Role of Science Diplomacy in Addressing Monopolisation of Seeds' Market

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Introduction

Science diplomacy is often conceived as the use of the "soft powers" of scientific collaboration to smoothen the political relations between two or more nations. It has become common to refer to this conceptualisation of science diplomacy as "science for diplomacy", which must be distinguished from "diplomacy for science", which refers to establishing scientific collaboration between two or more nations with the goal to address common problems (Gluckman *et al.,* 2017).

The concept of science diplomacy was given contemporary emphasis and currency by a meeting held in 2009 at Wilton House, United Kingdom. The most influential outcome of that meeting was the development of taxonomy for science diplomacy that has come to be widely used: (Gluckman *et al.,* 2017).

Science in diplomacy: Science providing advice to inform and support foreign policy objectives.

Diplomacy for science**:** Diplomacy facilitating international scientific cooperation.

Science for diplomacy**:** Scientific cooperation improving international relations.

Bilateral relationship

India - Tunisia Bilateral Relations

India has traditionally maintained cordial and friendly relations with Tunisia since establishment of diplomatic relations in 1958. The first resident Indian Mission at the level of Cd'A was established in Tunisia in 1963 and raised to the Ambassador level in 1976. The Tunisian Embassy in New Delhi was set up in 1981. Tunisian leaders have expressed admiration for India's democracy and its leaders such as Mahatma Gandhi and state that India's freedom struggle has served as an

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inspiration for Tunisia. India accounts for around 50 per cent of Tunisia's global phosphoric acid exports.

Under the two governments of President Bourguiba and President Ben Ali, the two countries also shared a respect for secularism, and moderation was a hallmark of the Tunisian foreign policy. In the early 2000s, a substantial progress was made in bilateral cooperation in phosphates with the establishment in 2006 of a joint venture in this sector. In international fora including the UN, cooperation between Indian and Tunisia continues to be good – the countries supported each other's candidatures at several International bodies and continues to be in similar positions (MFA, 2019).

Science & Technology Cooperation

India-Tunisia Cooperation in Science & Technology is guided by the Agreement on Scientific and Technological Cooperation signed between the two countries in October 1995 and the Programmes of Cooperation there under. The 4th session of the Joint Committee on S&T was held in New Delhi on 23-24 March 2017. Both sides agreed to support 19 new R&D projects in areas including material science, ICT, health science, agriculture, biotechnology, renewable energy and water technology (EI/TBR, 2019).

How Seeds Become a Serious problem

Seeds are the primary basis for human sustenance. They are the repository of the genetic potential of crop species and their varieties resulting from the continuous improvement and selection over time.

Crop improvement and the delivery of high quality seeds and planting materials of selected varieties to growers is necessary for ensuring improved crop production and meeting growing environmental challenges. Food security therefore is dependent on the seed security of farming communities. (FAO, 2014)

Despite the clear advantages of improved varieties, especially with regard to yield, their use in subsistence agricultural systems must be appraised carefully. Because they are generally commercial products, they usually depend on market availability, are protected by intellectual property rights and often require more costly inputs like fertilizers and pesticides. In addition, some of them (like hybrids) require the purchase of seed every season.

Furthermore, the process of developing new varieties which have the desired characteristics and which have the requirements of distinctness, uniformity and stability takes a great deal of time and resources; at the same time, the resultant new varieties generally can be easily and quickly reproduced by consecutive seed-saving and replanting. For this reason, plant breeding companies usually protect their new varieties with intellectual property rights.

That is similar to the work pharmaceutical companies do to produce drugs that don't work, or do not receive FDA approval. In both cases, the company needs to make up for the cost of failed experiments by charging more money for the successful ones. As a result, when you pay for hybrid seeds, you are paying for both the successful and unsuccessful experiments. There is no way around this – after all, it's called "research" for a reason.

These important issues should be taken into account when planning the introduction of improved varieties because the issue will be transferred from the farmer to the decision makers or to the government, since the farmer will complain to the government which in turn encounters a lot of strategic and financial issues to plan the purchase of seeds each year with a monopolized market at rising prices from one year to another which has an impact on the economic balance.

Impact of hybrid seeds in world-market

Year in and year out farmers are losing the seeds from their own plants, and are forced to purchase them anew from seed providers. Monsanto has monopolized the seed market which has significantly limited the variety of plants available on the market. The consequences of which have had fatal effects on both our environment, and the farmers that harness crops from it. The seed industry is more concentrated today than it ever was before.

The ten largest seed corporations dominate three quarters of the commercial seed market. The top three of these, Monsanto, DuPont and Syngenta, represent more than half (53 per cent) of the market. Even more striking are the figures of genetically modified (GM) seeds - according to Greenpeace, Monsanto sold 90 per cent of GM seeds worldwide in 2009 (Reset, 2015).

Outlook for the impact of hybrid seeds in Tunisia

The use of auto species produced by farmers is steadily declining; it went from 65 per cent in 1975 to 42 per cent in 1994 and to 25 per cent in 2004. Among these species, some are characterized by their rarity (tomato, chilli pepper, potato, pasthéque, melon, wheat, barley…) and others are threatened with extinction Currently the selected varieties are widely distributed on farms that support themselves because of their high productivity and this is how hybrids and genetically modified organisms entered the country without anyone being able to report the reality While cereal crops and arboriculture (olive, fig, almond, palm, pomegranate, etc.), a very widespread culture in Tunisia, have kept their specificities (Dabbabi, 2013).

Outlook for the impact of hybrid seeds in India

As a result of a monopolized seed economy and the limited engineering of seed varieties, the overall loss of plant diversity has significantly increased. Over the course of the 20th century, according to the FAO, approximately 75 per cent of crop diversity has been lost. Before the Green Revolution in India there were roughly 50,000 rice varieties, and within twenty years this number dropped to a mere 40-40 from 50,000. Many of the new hybrid variations being created would not be able to keep up considering they share many genetic characteristics (Reset, 2015).

Science diplomacy holds enormous potential for solving problems and building international relationships

Science diplomacy is the use of scientific collaborations among nations to address the common problems facing 21st century humanity and to build constructive international partnerships. There are many ways that scientists can contribute to this process. The global food crisis of 2008 triggered food riots in more than 30 countries and calls for a new Green Revolution. The first Green Revolution, however, was relatively straightforward, if not easy:

Improved crop varieties and increased fertilizer use. The next Green Revolution will be more difficult, even if we succeed in overcoming the deep and widespread mistrust of using modern methods for the genetic improvement of crop plants (Fedoroff, 2009).

How do we as scientists begin to think—and act—on a global scale to address such complicated problems? We must first become citizens not just of our own nations, but of this world without borders. We need to see, experience, and identify with the peoples and the problems of other nations and to recognize the complexity and interconnections among the challenges facing humanity. And perhaps most importantly of all, we need to understand, at a deep gut level, that all our fates are truly intertwined. We must move quickly to develop the science that will allow us to model and understand the complex system that is our planet and its crust of human activities. We need to solve the small and poor farmer in developing country. We need to invest in the research that will allow us to improve how we manage water, grow food, battle disease, and build economies into the next generation— and the next. Science, of course, provides the common language to build bridges between cultures. Education is a stumbling block.

The Green Revolution in India and the establishment of multiple CGIAR Centres across many countries are some of the successful instances where the international partnerships in S&T ked by the national governments have played a critical role.

Speed breeding technology is a powerful tool to accelerate crop

The process of developing new varieties takes a great deal of time, therefore for most crop plants, the breeding of new, advanced cultivars takes several years. Following crossing of selected parent lines, 4–6 generations of inbreeding are typically required to develop genetically stable lines for evaluation of agronomic traits and yield, as a result the farmer cannot wait and he will need seeds to work, to live.

"Speed breeding" technology shortens the breeding cycle and accelerates crop research through rapid generation advancement. Speed breeding can be carried out in numerous ways, one of which involves extending the duration of plants' daily exposure to light, combined with early seed harvest, to cycle quickly from seed to seed, thereby reducing the generation times for some long-day or day-neutral crops.

Speed breeding can be used to achieve up to 6 generations per year for wheat, barley, chickpea and pea, and 4 generations for canola, instead of 2–3 under normal glasshouse conditions. The technique has also been successfully adapted to oat, various Brassica species, grass pea, quinoa, Medicago truncatula. (Watson *et al*, 2018).

Speed breeding in controlled environment growth chambers can accelerate plant development for research purposes, including phenotyping of adult plant traits, mutant studies and transformation. The use of supplemental lighting using LEDs in a glasshouse environment allows rapid generation cycling through single seed descent (SSD) and plant density can be scaled-up for large crop improvement programs.(Ghosh *et al*, 2018)

Conclusion and Challenges

Science diplomacy links the two policy domains of foreign affairs and science. Competitive thinking and the ways in which this affects global challenges are now putting the globalisation trends in science, technology and innovation under pressure.

In fact, international centers such as International Maize and Wheat Improvement Center (CIMMYT) and International Center for Agricultural Research in the Dry Areas (ICARDA) can supply developing countries and small farmers with varieties that have potential for tolerance.

Tunisia and India has increased cooperation during the last decades in different areas but it is still not sufficient, particularly, in science, agronomic research and technology disciplines. Compared to the number of scientists and researchers who are interested in pursuing their education or for capacity building training in India, the number of seats made available to them is much less. There is good potential but it is virtually unexplored. Addressing this issue is important for both the countries. Moreover, science diplomacy can play an important role in transferring the Indian technology in agricultural sector which it can be a first step forward to an ultimate Tunisian-India collaboration, initiatives and could be an excellent start up to fulfill above possible technologies to be transferred and shared. Therefore the establishment of good scientific relations between the two countries, many problems will be resolved and specifically the varieties problem which is becoming more and more serious in Tunisia. In fact, it is gradually starting to put small farmers into unemployment, which has an impact on young people who are increasingly leaving agricultural work.

Acknowledgment

Author would like to express gratitude to the Research and Information System for Developing Countries (RIS) and the Indian Technical and Economic Cooperation Programme (ITEC) Capacity Building Programme in Science Diplomacy, for this great opportunity and for their hospitality and willingness to host all participants during the training in Delhi.

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