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Factors Affecting Continuance in the Scientific Activity of Iranian Authors

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Abstract

The aim of this article is to study factors that affect continuance and gaps or transience in scientific activity of Iranian scholars. Scientific activity here is considered as writing and publishing articles in ISI ranked journals. Email interviews were conducted with a purposive sample of 48 scholars from the fields of biotechnology, psychology, humanities, health policy & services, aerial engineering, behavioral sciences, chemistry, and information science in 2015. The chosen fields were mentioned as priority in the Iranian scientific roadmap. The interviews were the qualitative phase of a mixed-methods study. The scholars were asked about the reasons for transience and suggestions for increasing continuance in article writing. The interviews revealed nine categories of factors causing gaps in the scientific works including personal and family factors, internal and external motivating factors, factors relating to work environment and facilities and the nature of the field, factors relating to publishing process, and finally factors relating to the knowledge of ISI journals. Interdisciplinary differences were found with regard to these factors, and five groups of solutions were suggested by interviewees for improving the continuance in authorship including providing research requirements, motivating researchers, encouraging team work, empowerment or enabling, and helping creativity or idea fostering.

Keywords: Continuance in science, scientific activities, Iran, authorship,

Introduction

According to Wible "Science is difficult and costly to do well. The remarkable benefits of scientific research require the efforts, time, and talents of some the very best minds and research teams in the world and the expenditure of significant sums of material and financial resources. Consequently, science is an economic phenomenon" (1998, p.1). Workforce is an important element in any economic activity. Special attention is paid to human resources in most of the science evaluation systems.

Price and Gursey (1975a) divided authors in each given period in any field into four main groups which are continuants, newcomers, terminators, and transients. Their idea was inspired by actuarial statistics. The definitions for these four groups of authors are:

1. Newcomers: those who have just started publishing articles;
2. Continuants: those who have started in the past and are continuously publishing articles;
3. Transients: authors who have started in the past and still publish articles with gaps in some years;
4. Terminators: those who have just terminated publishing articles.

Ioannidis, Boyack, & Klavans (2014) in a large scale study showed that there is a correlation between continuity in research activity and the impact that one's research could leave on science, at least when we measure the impact through citation counting.

The first phase of this study (of which some findings were published in Nikzad, et al. 2016, Nikzad et al., 2017) which is based on a PhD dissertation (Nikzad, 2015) showed that the average scientific life expectancy of Iranian scientists was about two years. The number of continuant authors in all fields were marginal relative to newcomers and transients and there was a high rate of scientific infant mortality which means many authors published one or two articles in one year and then they disappeared as authors and did not publish again. The aim of this paper, which reports the results from the second phase of that study, is to find the reasons causing gaps in scientific activities of authors and find solutions to this situation or find strategies to improve continuance in scientific activity.

Literature Review

Studies on authorship continuance

The first study to deal with the continuity in research activity seems to be the work by Garvey and Tomita (1972) who studied the scientific communities of nine disciplines between 1968 and 1971. They found out that 48% of 2,030 authors studied had changed field and the other 52% were still working in their original field. They proposed the notion of continuity in research based on this study.

However, it was Price and Gürsey (1975a) who studied this subject more systematically and proposed new concepts. They draw a random sample of 506 authors from half a million authors indexed in Science Citation Index between 1964 and 1970. They showed that 281 out of 506 authors were transient, and only 19 authors were continuants i.e. they continued publishing articles with no gap. Their results also showed that 20% of authors formed the core. Transient authors accounted for 22% of all authors in each year and two-thirds of newcomers. Price and Gursey (1975b) in another study focused on citations of 640 authors from the period 1964-1968. The results showed that 71% of transient authors who had published only a single paper, received no citation. Only 10% of authors were continually cited.

After Price and Gürsey, a few other studies dealt with the notions of continuity and transience in authorship including Hawkins' (1978) study on the field of gas compounds, Silke's (2004) study on terrorism, Gordon's (2007) study again on terrorism, Kumaravel et al's (2013) study on medical robotics. All of these studies have shown more or less similar pattern of skewness on the continuance of authorship. i.e a minority of authors publish for a long period of time and a majority of authors publish for just a few years usually with gaps.

The largest of such studies is the study by Ioannidis, Boyack and Klavans, (2014). They studied all of the articles indexed in Scopus between 1996 and 2011 which included 15,153,100 authors and found that only less than one percent of authors published continuously with no gap during the 16 years. This small group of authors were cited far more than the others and accounted for 41.7% of all published articles during the period, and 87.1% of articles with more than 1000 citations. Authors in the field of chemistry and medicine appeared to have more continuance in their research activities compared to the authors of some other fields such as social sciences and humanities.

The first Iranian study on subject is the one by Nikzad (2015). They studied all Iranian articles in ISI ranked journals between 1931 and 2012. They created a relational database and used SQL to analyze the data. The results showed that overall during the period, the average birth rate was 71%, the average death rate was 30.1%, the average infant death rate was 57.6%, the rate of natural increase was 14.1% and the length of life expectance was 2.09 year. Statistical significant differences were found among all seven subject fields with regard to these five measures. Chemistry positioned somehow better than other fields in terms of the number of articles, number of authors, rate of natural increase and length of life expectancy. The study also included interviews with 48 authors in order to find out about the causes of gaps in the scientific activity. The interviews revealed nine categories of factors causing break in the scientific works including personal and family factors, internal and external motivating factors, factors relating to work environment and facilities and the nature of the field, factors relating to publishing process and planning, and finally factors relating to the knowledge of journals. Interdisciplinary differences were found with regard to these factors, and five groups of solutions were suggested by interviewees for improving the continuance in authorship including providing research requirements, motivating researchers, encouraging team work, empowerment, and helping idea fostering. The conclusion of the study was that the authorship flow in Iran is not satisfactory as the rate of scientific life expectancy is low and the rate of infant mortality is high. Measures should be taken in order to improve the continuance in scientific activities.

Another Iranian study that was inspired by the aforementioned dissertation is a conference paper by Jamali, Mansourian and Alijani (2015). They studied the authorship of Persian library and information science articles (articles published in 11 LIS Persian journals 1991-2014). Their results showed that the average birth rate was 54.7%, the average death rate was 40%, the infant mortality rate was 55.3%, the average natural increase was 17%, and the average life expectancy was 2.7 years. The publication expectancy was 4.1 articles per person Duration of activity for ninety percent of authors was less than 5 years.

Studies on factors affecting authorship continuance

There is a rich body of literature on the factors affecting scientific productivity, although few of them touch upon the issue of continuance in scientific activity or the length of activity. Several factors have been mentioned as influencing factors of scientific productivity in the past studies. Kelly and Warmbrod (1986), Dundar and Lewis (1998), Hu and Gill (2000), and Kotrlik et al. (2002) have shown the positive impact of the presence of postgraduate and research students on the scientific production of faculty members. In Iran a study by Talebi

(2002) has led to similar conclusion. Factors related to context of work and the organization including the size of organization are another set of factors that are found in studies such as Vasil (1992) and Dundar and Lewis (1998). Scientific production of researchers in a large university is better than those working in a small college. The supports that an organization provides for its researcher is another key factor mentioned by Kelly and Warmbrod (1986) and Buchheit et al. (2001). Age is another factor, although its impact is not conclusive. Some studies (Blackburn et al., 1991) conclude that senior researchers at older ages are more productive while some other studies (Bland and Berquist, 1997) conclude that productivity reduces by aging.

Years of experience appeared in some studies (e.g. Gorman and Scruggs, 1984, Vasil, 1992) to have positive impact on productivity. Gender is also another personal factor and in most studies (Mozaffarian and Jamali, 2008, Barrios et al., 2013) men appear to be more productive than women researchers. The amount of teaching duty has negative correlation with productivity (Buchheit et al., 2001). Hu and Gill (2000) set the threshold for teaching duty at 11 hours a week, i.e. if a faculty member is to teach more than this amount, his or her productivity would be affected negatively.

Overall, the literature shows that few studies specifically have paid attention to the causes of continuance and gaps in the scientific productivity or publishing activities of scientists and in the case of Iran there is no such study at all.

Methods

The original study was a sequential quantitative-qualitative mixed method study with quantitative part being the dominant part. After a bibliometric analysis of Iranian ISI articles (the quantitative part of the study, the results of which were partly published in Nikzad et al., 2016; 2017), the qualitative phase of the study sought to find out the factors that have impact on the break of scientific activities. This phase of the study used basic / pragmatic qualitative method. Basic qualitative method is a kind of qualitative research that tries to explore and understand a phenomenon (Merriam, 1998). In this type of qualitative research, thematic analysis is normally used for data analysis (Caelli, Ray and Mill, 2003). The author did not use grounded theory as the aim of this part of the study was not to develop a theory or model.

Email interviews were conducted (between September 2014 and March 2015) with 48 authors from the fields of psychology, behavioural sciences, aerospace engineering, health services and policy, biotechnology, humanities, and chemistry, and library and information studies (LIS). These fields (except LIS) were chosen purposefully as they have been mentioned in as priority subjects in Iranian national scientific roadmap.

The sampling method was purposive and were limited to those who had published articles in ISI ranked journals between 2008 and 2012. The reason for choosing these years was that the quantitative part of the study analyzed the Iranian publications of these years, therefore, the aim was to interview the authors whose publications were included in the bibliometric phase of the study. The minimum number of interviewees from each field was five. Emails of interviewees were obtained from WoS records and invitation emails were send to people. Overall 329 emails were send and 48 answered. The number of authors was very large but the aim was to interview a large enough number of authors up to the point of data

saturation. Therefore, the interviews and analysis were conducted gradually and if a person did not reply to invitation email, an invitation email was sent to another person as a replacement and the author stopped sending invitation emails when she felt she had collected enough data (reaching data saturation).

Table 1
Profiles of interviewees

No	Sex	Age	Rank	Subject	Field	No of ISI articles	Year of first article
1	M	42	Associate Prof.	Biotechnology	Technology	10	2006
2	M	36	Assistant Prof.	Biotechnology	Technology	6	2011
3	M	40	Assistant Prof.	Biotechnology	Technology	2	2010
4	M	34	Assistant Prof.	Biotechnology	Technology	37	2007
5	M	48	Full Prof.	Biotechnology	Technology	50	2002
6	M	57	Associate Prof.	Biotechnology	Technology	27	2002
7	M	54	Associate Prof.	Aerospace Eng.	Technology	16	2001
8	M	52	Associate Prof.	Aerospace Eng.	Technology	8	2007
9	M	54	Full Prof.	Aerospace Eng.	Technology	40	1995
10	M	34	Assistant Prof.	Aerospace Eng.	Technology	15	2011
11	M	44	Associate Prof.	Aerospace Eng.	Technology	22	2006
12	M	54	Full Prof.	Aerospace Eng.	Technology	100	1987
13	M	43	Associate Prof.	behavioral Sci.	Basic and Applied Sci	13	2009
14	M	50	Assistant Prof.	behavioral Sci.	Basic and Applied Sci	11	2011
15	F	55	Associate Prof.	behavioral Sci.	Basic and Applied Sci	20	2005
16	M	57	Full Prof.	behavioral Sci.	Basic and Applied Sci	22	1999
17	M	48	Associate Prof.	behavioral Sci.	Basic and Applied Sci	13	2004
18	M	35	Assistant Prof.	behavioral Sci.	Basic and Applied Sci	5	2012
19	M	٤٠	Assistant Prof.	behavioral Sci.	Basic and Applied Sci	8	2010
20	M	39	Assistant Prof.	Health Services and Policy	Health	60	1999
21	M	46	Associate Prof.	Health Services and Policy	Health	50	1998
22	M	48	Full Prof.	Health Services and Policy	Health	24	1997
23	M	36	Assistant Prof.	Health Services and Policy	Health	10	2008
24	F	45	Assistant Prof.	Health Services and Policy	Health	11	2001

No	Sex	Age	Rank	Subject	Field	No of ISI articles	Year of first article
25	M	50	Associate Prof.	Health Services and Policy	Health	20	2000
26	M	39	Assistant Prof.	Health Services and Policy	Health	10	2010
27	M	56	Full Prof.	Psychology	Humanities	30	1998
28	M	43	Associate Prof.	Psychology	Humanities	15	2005
29	F	40	Assistant Prof.	Psychology	Humanities	5	2009
30	M	51	Associate Prof.	Psychology	Humanities	16	2006
31	F	38	Assistant Prof.	Psychology	Humanities	7	2011
32	M	56	Associate Prof.	Psychology	Humanities	35	2001
33	M	59	Full Prof.	English Literature	Humanities	12	2000
34	F	44	Associate Prof.	Philosophy	Humanities	18	2007
35	M	50	Associate Prof.	History	Humanities	20	2002
36	M	39	Assistant Prof.	Archeology	Humanities	13	2009
37	M	41	Assistant Prof.	History	Humanities	9	2010
38	M	38	Assistant Prof.	Theology	Humanities	6	2010
39	M	40	Associate Prof.	Linguistics	Humanities	15	2007
40	F	41	Assistant Prof.	Linguistics	Humanities	3	2008
41	M	39	Lecturer	Information Sci.	Humanities	7	2005
42	M	43	Assistant Prof.	Information Sci.	Humanities	5	2008
43	M	42	Associate Prof.	Information Sci.	Humanities	10	2006
44	M	41	Associate Prof.	Chemistry	Basic and Applied Sci	23	2005
45	F	38	Assistant Prof.	Chemistry	Basic and Applied Sci	9	2009
46	M	36	Assistant Prof.	Chemistry	Basic and Applied Sci	12	2010
47	M	51	Full Prof.	Chemistry	Basic and Applied Sci	86	2000
48	F	43	Associate Prof.	Chemistry	Basic and Applied Sci	42	2003

Email interview is a reliable and well-established method for collecting qualitative data (Meho, 2006) and there are several studies that has applied this technique such as Meho and Tibo (2003).

The interview questions that were send with the invitation emails were:

1. Questions related to the demographic information (age, academic rank, number of ISI articles, publication year of the first article, discipline.)
2. Since your first article, have you published article every single year or there have been gaps in your publications?
3. If the answer is yes, what have caused the gap in your publications?
4. What factors do you think affect the continuance or gap in researchers' publications?

5. Do you think continuance or gaps in publications are field dependent?
6. In what situation you would be more motivated to avoid any gaps in your publications?
7. What suggestions do you have to increase the continuance in scholars' publications?

The collected data were subject to coding and thematic analysis. Thematic analysis is a basic technique in qualitative research. (Marshall and Rossman, 2006).

For the validity and reliability of the research, the researchers followed the four criteria proposed by Lincoln and Guba (1985) which include credibility (i.e. the results are valid and trustworthy), transferability (i.e. the findings can be transferred to another situation), dependability (i.e. stability or consistency of the inquiry process), and confirmability (i.e. results can be confirmed or corroborated by others). Measures such as continuous involvement with the data, documentation of the whole research process, writing memos, continuous communication with research participants, constant comparison of interviews, sending the preliminary findings of the interviews to a few of the interviews for their feedback and seeking their confirmation were taken to make sure the study met these criteria. The most important of these was the documentation of the whole research process which was recorded in Nikzad (2015).

Results

Figure 1 shows the reasons mentioned by interviewees for gaps or breaks or discontinuity in scientific activity or authorship. Factors relating to personal or family issues such as becoming parents or getting married formed the first group of reasons. This group of factors are probably truer in the case of female scientists as they are more likely to sacrifice their career for their children or family life (Davarpanah and Moghadam 2012).

The second group of factors were related to internal motivating elements. Personal incentives or believes on the one side and laziness and lack of motivation on the other side could affect the continuance of work. Believing in the usefulness of publishing articles in international journals is very important for scholars otherwise they are not going to do so. Internal motivations are stronger than external motivations which are presented in the third group of factors. Examples of external motivations are financial or monetary rewards or support by universities for publishing in international journals. Economic austerity during the last decade has reduced the amount of such supports universities provide for their researchers.

Work environment is the label of another group of factors that affect continuance in article writing. Engaging in too much of administrative work or teaching and depending too much on graduate students for doing the research and producing articles are among the factors in this group. Kotrlik et al. (2002) have shown that the number of graduate students has relation with the number of articles produced by a department.

Other reasons for having a gap in one's authorship activity include lack of facilities, nature of disciplines, publishing process and its planning, knowledge of ISI journals and research limitations. Lack of facilities in some fields such as experimental physics or chemistry is a big barrier for doing science. Disciplines also vary in nature and in some fields it is much easier to conduct a study and publish papers. For example it is much easier to

produce a paper in psychology than it is in mathematics. There is a very low level of knowledge of ISI ranked journals among Iranian scholars. Due to the rapid increase in the number of predatory open access journals, a wide confusion exist among Iranian scholars as to what is a valuable journal. Also publishing an article might be a very lengthy process and this varies from one field to another. In some fields, probably in humanities, the publishing speed is very slow and it takes a long time to have one paper reviewed, accepted and published.

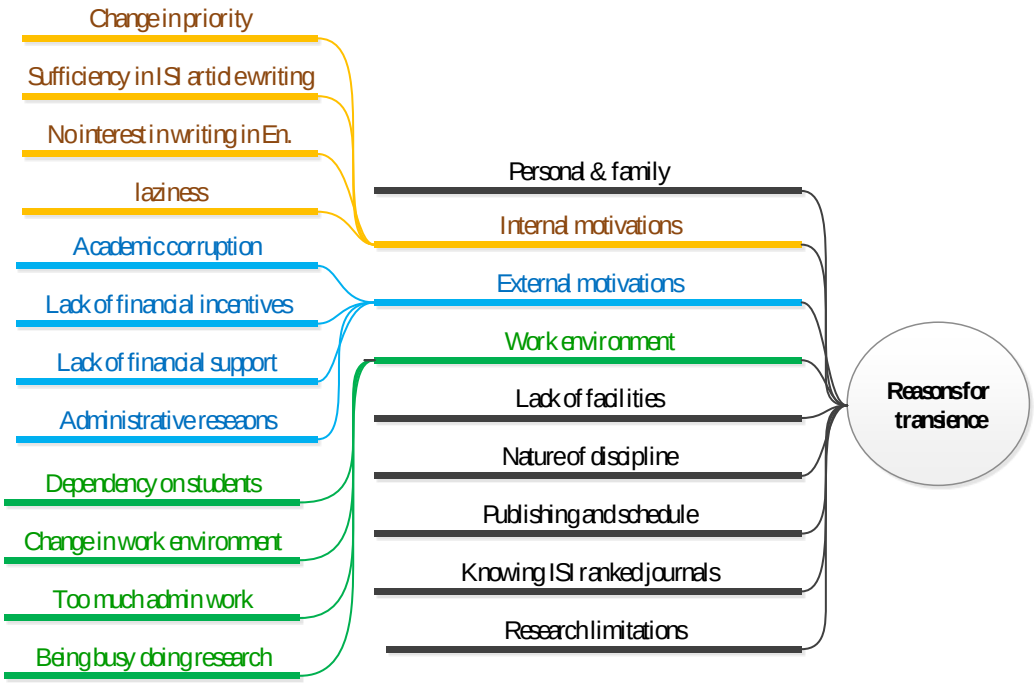

Figure 1. Reasons for gap or transience in scientific activity (publishing articles)

Interviewees were asked about any strategies or solution they could propose for increasing continuance in scientific activities, especially in writing and publishing journal articles. Five groups of solutions were mentioned by the interviewees which are summarized in Figure 2.

They include providing research requirements, motivating scholars, fostering team working, enabling or empowering researchers, and supporting creativity and idea fostering. Doing research needs money, facilities, equipment and material. Universities need to provide researchers with what is needed for doing research. Providing motivations for researchers is also critical for improvement of science. Creating a job atmosphere where internal motivations are strengthened and giving external motivations such as financial support also help. Some of the scholars are motivated enough, however, they lack some skills and knowledge for doing good science and producing high quality output. They for example need to learn more of information literacy, research methods, academic writing and so on. Universities need to provide workshops or short courses to enable and empower researchers and help them keep their knowledge and skills up-to-date. Team working culture in Iran is very poor and the majority of researchers prefer to do individual works or work with their

students. Regulations of the two ministries involved in higher education for promotion of faculty members have not lead to the improvement of this culture. More needs to be done in this respect. Generally working environment in Iran is not supportive for creativity fostering. Ideas are not fostered systematically and modifications are needed.

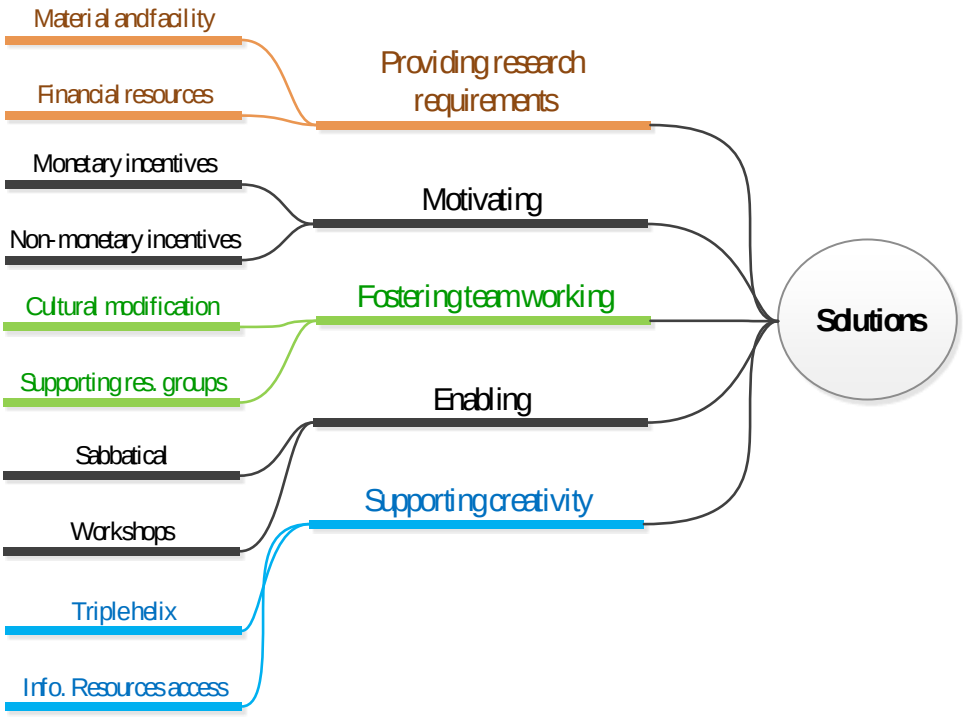

Figure 2. Solutions suggested by interviewees to increase continuance in scientific output

Conclusion

This study used a qualitative approach with email interview as the data collection tool with the aim of shedding some light on the factors the affect continuity in scientific activity, or more precisely reasons that cause gap or discontinuity in article publishing. The study found nine groups of reasons for lack of continuance in article writing. The Interviewees also suggested five groups of strategies/ solutions for improving continuance in scientific activity.

The influencing factors cover a range from personal and family issues to issues that are more related to the working environment and regulation of academic works in Iran. Correspondingly the suggested solutions are also related mainly to what officials at the ministry of science and universities need to do in order to improve the science.

However, in order to more appropriately apply the solutions we need to take into account the differences that exist among the different fields. The sample of researchers were interviewed in this study came from a representative range of subjects and their comments indicate some interdisciplinary differences.

Using Becher's (2000) classification of scientific disciplines that have been adopted by Fry and Talja (2004) for studying interdisciplinary differences in scholarly communication culture, we arrive at a better understanding. Becher divided scientific fields into four groups of applied hard, pure hard, applied soft, and pure soft. They are illustrated in Figure 3 with

examples for each category. However, according to Smith et al. (2000) there is no consensus on the definition of hard and soft sciences, hard science is usually used to refer to natural sciences such as physics and chemistry that try to understand the world and nature by experimental methods, while soft science refers to the fields that study human and society where the methods are not very positivistic. Comments by interviewees showed that for example moving from applied hard disciplines to pure soft disciplines, we move from global subjects to local subjects. Also doing research in applied hard fields require more money, more facility and equipment and more collaboration in comparison with pure soft fields. Also the number of journals decreases from applied hard sciences to pure soft sciences.

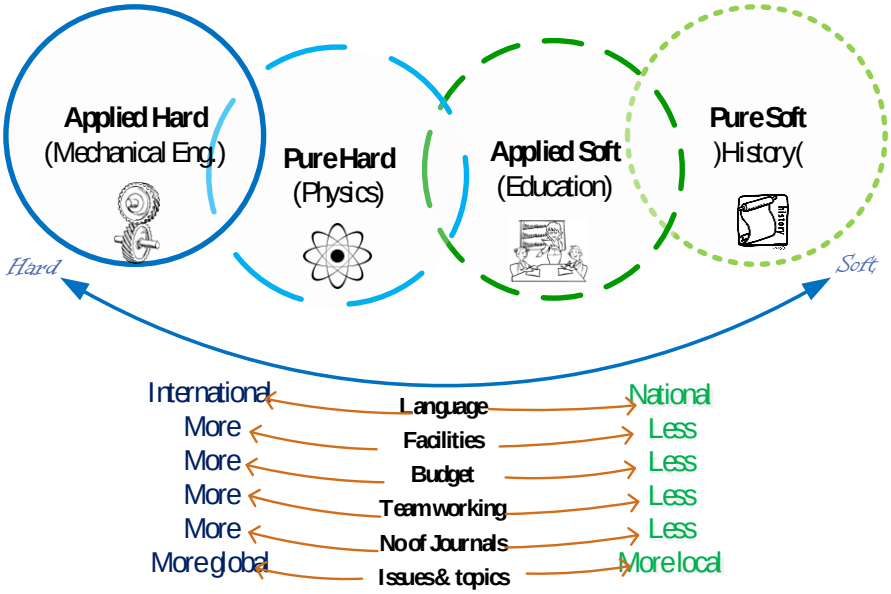

Figure 3. Typology of scientific fields and their features

A glimpse at the reasons causing lack of continuity in scientific activity shows that the majority of the factors are related to the system in which universities work and they need to be addressed systematically. Over the years, this factors have created an unsuitable academic culture in Iran in which scientific community and scientific spirit has been lost. The government and the ministry of science need to take measures in order to improve this situation.

As suggestions for further research, successful researchers should be deeply studied in order to find out about the critical success factors in science. We need to understand what factors also contribute in the success of a researcher in Iranian society so we could promote that as best practice and a role-model for other researchers.

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