some developing countries; for example, Iran and Turkey. It goes without saying that it is hard, if not impossible, under the present conditions to compete with some countries with relatively small number of residents; for example Norway and Hungary. It appears also that relatively small countries, in terms of the number of residents; for example Norway, using national language as medium of instruction in the education system, are doing much better than Arab countries adopted English as medium of instruction in teaching engineering and sciences. This contradicts with the claims that using English as a medium of instruction will result in better communication with the rest of the world in terms of research productivity. This result supports the claim that using the national language in teaching engineering and sciences will result in better understanding of the material and consequently improves the possibility of innovation and publications in reputable journals and conference proceedings listed in the ISI data base.

Acknowledgement

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