Proceedings of 10th International Conference on Webometrics, Informetrics and Scientometrics & 15th COLLNET Meeting 2014

September 3-5, 2014
Technische Universität Ilmenau, Germany

Edited by
Bernd Markscheffel • Daniel Fischer •
Daniela Büttner • Hildrun Kretschmer

THOMSON REUTERS

TECHNISCHE UNIVERSITÄT ILMENAU

Elsevier
Research Intelligence

Proceedings
of
10th International Conference on
Webometrics, Informetrics and Scientometrics &
15th COLLNET Meeting 2014

September 3-5, 2014

Technische Universität Ilmenau, Germany

Edited by

Bernd Markscheffel,

Daniel Fischer,

Daniela Büttner and

Hildrun Kretschmer

Bernd Markscheffel,
Daniel Fischer,
Daniela Büttner and
Hildrun Kretschmer

Technische Universität Ilmenau
Fakultät für Wirtschaftswissenschaften und Medien
Institut für Wirtschaftsinformatik
P.O. Box 100565
98684 Ilmenau
Germany

bernd.markscheffel@tu-ilmenau.de
daniel.fischer@tu-ilmenau.de
daniela.buettner@tu-ilmenau.de
kretschmer.h@onlinehome.de

Ilmenau, 2014

Index

Invited Papers

Research in what fields? Determining Iran's research priorities according to their impact on economic development

Hamzehali Nourmohammadi*, Mahdi Keramatfar** and Abdalsamad Keramatfar***

*Shahed University, Tehran, Iran
nourmohammadi.h@gmail.com

**Tarbiyat Modaress University, Tehran, Iran
mkeramatfar@gmail.com

***Scientometrics Section of SID, Tehran, Iran
keramatfar@mailfa.com

Introduction

The ability to assess a country's scientific situation is of pressing importance. Since all the sciences do not have the same degree of application (Berer, 2012) and in a particular time an economy can develop technology in a number of sections and it is difficult to predict which technologies would more beneficial (Kealey, 1996), determining research priorities is a very important issue for science and technology policy-makers (Lee et al, 2011). One of the Iran's attempts is the Country's Comprehensive Scientific Plan document that in the third season determines the country's scientific and technological priorities. On the other hand, economic issues have to be deal with effectively in making any decision related to science and technology (Salter 2001). It is also of highest importance to decide which fields are economically worth investing. Ray and Lal (2000) suggest that developed countries should investment in basic research and developing countries should invest in education, infrastructures, and engineering because these fields have the biggest impact on economic development. Vinkler (2008) holds out the effect of development level on researches' outputs and argues that the relation between economic development and researches' outputs differs in different countries; in developed countries there is no significant relation between economic development and researches's outputs while in central and Eastern European countries there is more significant relation; he argues that developed countries are more capable of supporting basic researches, therefore, their researches includes basic researches and deals less with future researches. Chuang et al. (2010) indicated that the research areas in which Singapore, Taiwan, and South Korea have been working during the last decade have been engineering areas. Newly industrializing countries, especially South Korea and Taiwan, have been focusing on understanding and spreading the existing technology rather than producing new technology. Moreover, Japan's policy of science and technology is increasingly concerned with technologies with economic importance. Kealey (1996) argues that concentration on basic science is not effective in advancing technology. Since Iran is a developing country, and due to the presence of oil resources, research expenses may be directed toward unimportant areas that have the least impact on economic development. Thus, the present paper aims to determine which research area will have the most central effects on the country's economic development.

Research purposes

The main objective of this study is to determine of Iran's research priorities according to their impact on economic development.

Other objects of this research include:

- Quantity in science productions in countries' subject areas
- Quantity of GDP during different years
- Determining of relation between the country's different subject areas of science production and GDP
- The majors of the greatest impact on GDP in engineering field

Theatrical Framework

Today assessment of scientific papers is performed based on Citation Indexes that collect bibliography information because these Indexes provide Ability to identify and recover valid information of various subject areas and citation information that link the work to other works, and To a large extent reflects the impact of the paper(Noroozi Chakoli, 2011). The most important of these indexes are Web of Knowledge and Scopus. In 2007 Scimago Research Group offered a tool based on Scopus data that provide ability to study and comparison of scientific production in two main Unit, countries and journals. This tool divides all scientific papers to 320 disciplines and 27 areas that provide ability to subjective analysis.

There is a broad literature in studying the relation between science and technology. Price(1967) stated that academic researches Create a generation of researches and future researches of these researchers and will cause economic prosperity also basic researches that usually performs by universities are input of R&D activities. Jaffe(1989) showed that academic researches improve industrial R&D. in fact providing basic research spending by government, many industrials do not pay for basic research in development of technology and they will be able to use it, thus social benefits will result. Diamond(1996) stated that science is Leader of Technology and technology will lead to productivity and growth. Narin et al(1997) studied citation in patents to scientific papers and showed that this type of citation grew and concluded that Technology is based on science. Mansfield et al(1991) studied new goods and process and stated that 11% of new product and 9% of new process could not be improved without academic research. Martin et al (1996) stated the various types of contributions that publicly funded research makes to economic growth:

1. Increasing the stock of useful knowledge;
2. Training skilled graduates;
3. Creating new scientific instrumentation and methodologies;
4. Forming networks and stimulating social inter- action;
5. Increasing the capacity for scientific and technological problem-solving;
6. Creating new firms.

On other hand, some of R&D researches publish a paper of their work in scientific journals, so assessment of papers can obvious economic activities in R&D sectors. Overall Evidences show that publicly funded basic research have many benefits (Salter&Martin, 2001).

One of the common tests in econometrics is Granger causality test. In The Granger causality test for testing the hypothesis; "(X_t) is not Granger cause of (Y_t)" a (VAR) model is formed:

$$Y_t = \sum_{i=1}^{k} \alpha_i Y_{t-i} + \sum_{i=1}^{k} \beta_i X_{t-i} + u_t$$

So this linear model is estimated and the significant assumption is tested. If the assumption coefficients of X_{t-i} i.e. β_i being zero Confirm then X_t is not Granger cause of Y_t. In fact if the being zero assumption of test is rejected X_t is cause of Y_t. Since there is a time gap between

publication and their impact (King, 2004), here we test the impact of science on welfare with a lag.

Methodology

This study is applied and descriptive - based and due to its use of Scientometric methods. The data related to the country's scientific production were extracted from Scimago data base, Country Search section. Data related to GDP were extracted from the World Bank's data base. In order to analyze the data Eviews7 was employed and stationary and Granger test were administered. The data were gathered early in December 2013.

Findings

First Data is an indication of the country's science production from 1996 to 2012 in Scimago data base. As is seen, medical science has the highest share, engineering and chemistry rank second and third.

Table1. Number of scientific production of Iran in different subjects 1996-2011

Subject Area	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
Agricultural and Biological Sciences	78	84	83	119	129	137	227	274	368	513	1134	1597	1846	2088	2574	3686
Arts and Humanities	4	4	2	2	1	7	2	4	4	17	25	32	46	75	76	127
Biochemistry, Genetics and Molecular Biology	70	80	82	115	131	182	244	337	449	558	816	1256	1474	1666	2009	2824
Business, Management and Accounting	4	2	6	4	6	1	4	8	13	17	26	33	77	108	153	217
Chemical Engineering	51	74	72	86	114	135	181	229	320	454	612	792	939	1142	1457	1987
Chemistry	142	168	236	316	363	502	616	838	1	1271	1515	1931	2155	2622	3016	3605
Computer Science	40	53	54	56	79	90	115	219	277	412	518	648	101	1117	139	1956
Decision Sciences	12	14	15	8	17	11	17	16	29	57	72	93	146	212	238	276
Dentistry	2	-	1	3	9	5	9	19	22	22	32	63	83	116	117	137
Earth and Planetary Sciences	28	45	35	36	67	64	85	148	161	204	263	334	337	537	601	807
Economics, Econometrics and Finance	2	-	2	1	2	2	2	4	2	4	10	9	16	32	69	150
Energy	16	27	22	22	17	24	60	75	97	102	167	208	325	404	580	873
Engineering	133	163	161	176	245	331	464	766	1028	1106	1471	1687	2125	3554	4293	5761
Environmental Science	26	33	33	41	45	62	109	136	197	245	347	583	693	1031	1281	2131
Health Professions	1	-	1	3	1	7	5	12	35	41	52	58	63	62	82	107

Subject Area	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
Immunology and Microbiology	19	22	23	33	41	50	72	114	117	171	263	325	412	446	688	898
Materials Science	63	86	88	109	144	208	277	405	528	711	937	1103	1619	2061	2599	3412
Mathematics	47	71	78	107	111	137	186	247	407	559	697	900	952	1299	157	2206
Medicine	124	188	165	161	194	276	480	720	827	1545	2346	305	3818	4499	5359	6684
Multi-disciplinary	11	12	14	23	22	13	33	30	62	48	138	216	511	620	522	1665
Neuroscience	10	10	9	15	17	22	31	45	56	67	107	156	176	196	218	309
Nursing	-	-	1	3	4	1	5	3	12	24	33	58	108	108	96	146
Pharmacology, Toxicology and Pharmaceutics	31	48	66	73	72	58	110	117	198	237	332	419	440	647	775	1169
Physics and Astronomy	64	77	109	115	133	148	234	283	420	472	809	103	1357	1675	1939	2577
Psychology	-	2	2	7	10	8	12	23	19	21	31	42	45	48	307	820
Social Sciences	10	5	8	8	11	9	29	48	48	75	106	150	190	306	653	1761
Veterinary	28	22	27	25	30	21	31	52	64	87	143	151	337	310	378	512

Second Data set shows the Iran's GDP from 1996 to 2011.

Table2. GDP per capita of Iran 1996-2011

year	*GDP per capita (current US$)*	*year*	*GDP per capita (current US$)*	*year*	*GDP per capita (current US$)*	*year*	*GDP per capita (current US$)*
1996	1799.672	2004	2353.931	2000	1536.715	2008	4899.312
1997	1683.634	2005	2737.112	2001	1726.63	2009	4931.283
1998	1611.308	2006	3140.198	2002	1718.965	2010	5674.924
1999	1613.599	2007	3983.582	2003	1975.539	2011	6815.57

Third Data includes the results of Granger's causal test for the country's different subject areas of science production, yellow cells indicate significance at the level of 0.05 and green cells indicate significance at the level of 0.01. As is observed, nursing has had the greatest impact on GDP, and at the same time, nursing has been influenced most by GDP.

Table3. Causality test in between different subject areas and GDP

	causality	
Causality direct	*Science production to GDP*	*GDP to Science production*
Agricultural and Biological Sciences	0.4669	0.2276
Arts and Humanities	0.0163	0.0304
Biochemistry, Genetics and Molecular Biology	0.0673	0.0327
Business, Management and Accounting	0.0064	0.1396

causality		
Causality direct	*Science production to GDP*	*GDP to Science production*
Chemical Engineering	0.0704	0.2858
Chemistry	0.0253	0.1613
Computer Science	0.7136	0.212
Decision Sciences	0.0513	0.0112
Dentistry	0.0499	0.0822
Earth and Planetary Sciences	0.0166	0.6185
Economics, Econometrics and Finance	0.016	0.1455
Energy	0.0564	0.0181
Engineering	0.0024	0.4192
Environmental Science	0.0784	0.0134
Health Professions	0.9895	0.0412
Immunology and Microbiology	0.1873	0.4948
Materials Science	0.0283	0.2405
Mathematics	0.3154	0.0369
Medicine	0.2462	0.0697
Multidisciplinary	0.0052	0.0098
Neuroscience	0.2163	0.0198
Nursing	0.0002	0.0029
Pharmacology, Toxicology and Pharmaceutics	0.0284	0.5019
Physics and Astronomy	0.1291	0.0168
Psychology	0.1354	0.2268
Social Sciences	0.0042	0.0292
Veterinary	0.0223	0.0182

As was mentioned before, each of the 27 separated areas in Scimago includes different majors, in engineering field such a separation has been carried out. Table 4 indicates the result of causal test for different engineering majors. Table 4 shows that eco-medicine engineering, civil engineering, system and supervising engineering, industry and production engineering at the level of 0.01, and mechanical engineering, material mechanics, and science of material at the level of 0.05 have impact on GDP.

Table4. Causality test for different engineering areas

Subject Area	*Impact on GDP*	*Impact of GDP*
Aerospace Engineering	0.41	0.16
Architecture	0.32	0.001
Automotive Engineering	0.8	0.08
Bioengineering	0.0009	0.13
Construction	0.59	0.22
Civil and Structural Engineering	0.003	0.17

Computational Mechanics	0.06	0.86
Control and Systems Engineering	0.008	0.12
Electrical and Electronic Engineering	0.25	0.51
Engineering (miscellaneous)	0.38	0.42
Industrial and Manufacturing Engineering	0.008	0.04
Mechanical Engineering	0.02	0.006
Mechanical Engineering	0.04	0.1
Media Technology	0.92	0.42
Ocean Engineering	0.99	0.0041
Safety, Risk, Reliability and Quality	0.29	0.007
Chemical Engineering	0.0704	0.2858
Computer Science	0.7136	0.212
Material science	0.0283	0.2405

Conclusion

The major's eco-medicine engineering, civil engineering, system and supervising engineering, industry and production engineering at the level of 0.01 and the major's mechanical engineering, material mechanics, and science of material at the level of 0.05 have impact on GDP. In other words, these majors should have research priority in Iran. Of course, it should be mentioned that since industry and production engineering and mechanical engineering are affected by GDP, it might mean that these sections have been financed. Being affected by GDP presented above could be analyzed in this way: if an increase in GDP has had effects on a group or a major, it probably means that GDP increase has been accompanied by budget increase in that group or major, therefore, if the reverse relation, i.e. the effectiveness of that group or major in GDP is not significant, continuing to increase the budget for that group or major cannot be justified. Consequently, in engineering group majors like architecture engineering and safety engineering do involve the risk and problem just mentioned and therefore investing in these sectors is not justifiable.

References

Vinkler, P. (2008). “Correlation between the structure of scientific research, scientometric indicators and GDP in EU and non-EU countries”. *Scientometrics.* 74(2). pp. 237-254.

Narin, F., Hamilton, K., Olivastro, D., 1997. The linkages between US technology and public science. *Research Policy* 26, 317–330.

Lee, Ling-chu. Lin, Pin-hua. Chung, Yun-wen. Lee, Yi-yang. (2011). “Research output and economic output: a Granger causality test”. *Scientometrics,* 89(2). pp 465-478.

Borer, Kealey. (2012). The state is an enemy of science: a review of terence kealey’s the economic laws of scientific research. *Libertarian papers*, 4(2). Pp 89-96.

Terence Kealey. The Economic Laws of Scientific Research. London: Macmillan, 1996.

SALTER, A. J., B. R. MARTIN, The economic benefits of publicly funded basic research: A critical review, *Research Policy*, 30 (3) (2001) 509–532.

Godin, B. and Doré, C. (2004) 'Measuring the Impacts of Science: Beyond the Economic Dimension,' CSIIC Working Paper.

Rai, L. P., & Lal, K. (2000). Indicators of the information revolution. *Technology in Society, 22*, 221–235.

Chuang, Y. W., Lee, L. C., Hung, W. C., & Lin, P. H. (2010). Forgoing into the innovation lead—A comparative analysis of scientific capacity. *International Journal of Innovation Management, 14*(3), 511–529.

Diamond Jr, A.M. (1996), 'The economics of science', Special Issue of The International Journal of Knowledge Transfer and Utilization, 9, 3–49.

Jaffe, A., 1989. Real effects of academic research. American Economic Review 79, 957–970.

Price, Derek J.De Solla., 1967, "Nations can publish or perish", *Science and Technology*. 70. pp.84-90.

Mansfield, E. et al., 1991. Academic research and industrial innovation. *Research Policy* 20, 1–12.

Martin, B., Salter, A., Hicks, D., Pavitt, K., Senker, J., Sharp, M., Von Tunzelmann, N., 1996. The Relationship Between Publicly Funded Basic Research and Economic Performance: *A SPRU Review*. HM Treasury, London.

Noroozi Chakoli, Abdoreza. 2011. Introduction to Scientometrics (Principles, concepts, relations and roots). Tehran: SAMT.