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Representing US-India Agricultural Cooperation as a Game

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Introduction

Game Theory is a branch of mathematics that essentially analyses situations involving conflicting interests in terms of gains and losses among the players involved in a game. It first appeared in the west after the end of World War II and has, since then, been developed into a major field of study applied to a range of disciplines like economics, sociology, psychology and political science. Attempts have been made to demonstrate Game Theory's relevance to understanding the theoretical problems in international relations¹. The ultimate promise of game theory lies in moving beyond the restrictive confines of the traditional Realist perspectives of a zero-sum game to a more complex world where concern is less exclusively with problems of conflict and as much with problems of cooperation².

There has been resurgence in the application of Game Theory models to international political economy in addition to their now standard role in military-political strategic analysis³. A game refers to an interaction between a set of players, where each player has a set of strategies to choose from and the outcome of the interaction for any player depends not only on the strategy chosen by the corresponding player, but also on the strategies chosen by all the players.

A game is represented by defining the players involved, their strategic possibilities, their objective functions, their constraints, the order of the game and the payoffs to each player for each configuration of possible actions that can be chosen by all the players. Any possible stable outcome is an equilibrium referred to as the Nash equilibrium, referring to a strategy profile that includes a strategy chosen by each player. Games in international politics might have no equilibrium, or multiple equilibria, or a single equilibrium. Equilibrium in the Game Theory may not lead to a fair outcome, some players may be better off while others are made worse off. This according to the Game model has led to a social dilemma with the collective outcome leading all players to a worse-off position. A social dilemma calls for public intervention in terms of a new policy framework. A representation of real contexts as games helps us to understand the strategic underpinning between the different players involved in the game⁴.

Taking cue from this, this study attempts to represent US-India agricultural cooperation as a game. In case of US-India agricultural partnership, the key players from both countries that were

identified were the government, the opposition political party or parties, the private sector, non-governmental organisations and international events, on certain occasions. This study would demonstrate that through agricultural collaboration, there have been and espouses to have multiple equilibria.

US-India Agricultural Cooperation: Initial Decades

The social dilemma soon after India's independence was imminent from consecutive and massive droughts because of the failure of monsoons, due to which the nation's agricultural production and productivity dwindled, leading to massive unrest among the populace due to hunger and starvation. This was the first instance when there was public intervention in terms of a new policy framework that led to the invitation of US Land Grant Universities (LGUs) to set up similar State Agricultural Universities (SAUs) in the country and simultaneously requesting food assistance in the 1950s, the equilibrium attained was represented by the successful establishment of a total of nine agricultural universities in the country, with US assistance.

It produced an encouraging impact when other eleven agricultural universities were established in the several states of the country without any external help. In this case it can be argued that with the goal to assist the states in developing policies, plans and programs and providing advice on the organization, administration and operation; developing instruction, extension and research programs on ways and means by which the sons and daughters of rural people and others would be provided opportunities for training in modern agriculture; and help in the construction and maintenance of physical facilities and equipment of the universities⁵, the equilibrium reached led to a fair outcome and provided a revolutionary redirection of agricultural education in India, expressed commonly as the Green Revolution. Agricultural scientists in India were better able to connect with the farmers than they could twenty years ago. The integrated approach used by the land-grant universities, that is, making a single institution responsible for performing vital functions of teaching, research and extension education, made the farmer the ultimate beneficiary⁶. This went a long way in fostering vocation-oriented education for the rural young to serve the socio-economic needs of the large population of the country.

With the abrupt ending of the formal university partnership, mainly attributed to reasons of prevailing geo-politics in India's neighbourhood, that is the war with Pakistan in 1971 and the subsequent creation of a new state of Bangladesh, the equilibrium that eventually appeared in the Indo-US relations did not lead to a fair outcome for most of the players- scientists and the

academia working hard to achieve their set targets, the farmers and peasantry toiling hard on their lands to enhance the production of their crops through newly learnt techniques and the common women and men who were desperately seeking an end to their hunger and poverty. The only player that was better-off and satiated by this decision was the decision-maker itself, which is the Government of India. Thus, the equilibrium in the Game Theory may not lead to a fair outcome; some players may be better-off while others are made worse off. This according to the Game model led to a social dilemma with the collective outcome leading all players to a worse off position.

India's New Economic Policy: Stepping-up the Game

The next social dilemma that appeared in India's economic set up was in 1990-91, when the country passed through the most severe Balance of Payment crisis. The new policy framework that was adopted to resolve the impending catastrophe was unveiling of the New Economic Policy in 1991, spearheaded by the then Finance Minister Dr. Manmohan Singh in the then PV Narsimha Rao government. Trade policy reforms in the increased market access, and domestic price support policies have generally favoured production of crops that compete with oilseeds, resulting in waning oil crop production and stagnant yields⁷.

While this new policy agenda made all the key players from both countries, namely the government, the private sector, the population better-off, except for the then opposition parties of the country, mainly having left leanings in the political spectrum⁸. They viewed the economic liberalisation as being imposed upon by the International Monetary Fund (IMF), the World Bank, and under the overall guidance of US- often referred to as representing the of neo-imperialism in the world scene. Similar views were espoused by the opposition political parties on India's decision to join the World Trade Organisation (WTO), where critics protested that this would be a vehicle of US imperialism, whose tough patent rules would ruin India's agriculture and pharmaceutical industry⁹.

Rapid income growth following the economic reforms in the 1990s and some key policy changes attracted significant private interest and investment, encouraging a number of potentially transformative developments. Trade liberalization and the prospects of rapid income growth led to private sector investments in consumer products fostering more efficient allocation of resources¹⁰, including for example the entry of PepsiCo (in 1989) and McDonald's (in 1996). These two major investments generated ripple effects with the rapid emergence of snack foods

and fast foods through the quick service restaurant (QSR) chains. The ripples backwards were through contract farming and the ancillary industry to supply the raw materials or intermediate prepared food products¹¹, thereby ushering in prosperity for the farmers at the grassroots.

But, in 1997-98, world prices of most agricultural commodities fell sharply, triggered by the East Asian crisis, leading to all key players in the Game being worse off. This decline highlighted the difficulties in integrating domestic agricultural markets with world markets, with a lesson in the Game of international political economy that there was a need to establish and strengthen a rule-based system in the global trade of agricultural commodities.

Three key policy changes in this Game were to allow Foreign Direct Investment (FDI) in wholesale trade (1997), the de-licensing of Food Processing Industries (1999), and the New Seed Policy (1998). For agriculture, these policies induced a number of potentially transformative private sector initiatives and investments. Several global and domestic corporate investors entered the agro-processing sector (such as PepsiCo, Coca-Cola, Cargill, Hindustan Unilever, Reliance, Tata, Godrej, ITC, and Mahindra's). McCain, the world's largest producer of French fries and potato specialties, started operations in 1998 with a focus on the frozen food market for India and the Indian subcontinent. McCain's experience highlights the importance of the policy space and gestation period for establishing a viable business. It undertook research and development experiments in five states to grow the "right" quality of potato for its core business and was successful in establishing a reliable supply chain for French fries for the fast evolving QSR market. Its produce effectively substituted for imports for the highly specific types of French fries demanded by the QSR giant, McDonald's. Similarly, PepsiCo developed the specific variety of potato needed for its Frito Lays chips business, and it now operates a large "contract" farming program for an assured supply for its factories. The demand from the burgeoning fast-food market is one key factor behind the "success" of the potato supply chains (including the wide network of much needed cold stores for potatoes) despite existing obstacles¹².

India and the US in 21st Century: Not competitors but partners

When the *India-U.S. Relations: Vision for the 21st Century* was unveiled by the then President of the US Bill Clinton and the then PM of India Atal Bihari Vajpayee, this policy framework was appreciated by all the players across political lines. The rationality for each of the players in the context of this new Game seemed to conform to that of others and exhibited multiple equilibria,

where all the players appeared to be better off with the promising prospect of enhanced US-India relations. It resolved to forge overall ties with each other working towards expanding economic and trade relations, global non-proliferation, joining hands to counter terrorism, narcotics, teaming to protect the global environment, clean energy, rights of women and children, public health, and boosting education, culture and people-to-people exchanges¹³.

The private sector engagement in the agricultural sector continued. The DCM Shriram (DSCL) group launched its Haryali Kissan Bazaar (rural markets) in north India in 2002, and FieldFresh Foods started to market horticultural products in 2004. The new seed policy attracted a number of multinational companies in the seed sector, like Novartis (later to become Syngenta), Cargill, and Pioneer Seeds. Private sector seeds supply is rapidly growing; it now provides the bulk of improved seed varieties for horticulture and introduced the revolutionary *Bt* Cotton (in 2002) that has since transformed the Indian cotton sector. Recognizing the importance of key services, ostensibly to fill the large void in public service delivery in agricultural market information and extension¹⁴, two important private initiatives with huge potential for transformative impact are the “e-choupal” of Indian Tobacco Company (ITC) and the mobile text based information service by Reuters Market Light (RML). The “e-choupal” started in 2000 and seeks to connect rural India with data access to market prices, agricultural extension services, and other e-services. The RML information service, started in 2007, provides a highly customized and localized agricultural and related information service, primarily aimed at farmers, through mobile phone-based text messages¹⁵.

In the meantime, the ongoing extensive research collaboration between India and the US led to levels of agricultural productivity increases, leading to yet another ‘one equilibrium’ at multiple levels. It fostered better education of farmers generally and in specific areas relevant to farming was essential for the implementation and consolidation of the newly acquired expertise. Improved soil cultivation, weed control, ways to combat pests and diseases, and the use of fertilizers and irrigation where necessary, and use of biotechnology promoted best possible development of plants. As a result, the new crop varieties began to make their presence felt, sparking off an upsurge of the need for a second-generation Green Revolution across the country¹⁶. The argument that the first Green Revolution led to a social dilemma of unequal prosperity in certain pockets of the country, leaving the rest of the areas worse off motivated the need for a renewed agricultural partnership between India and the US. The resultant policy framework was the unveiling of the US-India Knowledge Initiative on Agriculture in 2005, by

then US President George W. Bush and the then PM of India Dr. Manmohan Singh, which was focussed on promoting teaching, research and commercial linkages and a second 'Green Revolution'. This was motivated by the commitment of the Bush administration to establish global partnership between the two largest democracies of the world.

Unlike the "first" green revolution, which was implemented through state planning and through public institutions such as cooperative banks, cooperative marketing associations, and public sector agricultural research and extension systems, the private sector is now set to drive changes within the rural economy. Indian and multi-national corporations involved with agriculture, such as the ITC, Pepsi India, Monsanto, Tata Rallis, Mahindra Shubh Labh, Hindustan Lever, and many others, are eager partners in the government's plans to use public-private partnerships as the engine of future agricultural growth. Two major Indian business groups with no prior experience in agribusiness, Reliance and Bharti, have both started major operations. According to Agriculture Minister Sharad Pawar, the US-India Agriculture Knowledge Initiative, hammered out in the shadow of the civilian nuclear deal, "will contribute tremendously to launching a second green revolution in our country"^{17 18}.

The outcome of the revamped strategic decision for advancing agricultural ties created an equilibrium in the US policy making circles as consolidating Indo-US ties received unprecedented bipartisan support. Similar sentiments were echoed in India, except for a few left-of-center political parties as well as few activists who continued to view the bilateral relationship from the lenses of the US being a hegemonic power and the chief of neo-imperialism. The social dilemma was further created with the outright rejection of Genetically Modified (GM) crops as being the agents of destruction of India's agriculture, and completely disregarding the efforts of the scientists and experts towards providing affordable and accessible solutions for food security amid looming challenges of climate change, soil degradation, rapid loss of biodiversity, water insecurity and challenges to human security^{19 20 21}.

President Obama, ever since his first term called for strengthening the economic relationship between India and the US on a mutually beneficial basis deliberating a higher priority to agriculture. The emerging scientific progress on the farms as an 'Evergreen Revolution', to emphasise that the productivity advance is sustainable overtime since it is rooted in the principles of ecology, economics, social and gender equity and employment generation. The US-India Strategic Dialogue on Agriculture was initiated and this administration made India a

key partner in President Obama's Feed the Future Initiative to provide its expertise as well as play a leadership role in achieving food security in a select nineteen countries of the world. This intervention in terms of a new policy framework has been received well by all the key players in the Game, including the Feed the Future-recipient countries, with the obvious sceptics whose rationality does not conform to that of the rest.

A flourishing private sector in any country is demonstrative of a flourishing and liberal market economy²². It was after economic liberalization, in mid-1990's, that Indian companies began seeking commercial opportunity in the US. Also, Indian companies have gradually been making a discerning presence in the US. The CII-Grant Thornton survey of 2014 demonstrates that they have operational presence (by way of physical investments as well as leased spaces) in all 50 states in the United States, as well as Washington, D.C., collectively generating revenues in the billions and creating thousands of jobs. The top five states in which Indian companies have generated maximum employment are: New Jersey (9,278 jobs), California (8,397 jobs), Texas (6,230 jobs), Illinois (4,779 jobs) and New York (4,134 jobs).

According to the survey, the top five states that have the highest concentrations of Indian companies are New Jersey, California, New York, Pennsylvania and Illinois. Many of the companies are partnering with local non-profit organizations to support a variety of programs and initiatives for the betterment of the community²³. Diversified across a wide array of sectors, these companies are most prevalent in the following sectors: Information Technology (IT) and IT-enabled services (IT-es); life sciences, pharmaceuticals and health care; mining, materials and manufacturing; design, engineering and construction; financial services; automotive; energy; media and entertainment; tourism and hospitality; and food and agriculture. They point towards a particularly positive trajectory, taking advantage of the common values such as democracy, social diversity, as well as enduring people to people contact, has further helped solidify the US-India partnership. Today they are an integral part of the economic and social fabric²⁴.

More companies operating in the financial services space is indicative of their growing prominence in the US market, as well as the surging demand from a large and economically strong Indian Diaspora. The top five states that have received the highest volume of investment, \$1 billion and above, from Indian companies are: Texas (\$3.85 billion), Pennsylvania (\$3.56 billion), Minnesota (\$1.8 billion), New York (\$1.01 billion) and New Jersey (\$1 billion). Thus,

significant and growing contributions of Indian investments on the US economy remain a critical component of the bilateral partnership²⁵.

Conclusion

From the above discussion it is clear that when US-India agricultural partnership is presented as a Game, at each stages of social dilemma created by domestic or international pressures has led to making each key player better-off than they were before the particular event. From a utilitarian perspective it has contributed to the greatest good of the greatest number. Hence, hunger free and a prosperous world could be possible if every nation pays concurrent attention to improving food availability through ecologically sustainable methods of production, to enhancing economic access to food by promoting a job-led economic growth strategy and to ensuring the biological absorption of food in the body through the availability of safe drinking water and environmental hygiene²⁶. US and India should intensify their efforts to foster relevant partnerships and networks for launching and sustaining an ever-green revolution on the farms in India. Thus the Game theory as applied to US-India agricultural cooperation, brings the opposing 'interdependence liberal' and the 'realist' positions together into a common framework. Although restricted by the accuracy of its assumptions about strategic rationality, the study shows that game theory is adequately flexible to incorporate differing assumptions about world politics and individual issues. Neither is the self-interested behaviour of states not presumed to be as necessarily leading to either cooperation or conflict, nor is the emergence of stronger international institutions, formal or informal, seen as either inevitable or utopian²⁷. Thus, application of Game theory in the study elucidates Jean-Jacques Rousseau's 'General Will' in the realm of international politics and develop midlevel theories applicable to real political problems, thus developing a positivist agenda for the study of international politics²⁸.

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End Notes

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