



Iran's Science Diplomacy: A Holistic View



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Introduction

Nowadays it is widely acknowledged that science, technology, and international affairs affect one another, bearing pervasive mutual influences. It goes without saying that globalization has considerably enhanced and extended the importance of science and technology (S&T) for and in international relations (IR) beyond their traditional domains. National policy-making, for instance, today can no longer afford to ignore S&T developments and activities abroad, especially not those of rival countries. At the same time, S&T issues underpin many concurrent global challenges while scientific collaboration clearly bears upon social capital and trust-building badly needed to nourish civil relations between different and above all adversarial countries or cultures (Flink and Schreiterer, 2010).

The term 'science diplomacy' is a relatively new one and reflects the fusion of two previously distinct elements: science and diplomacy. Science is an evidence-based form of knowledge acquisition. Also, Diplomacy is a non-violent approach to the management of international relations characterized by dialogue, negotiation, and compromise. Science diplomacy, therefore, is the process by which states represent themselves and their interests in the international arena when it comes to areas of knowledge acquired by the scientific method. Science diplomacy is increasingly critical to addressing many of the planet's most urgent challenges such as management of the global commons, faltering public health systems, and the threat of collapsing ecosystems (Turekian et al., 2014).

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Science diplomacy's direct relationship with national interests and objectives distinguishes it from other forms of international scientific cooperation, which are sometimes commercially oriented and often occur without direct state participation. Thus, international science cooperation and science diplomacy are overlapping endeavors: they are related, yet analytically separate. International science cooperation is mainly concerned with the advancement of scientific discovery, while the central purpose of science diplomacy is often to use science to promote a state's foreign policy goals or inter-state interests. In other words, international science cooperation tends to be driven by individuals and groups, whereas science diplomacy, while it may derive from the efforts of individuals, often involves a state-led initiative in the area of scientific collaboration (Turekian et al., 2014).

Governments are well aware that S&T cut across national politics and feel confident they can be engaged to tackle and hopefully solve these global problems. However, the degree to which their international S&T policy is guided by one or the other strand of reasoning, by offensive or defensive objectives or by a blend of all these varies considerably. Also, the great variety of approaches, both in goals and means, suggests it is futile to look for a one-size-fits-all model to deal with international S&T and science diplomacy. Instead, different institutional settings and political trajectories, interests and governance modes entail different approaches that are still difficult to clearly tell apart (Flink and Schreiterer, 2010).

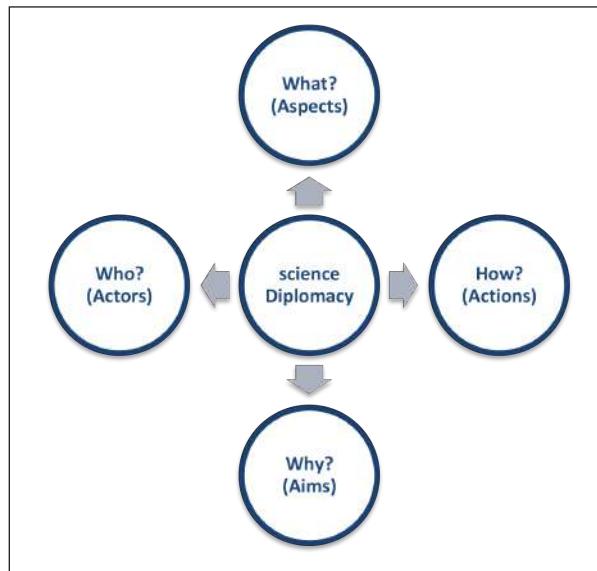
Not only there are not plenty of literatures about science diplomacy, but also it is relatively difficult to find some previous work that proposed a holistic view of science diplomacy. Some of them focused on goals and objectives (Nye, 1990; Flink and Schreiterer, 2010), while the others highlighted initiatives and activities (Leach, 2015; Gluckman et al., 2017). Therefore this paper aims at proposing a comprehensive model about science diplomacy that consists of four key components including aspects, aims, actions, and

actors through reviewing the current literature and body of knowledge of science diplomacy. These components respectively refer to what, why, how and who questions regarding science diplomacy. After that, this paper intends to shed light on Iran's science diplomacy regarding these four components. The remainder of this paper is organized as follow: in session 2 the proposed model was introduced and explained; in session 3 some evidence and examples about Iran's science diplomacy were presented, and session 4 includes a summary and some concluding remarks.

Literature Review and Conceptual Model

As mentioned before there are two shortcomings in science diplomacy literature. Firstly, since science diplomacy body of knowledge is very thin, there are few previous studies in this area in terms of journal articles and books in comparison to some other areas such as science, technology and innovation policy (STIP). Secondly, most of the existing works focused on some components of science diplomacy like science diplomacy goals and objectives (Nye, 1990; Flink and Schreiterer, 2010) or initiatives and activities (Leach, 2015; Gluckman et al., 2017) and they didn't develop and proposed a comprehensive model. To address above-mentioned shortcomings, this paper aims at proposing a big picture or holistic view of science diplomacy that consists of four components including aspects, aims, actions, and actors through reviewing the current literature and body of knowledge of science diplomacy. The above-mentioned components respectively refer to four question regarding science diplomacy: what, why, how and who?. The proposed model for science diplomacy is displayed in Figure 1. By applying this model not only we can analyze and investigate science diplomacy in individual countries, but also we can do some comparative case studies about different countries experiences. Moreover, through employing this model we will be able to recognize the deficiencies and weaknesses of science diplomacy in different countries and propose some policy, program and initiatives for strengthening one country's science

diplomacy. The components of the model are introduced below.



What (aspects)

Science diplomacy consists of three aspects as follow diplomacy for science, science in diplomacy and science for diplomacy.

Diplomacy for Science

This aspect of science diplomacy seeks to facilitate international scientific cooperation in both top-down strategic priorities for research and bottom-up collaboration between individual scientists and researchers' (The Royal Society, 2010)

Science in Diplomacy

Many of the major challenges facing states are increasingly global in nature and scale, and have science and technology in the fingerprint of their cause or cure. Science in diplomacy describes the role of science and technology in providing advice to inform and support foreign policy objectives. The function of science in diplomacy should be to ensure the effective uptake of high-quality scientific advice by policy makers (National Research Council, 2002). Nowadays it is essential for diplomats and foreign affairs policy makers to know about key trends in some areas such as nuclear energy, new and renewable energies, climate change, ICT revolution, nanotechnology, biotechnology, industry 4.0 and etc.

Science for Diplomacy

Science for diplomacy is the use of science to help build and improve international relations, especially where there may be strain or tension in the official relationship. Science for diplomacy primarily draws on the 'soft power' of science: its attractiveness and influence both as a national asset and as a universal activity that transcends national or partisan interests. Perhaps the real promise of science for diplomacy, however, lies in its ability to develop stronger links between countries in which the political environment is tense and official relationships are strained or limited (Lord and Turekin, 2007).

Why (aims)

We can divide the aims of science diplomacy activities into two levels including national and international level.

National-level

Accessing to researchers, research findings and research facilities, natural resources and capital is one of the national-level aims of science diplomacy. Here, the thrust is to improve national innovation capacity and competitiveness by way of benchmarking international R&D trends and policies; spotting new technologies, scientific discoveries and research potentials; seizing new markets, knowledge and key technologies; and attracting foreign talents and investments. Also, promotion of a country's achievements in R&D is another national-level aim of science diplomacy. As part of a nation's global marketing efforts, SD and collaboration in S&T are geared to attract the world's best students, researchers, and companies. Getting them interested in its R&D may help raise the country's academic capacities, reputation and performance, stir innovations or enhance its innovative capacities, and lay grounds for sustainable international partnerships of mutual benefits (Flink and Schreiterer, 2010).

International-level

Apart from strengthening a nation's knowledge and innovation base, international scientific cooperation comes to be seen as an effective agent to manage conflicts, improve global

understanding, lay grounds for mutual respect and contribute to capacity-building in deprived world regions. All in all, it has become subject to policy initiatives around the world, though its scope and objectives, instruments and intensity differ widely (Flink and Schreiterer, 2010). The ongoing de-nationalization of scientific research (Wagner and Leydesdorff, 2005), economic globalization, and growing international competition on all markets for goods and services keep extending the playing fields of international relations. Science and Technology have gained an important and ever-increasing role in the competitive quarrel for market shares, power, and influence (Skolnikoff, 1993; Wagner, 2002).

The more a nation's prosperity and economic success hinge on its ability to tap into global resources and to attract talent, capital, support and admiration, the better it is advised to look for strategies to use its R&D assets most effectively to secure competitive advantages. At the same time, global phenomena such as climate change, infectious diseases, famines, migration, nuclear non-proliferation or terrorism call for international collaboration in S&T to tackle, or at least to ease, the many multi-faceted problems they raise or entail (Flink and Schreiterer, 2010).

Access-driven initiatives also carry opportunities for value-driven or merely instrumental activities to ease tensions between states, build trust, and manage or prevent conflicts which may or may not be made explicit goals. Furthermore, access is crucial for extremely expensive 'big science' projects that no country can afford to run alone, such as the International Thermonuclear Experimental Reactor or the International Space Station. Often times, even if not always, collaborative projects and programs of such a size are pitched under multilateral international S&T umbrella agreements (ISTA) (Flink and Schreiterer, 2010).

How (actions)

In general, science diplomacy actions are designed to meet some local needs, to address cross-border interests and to solve some global challenges.

Actions designed to directly advance a country's national needs

Science diplomacy can be enlisted to meet a range of national domestic needs, from exercising soft power to serving economic interests to promoting innovation (Gluckman et al., 2017).

- Exercising soft power: The concept of "science for diplomacy" emerged originally to describe the aspiration by larger countries to project their culture and influence beyond their boundaries. More recently, smaller countries have discovered the value of science in asserting themselves on a global stage and increasing their relevance to international policy discussions.
- National security and emergency response: National security needs are dominated by science, on a number of levels. Establishing and maintaining the confidence needed for many arms control treaties depends on scientific verification.
- Economic dimensions: In the twenty-first century, trade and diplomacy are intimately linked and, in many countries, organizationally linked within the same ministries. Correspondingly, trade in advanced technologies and technology-based services is on the rise. Given the global value chain encompassing intellectual property, data, and manufacturing, multiple countries are often involved in developing a single product. In turn, innovative countries seek out one another to achieve synergy toward optimizing such products. At the same time, countries look for advantages regarding the sale and protection of products with a high intellectual component. Thus, recent trade negotiations have been heavily invested in debate and negotiation about intellectual property, copyright, software, and advanced biologics. Scientific input into such negotiations is critical to protect national positions.

Actions designed to address cross-border interests

In addition to engaging in the actions described above, a country can serve its national interests

by using science to address specific bilateral or cross-boundary issues. One obvious case involves the management of ecosystems and resources that span jurisdictional borders. Clearly, matters relating to trans-border shared resources such as gas fields, fish stocks, rivers, and watersheds all have large scientific components, meaning that diplomatic efforts without adequate science can be ill-directed (Gluckman et al., 2017).

Actions primarily designed to meet global needs and challenges

In expanding the scope beyond national interests, one encounters truly global problems such as climate change, ozone depletion, global biodiversity, and marine pollution. On these topics, there is often greater focus on the perceived immediate interest versus longer-term implications that expand beyond traditional political timescales (Gluckman et al., 2017). Some examples of science diplomacy actions at different levels are presented in Table 1.

In addition, several science diplomacy actions are proposed regarding three main aspects of science diplomacy (Diplomacy for Science, Science in Diplomacy and Science for Diplomacy) in table 2.

Who: actors

To be successful in doing SD by any measure, a country has to be very clear about both its overall strategy and who should be in charge to carry it out. Often times, potential partners abroad do not know what is being offered to them and to whom they can turn with questions, project proposals, or grant applications. Regardless of which goals come first, which strategy looks most promising, and up to which department or agency it is to carry them out, ‘leadership’ becomes crucial in what has become a global war for talents and opportunities. Many of the obvious shortcomings, ambiguities, and inefficiencies in the ways to do science diplomacy can be associated with a lack of leadership, starting at the level of agenda-setting up to the ‘machinery of government’. Yet this does not mean that any compelling SD has to start with convening top-ranking committees to elaborate strategic guidelines that then need be pushed down the throats of the executive branch for successful delivery. Rather, the challenge lies in an effective, recurrent and sustainable combination of bottom-up interest aggregation with strategic decision-making (Flink and Schreiterer, 2010). Nowadays plenty of actors including governmental actors (e.g. Ministries of Science and Technology, Ministries

Table 1. Science diplomacy actions in different levels (Gluckman et al., 2017)

	Actions
National needs	<ul style="list-style-type: none"> • Influence, soft power, and reputation: bilateral relations; projections and development assistance • Security: crisis, emergencies, disasters, and threats • Economic: trade, innovation, standards, and definitions • National needs and capabilities: technical capabilities, access to know-how and development of domestic STI
Common interests across national boundaries	<ul style="list-style-type: none"> • Trans-boundary and regional issues • Standards and definitions • Shared technical services • Crisis and disaster management • Social licensing for new technologies • Big science
Global interests	<ul style="list-style-type: none"> • Shared challenges across borders • Ungoverned spaces

of Foreign Affairs, Universities and GRIs) and non-governmental actors (e.g. Think Thanks, Private research institutes, and companies) are active in science and technology diplomacy activities in terms of policy-making, programming and implementing strategies).

Iran's science diplomacy

This session encompasses some information and evidence about Iran's science diplomacy in terms of aspects, aims, actions, and actors.

Aspects and Actions

In this session some actions are presented in terms of diplomacy for science, science for diplomacy and science in diplomacy (Table 3).

Aims

The general aim of Iran's science diplomacy is creating a co-operation between diplomacy and science and technology through the expansion of interactions between governments, institutions and specialists in order to use the diplomacy capacities to develop the country's science, technology and innovation, and mutually to use the country's scientific and technological capacities and capabilities to advance foreign policy goals. Also, Iran's science diplomacy seeks for some International aims including the use of scientific and technological capabilities to advance political goals and use diplomatic capacities to advance scientific and technological goals in order to facilitate and facilitate bilateral or multilateral relations between countries, both to meet the interests of the countries involved and to solve

Table 2. Science diplomacy aspects and actions (Leach, 2015)

Aspects/ Actions	Professional Science Communication	Popularization of Science	Science Communication Policy
Diplomacy for Science	Researchers communicating to establish large-scale, international cooperation in science	Public relations and journalism activities raising awareness of outcomes of large-scale international projects	National attempts to give researchers skills in organizational communication, negotiation, and intellectual property issues
Science in Diplomacy	Initiatives by research bodies to communicate the potential of research to solve policy problems, to open dialogue, and give advice about the regulation of science and technology.	Targeting policy-makers as a key audience for research results and outcomes	National attempts to encourage researchers to communicate with policy makers and embed research in governmental processes
Science for Diplomacy	Researchers communicate with collaborators across national divides and despite restrictions	Popularization encouraging high levels of general scientific literacy, awareness, and dialogue about science and technology	National encouragement and support for international research through communication skills, cultural programs, and language programs to increase capacity for international collaboration as well as facilitate international dialogue about contested science and technology.

Table 3. Some science diplomacy actions in Iran

Aspects	Actions
Diplomacy for science	<ul style="list-style-type: none"> • To follow up of international cooperation projects for the development of education (inviting foreign professors to teach in the country) and an international cooperation plan for the development of applied research (conducting bilateral or multilateral research) • Membership in international assemblies (e.g. CERN) • To Identify overseas elites and to facilitate their cooperation with Iranian researchers • To Identify internal capabilities and to Introduce these capabilities and opportunities to international scientific assemblies • To facilitate studying abroad for Iranian researchers and students
Science for diplomacy	<ul style="list-style-type: none"> • To expand the Persian language in international scientific society • International collaborations (human resource exchanges), holding workshops and regional/international conferences, supporting conferences and workshops) <ul style="list-style-type: none"> • To attract, train and send people to different countries • Networking with other scientific centers, concluding scientific agreements • To attract foreign professors, researchers and students • Training and introduction of science and technology affiliates • Supporting and holding international conferences and workshops (e.g. Inotex, participation in the meeting of ministers of science in non-aligned countries, etc.) • Conducting consultative studies on other countries, providing technology donations to host delegations • To hold and support global, regional and Islamic events • Educational interactions and human resource exchanges • Networking among people
Science in diplomacy	<ul style="list-style-type: none"> • Networking, membership, and communications with international professional organizations • Conducting study and research activities • To provide human resources empowerment services at the state department • Education (Faculty of International Relations), providing advice on required political issues (Bureau of Political and International Studies of the Ministry of Foreign Affairs) <ul style="list-style-type: none"> • To educate and to introduce science and technology affiliates, conduct advisory studies on other countries • Bilateral cooperation (design and creation of the High Commission for Technology Cooperation with Russia, China Silk Road Science • To facilitate interaction with China, joint programs with countries such as Indonesia, Singapore, etc.), • To facilitate communication mechanisms among key actors (State, Financial, and ...)

international challenges. Moreover, Iran's science diplomacy aim in national-level is maintaining and enhancing the country's scientific and technological assets while trying to influence decision-making levels of other countries to strengthen the national authority and increase international influence by combining scientific and technological capacities and diplomatic capabilities.

Actors

We can divide Iran's science diplomacy actors into three levels including:

- High-level performers: Vice Presidency for Science & Technology, Ministry of Foreign Affairs, Ministry of Science, Research and Technology.
- Intermediate actors: Center for Innovation and Technology Cooperation, Center for International Scientific Cooperation, Center for International Scientific Studies and Collaboration, Iranian Research Organization for Science and Technology, Institute for Political and International Studies, Students

Affairs Organization, universities, other ministries

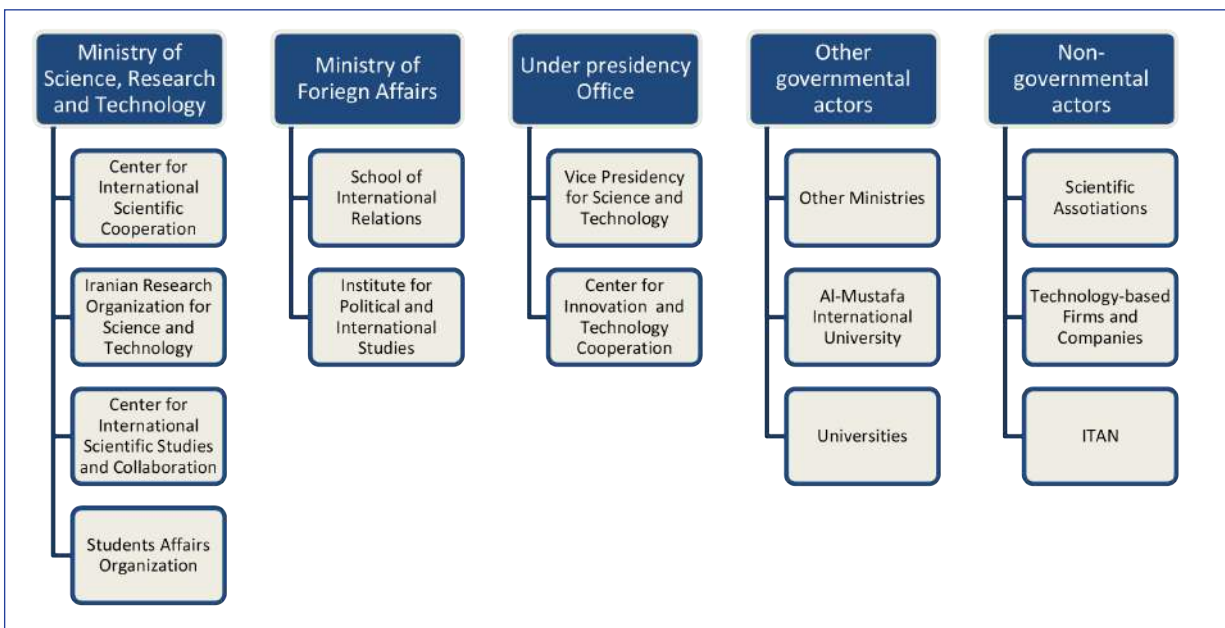
- Actors at lower levels: Scientific Associations, School of International Relations, Technology-based Firms and Companies and non-state actors.

Different actors of Iran's science diplomacy are introduced in Figure 2.

Summary and Conclusion

Science diplomacy should be a serious part of every nation's tool kit, whether the country is large or small, developing or wealthy. But it cannot be instituted capriciously. Science diplomacy requires a structure that must encompass not only the promotion of international science, as covered by many science agencies, but also explicit attention to issues on the national, regional, and global levels. Technical ministries and foreign ministries thus have compelling reasons to work more closely, and with greater coordination, and to recognize the need for specific expertise for the good of the planet and

Figure 2. Different Actors of Iran's Science Diplomacy



the reduction of transnational conflict (Gluckman et al., 2017). In current paper, in order to enhance our understanding of science diplomacy, a comprehensive model was proposed that consists of four main components including science diplomacy aspects, aims, actions, and actors. After that, this model was employed to shed light on Iran's science diplomacy. Some key findings regarding Iran's science diplomacy are presented below:

- The role of governmental actors in the field of science and technology diplomacy in Iran is a significant role, as many actions are also carried out by these actors. In Iran, non-governmental and academic actors (universities, associations, and think tanks) mainly carry out purely technological and non-political activities, and their potential capacity in the field of science and technology diplomacy has not become the actual capacity. In other words, both scientific and political activities are mostly carried out by governmental actors.
- A large share of science diplomacy actors in Iran is related to the Ministry of Science, Research and Technology (MSRT). Also, the variety of actions taken by the Ministry of Science, Research and Technology in the field of science diplomacy is so high that it covers all three aspects of science diplomacy.
- The Ministry of Foreign Affairs actions are limited to science in diplomacy and merely the empowerment of human resources. Although these dimensions are very important for the nature of Ministry of Foreign Affairs as the main actor in the field of science and technology diplomacy, it has not taken other actions on other issues, except for certain issues (such as nuclear negotiations).
- The Vice Presidency of Science and Technology has been pursuing diplomacy in two aspects of science for diplomacy and science in diplomacy, but it can be said that, these actions should be expanded to a greater degree in diplomacy for science and science in diplomacy.
- It seems that the actions of each group of actors are largely parallel to other actors and there

is a lack of inter-organizational mechanisms that help to integrate and coordinate these actions to cover all three dimensions of science diplomacy.

- In the structure of Iran's science and technology diplomacy, there is no specific organization for planning and setting short and long-term targets in this field (similar to the CSTI in Japan). So, various actors, based on their interests, benefits and organizational goals are working on this topic.
- Due to the lack of purpose and division of labor in this area, actors do not know their roles and do not create the required capacities and capabilities to play role in their specific positions. As a result, the scene of science and technology diplomacy, without a coordinator organization, various actors work individually and outputs are not tangible and inclusive. In addition, the resources and mechanisms for funding such activities are not enough and proper.

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