

## *An exploratory study of co-authorships among Iranian scientists in experimental sciences*

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### *Abstract*

This paper investigates the factors that made international co-authorship between scientists in Iran and elsewhere possible. A questionnaire was sent out to Iranian scientists in fields of physics, chemistry, and biology who had co-authored an internationally published journal article during 2003. The main foreign co-author in each of the articles was identified and questions regarding this co-author and the collaborative event were asked. The results show that not all co-authored articles were the results of collaborative projects. Also, the main collaborative motives behind the co-authorships were identified and described. Among these, we could mention sharing laboratory devices, accessing knowledge, and increase the efficiency of the study at hand. It is clear that emigrated Iranian scientists play an important role as collaborators and probably also as links to the international scientific community as a whole. Cultural factors mix with scientific and work related ones.

## 1. Introduction

Studies of research collaboration have been frequent in the field of scientometrics and bibliometrics, and often co-authorships are used as an indicator. There has been extensive mapping of the collaboration pattern of individual countries [1-5], investigations of particular scientific fields [6-8], as well as studies on methodological issues [1,9,10]. Co-authorship as indicator of research collaboration is not without reservations, and in particular it has obvious drawbacks when it comes to the character of research collaboration, or other features which may be of a more qualitative kind. As a tool for quantitative measures of research collaboration, it has anyhow become generally accepted.

Patterns of research collaboration regarding Iran are yet to be disclosed. There is reason to believe that the structure and the characteristics of Iranian research collaboration partly differ from that of many other countries, especially when it comes to international research collaboration. If true, this difference could be a result of Iran's often complicated relationships vis-à-vis many Western countries, but also because Iran has experienced a large brain drain that might be of importance. At the same time, Iran is not undeveloped in scientific terms, but has a highly trained scientific workforce in many areas.

International collaborations in science and technology have become of high interest for the Iranian government and policy makers. As stated by Osareh and Wilson, researchers working in Iran have been encouraged by the Iran's Ministry of Science, Research, and Technology to have their articles published in highly ranked international scientific journals [5]. Moreover, in the Proclamation of the Vision Iran 2025 (a governmental long term policy document), we read: "(Iran) shall become more involved in contributing to the world's scientific production..."[11]. This proclamation which was legislated in November 2004, shows the governments interest and emphasis for scientific research and collaborations.

It is thus of interest to further investigate international research collaboration from an Iranian perspective, in particular to better understand how research and research collaboration is carried out in Iran.

Here, we are primarily interested in the *fundamental* features that the international research collaboration has from an Iranian point of view. We wanted to discover scientometric and bibliometric related research priorities regarding international research collaboration in Iran, and we see this approach as a starting point. Especially we wish to pay attention to the following questions:

- What educational and scientific characteristics have the collaborating Iranian researchers?
- What are the characteristics of the collaborators?
- What is the reason for involving in international research collaboration?
- To what extent do cultural factors seem to influence the collaboration?

In order to meet these questions, a sample of Iranian article authors has been selected. We have limited the study to three main disciplines: physics, chemistry, and biology, and to one specific year, i.e. 2003. A questionnaire was sent to the authors with questions about the international collaboration that they were involved in.

Clearly, this study is an exploratory study of a limited sample of authors who have engaged in collaborative activities, which led to co-authored journal articles. The findings cannot be generalized beyond the sample as such, but as a context-bond generalization, they are well justified. The purpose is to reveal some structural patterns with respect to the collaborative event and entail a few conclusions regarding the Iranian context and make suggestions for further studies. The study of research collaboration in Iran is still in an initial phase.

## 2. *Theory*

A number of studies have discussed the ambiguous definition of research “collaboration” [e.g. 12,13].

de Solla Price was one of the first researchers who stated the assumption that co-publication was evidence of collaboration in academic research and that publishing together is the result of working together [14]. However, the different individuals’ conception of collaboration has led up to different ways of listing “co-authors” on the papers, as the collaborators’ involvement could vary in a wide range. From one point of view, gaining ideas on how to conduct research, or how to use a specific laboratory device, or even a communication around a chemical formula, are all examples of collaboration [13] and it is possible that the involved colleagues are to be listed as co-authors. In some contrast Melin and Persson define collaboration as follows: “Collaboration is an intense form of interaction, that allows for effective communication as well as the sharing of competence and other resources” [15].

Hence, there are different factors which encourage collaboration among scientists and ultimately the writing of a co-authored paper. Perhaps ‘sharing’ and ‘using’ what one does not have is the main motivation for starting a collaboration which could result in a co-authored paper. From this point of view researchers have identified various reasons for collaboration. Katz and Martin have stated six main factors motivating collaboration: “escalating costs of conducting fundamental science, falling cost and growing ease of communication, need for interactions with other scientists, increasing need for specialization, growing importance of interdisciplinary fields, and political factors” [12]. Among other factors one could note the sharing of knowledge and transmitting information, access to equipments and resources, the division of labor, sharing costs, higher quality of the research are recognized as other factors motivating collaboration[16-19]. Kim believes that international research collaboration in peripheral countries often functions as a way to attain knowledge and techniques from advanced countries [10].

Gaining better prestige, higher citations and increasing output are the main reasons persuading scientists to take part in writing a co-authored paper [7, 8, 17]. Also earlier results show that internationally co-authored papers enjoy higher citation impact in comparison with domestic papers [8].

Research exchange including fellowships, workshops or other meetings, cooperative projects or networks are examples of how the collaborators usually meet each other [17, 19]. However as Georghiou mentions, emigration of scientists who maintain links with colleagues in their country of origin plays an important part in initiating international collaborations [19]. The rate of collaboration could vary depending on the fields of study that the collaborators belong to [18]. This rate is usually higher in natural science, medicine and technology than in humanities and social sciences [16].

## 3. *Method*

As a tool of investigation, we designed and developed a questionnaire. The questions focused on how the collaborators had met and what the character of the collaboration was. Questions regarding factors that made the communication possible like using e-mail, knowing the same language and having similar cultural backgrounds, were also asked. Yet other questions targeted the reasons for writing a co-authored article and motivations for starting a collaborative project. The respondents were most often asked to grade the importance of these factors.

First, all Iranian authors in the fields of physics, chemistry, and biology who had at least one internationally co-authored article were selected from a database at the Scientometrics Division of the National Research Institute for Science Policy in Iran. This database contains retrievals of the names of Iranian authors who had articles indexed in Web of Science (by Thomson Scientific) during the year 2003 in all fields. During that year 2782 papers had been published in WoS-listed journals by scientists with an Iranian address, and 25% of those were internationally co-authored. In the fields of physics, chemistry, and biology 224 papers were internationally co-authored. Some authors may for various reasons decide to list more than one address, which may or may not mean that several

institutions have contributed to the reported work [15]. We discovered six papers in our sample where authors had more than one affiliation: one inside Iran and one outside; these papers were deducted. Thus, our sample contains a total of 218 internationally co-authored papers; 83 belonging to physics, 77 papers to chemistry, and 58 papers to biology.

Some of these 218 articles are naturally written by more than one Iranian author; an article may be written by one or several Iranians and one or several foreigners. Also, some Iranian authors in our sample may have written more than one article. As we wanted to ask questions about one specific collaborative event – one co-authored article – we decided to select only one Iranian author per article and each author could only give answers regarding one article. We made efforts to select the Iranian author who seemed to be most responsible in the collaboration, for instance because the alphabetical order of names indicated that one had done a major part of the work compared to the other co-authors. When there was no such indication, we simply selected the one who stood first of the Iranian authors on the list. In a few cases after we had sent out the questionnaire, it was returned with the note that one of the other Iranian authors of the paper at hand had been mainly responsible and therefore was more in the position to answer the questions. We then forwarded the questionnaire to this person instead.

Regarding those authors who had written more than one paper, which were 29 altogether, having authored 86 papers, we selected the paper where they were listed as first author. When there were several such first authorships to choose from, we selected those which seemed to involve most foreign authors.

This operation decreased the number of authors who should receive the questionnaire to 161. In several of these cases we had to search for valid addresses at the universities' websites or through free search on the Internet. For nineteen people the address was not found, leaving 142 Iranian authors who we could address our questionnaire to. A pilot questionnaire was sent out to 20 of these authors. Thus, for our study, in the end a total of 122 questionnaires were sent out. Out of these 68 questionnaires were sent back after one reminder, a return rate of 56%. Of these, 26 were in physics, 20 in chemistry, and 22 in biology.

#### 4. Results

To begin with, we wanted to know some basic features of the respondents regarding their educational background. Out of the 68 respondents, four had a master degree. The remaining 64 individuals claimed to have a PhD degree. We continued by asking when this degree was received, and Table 1 presents the results.

Table 1: "When did you receive your last degree?" Whole counts.

Time	Number
Less than 5 years ago	27
5-10 years ago	26
More than 10 years ago	15

The distribution of degree holders seems balanced. Iran is a country which has seen a very rapid increase of its population over the last couple of decades, something that has resulted in an unusually low average age of the population today. In the group of respondents, there is however no sign yet (2003) of any dramatic increase of younger people with recent degrees who enter the scientific career. Possibly, it is still too early and there may very well be such demographically related signs in a few years time. Next, it is of interest to know what position they hold at the university. A distribution of the answers according to main university positions is given in Table 2.

Table 2: “What is your current university position?” Whole counts.

Degree	Number
Lecturer	2
Assistant Prof.	27
Associate Prof.	22
Prof.	13
Missing	4

The lion share have answered that they hold various kinds of professorship positions, primarily assistant or associate professor rather than full professor, but only very rarely anything else. A follow-up question targets to what extent they conduct research? Table 3 shows some findings regarding this question. Do note that academic staff who work as professor but primarily teach, may be heavily underrepresented in this sample, as it builds on people who have published scientific articles. Generalizations are thus not to be recommended, as we have mentioned before.

Table 3: “What percentage of your professional activities involves carrying out research?” Whole counts.

Research activities (%)	Number
0-25	1
25-50	9
50-75	21
75-100	36
Missing	1
Total	68

The individuals in our sample are working rather intensively with research tasks. A majority answer that they devote at least half their time to tasks which involve research, and often above 75 percent of their time too. Teaching and administration seem not to occupy too much of their time.

We mentioned before that Iran has experienced a large emigration, both as a result of the Islamic revolution in 1979, and later the war with Iraq which ended in 1988. Many Western countries host large Iranian minorities, groups who in some cases are fairly well educated. Thus, this emigration can in part be regarded as a brain drain. Can this be seen in our group of respondents? We asked in which country the respondents received their last degree? Of the 68 respondents every second one had received the degree outside Iran (Table 4). United Kingdom and United States are the most common countries, not too unexpectedly. It may be worth noting that these Iranians seem more oriented towards Europe than to the otherwise highly attractive USA. This may be a consequence of the political tensions between Iran and the U.S.

Table 4: “From which country have you received your last university degree?” Whole counts.

Country	Number
Iran	34
UK	13
USA	8
France	3
India	3
Others	7

Of what nationality are the collaborators? Is there any correlation between the country where the respondents took their last degree, and the nationality of the collaborators? According to the results, which are presented in Table 5, there is a large share of Iranians who live abroad and maintain contacts with Iran. It seems that researchers in Iran are rather likely to collaborate with Iranian expatriates. A significant share also collaborates with American or Canadian colleagues. In order to avoid any possible confusion regarding nationality, we specifically asked if the foreign collaborator at

hand was originally Iranian or not. Twelve respondents answered yes to this question, compared to nine in the responses presented in Table 5. Thus, there is significant collaborative activities occurring between researchers in Iran and Iranians abroad in our sample.

Table 5: What is the nationality of the collaborator? Whole counts.

Nationality	Number
Iranian	9
American	8
Canadian	8
British	5
German	5
Australian	4
French	3
Italian	3
Japanese	3
Russian	3
Others*	14
Missing	3

\*Spanish, Chinese, Greek, Swiss, Indian, Lebanese, Malaysian, Pakistani, Austrian, Romanian, Swedish, and Turkish.

How have the researchers in our sample met their foreign collaborators? When asking the respondents about this, the most common responses related to shorter or longer studies abroad, either when participating in a course (including sabbaticals) or when studying for a full university degree. This is shown in Table 6. We added a question to those who studied abroad for a full degree (altogether fifteen individuals) about what the role of the collaborator had been when they met. In a majority of these cases the collaborator had been supervisor or advisor of some other kind. Of the eleven respondents who said that they had met their collaborator during an international workshop or conference, four said that the meeting took place in Iran. Although this is not a high figure for giving a general idea, it may be interesting to note that organizing international scientific gatherings in Iran has become more common as a way of initiating communication between Iran and other parts of the world. Support provided by the government for such events has probably been a motivation for different institutes to arrange meetings.

Table 6: “How have you met the main collaborator?” Whole counts.

Ways of meeting	Number
Doing a course abroad (including sabbaticals)	18
During studies for a university degree abroad	15
Attending an international meeting	11
Introduced by other researchers	7
Working at the same lab.	5
Review of the Iranian scientist’s paper by collaborator	4
Review of the collaborator’s paper by the Iranian scientist	4
Others (friendship or family)	4

How long have they been working together? Table 7 shows a distribution in two-year windows. More than half of the respondents declared that they have been collaborating with their foreign colleague from two to six years time. 37 of the 68 respondents say that they had published a scientific article with the same collaborator before.

Table 7: How long has it been since you started scientific collaboration with this colleague? Whole counts.

Years	Number
Less than 2	2
2-4	24
4-6	18
6-8	5
8-10	3
more than 10	8
missing	8

Already in the pilot study we found that not all papers were based on collaborative projects. We therefore asked if the co-authored paper had been based on a collaborative project or not. To our surprise, 27 of the 68 respondents said that the paper had not been based on a collaborative project. We continued to ask those respondents for the main reasons for listing the collaborators' names as authors of the article. The main reasons were "using data gathered under the supervision of the either sides" and "intellectual participation".

Table 8: "What has been the reason for the statement of the names?" More than one reason allowed. Whole counts. (n=27)

Reason	Number
Using data gathered under the supervision of the either sides	12
Intellectual participation	10
Corresponding authors	4
Scientific editor	3
Acknowledgement	1
Moral reasons	1
Others	1

The 41 respondents who had answered that the paper was the result of a collaborative project, got another question instead of the one above. We asked for the motivation for participating in that collaboration, and the answers are presented in Table 9.

Table 9: Motivations for participating in a collaborative project. Whole counts. (n=41)

	Very important	Important	Fair importance	Low importance	Unimportant	Missing	Total
Getting familiar with new equipments	17	8	1	5	5	5	41
Using lab. instruments	16	5	6	3	6	5	41
Use of species	4	5	4	4	14	10	41
Reducing the time for carrying out a project	11	5	11	3	5	6	41
Using grants	11	9	8	2	7	4	41
Using the knowledge of collaborators	24	12	4	0	1	0	41
Increasing the work's accuracy	19	9	8	2	3	0	41

Finally we also asked about the funding. We were interested in whether the project had been financed by Iranian funding sources or by foreign ones. Most usual was a mix of foreign and Iranian funding, and almost as common was sole foreign funding. 6 of the 41 collaborative projects had sole Iranian funding (Table 10).

Table 10: “How had the projects been financially supported” Whole counts. (n=41)

Financial Source	Number
Iranian source	6
Foreign source	16
Mix of Iranian and foreign funding	18
Missing	1

## 5. *Conclusions and Discussion*

We set out with four specific questions which we have attempted to answer:

- What educational and scientific characteristics have the collaborating Iranian researchers?
- What are the characteristics of the collaborators?
- What is the reason for involving in international research collaboration?
- To what extent do cultural factors seem to influence the collaboration?

In brief, the Iranian researchers in this study devote a majority of their time to research tasks, and they often work as either full professor, or as assistant/associate professor. This indicates that the ones who engage in international collaboration in Iran are experienced scientists rather than junior researchers. Many of them have met their foreign collaborators during visits abroad, be they longer or shorter. Many of them have foreign university degrees. When we look at the foreign collaborators, we realize that many of them are Iranians of origin. This groups seems to be of high importance to the Iranian scientists (in Iran) as they may function as a link towards the scientific community in other countries, beside being collaborating partners themselves. Cultural circumstances do influence scientific collaborations and it is thus all natural that Iranian expatriates play an important role for Iranian scientists in their efforts to reach out into the international scientific community, as well as getting access to information and take part in international networks. The reasons or motives for participating in international research collaboration encircle increased efficiency on the one hand, and benefit from the collaborators’ knowledge or equipment on the other.

From our study two major issues emerge that are worth further and deeper investigations. One is the composition of our data, which is an empirical issue, the other is the question of the nature of collaborators which has theoretical interest beyond our study.

(a) *Composition*: We observed that a large share of the collaborators were expatriate Iranians. This gives to our sample a touch of ethnicity – notwithstanding the specialty of the collaborators. In principle, one should expect a more distributed nationality structure, making the collaboration of a more scientific nature rather than springing from an ethnical cohesion. However, from an Iranian national point of view, one could imagine that this ethnical bias in our data could well be exploited to enhance the intensity of frontier research in the Iran, if properly encouraged and supervised.

(b) *Intellectual Participation*: We observed that a good part of our respondents defined the nature of their collaboration as “intellectual participation” although not the result of a collaborative project. However, for various reasons this could be interpreted as a cover term for many non-scientific implicit intentions (such as better recognition, gaining higher citation, prestige for national reasons in our sample).

In order to gauge this variation, we suggest a more detailed study to be undertaken. But the notion of “intellectual participation” seems to be in itself significant enough to pay more attention to it on a different scale. Therefore we would suggest that a detailed study of co-authorships to be undertaken in a multi-national environment like European community in order to discover its position



in various scientific collaborations not emerging from a genuine collaborative project. Such study would enjoy a statistical property not part of our sample, and would naturally cancel the ethnicity bias which we observed in the case of our own sample.

Acknowledgement: Goya Harirchi wish to thank Dr. Masoumeh Baghery from University of Tehran for advise and valuable comments on data and drafts.

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