TRUSTED PARTNERS: 30 YEARS OF

INDIA ISRAEL

DIPLOMATIC RELATIONS

Edited By

PRAMIT PAL CHAUDHURI AND **RAANAN REIN**

ananta centre

TEL AVIV UNIVERSITY
Pursuing the Unknown

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Preface

SANJEEV SINGLA, ***India's Ambassador to Israel***

On January 29, 2022, the colours of Israeli and Indian flags illuminated historic landmarks in Israel and India to mark the 30th anniversary of full diplomatic relations between our two countries: the Masada Fortress and Haifa Townhall in Israel, and the Gateway of India and Teen Murti – Haifa Chowk in India. Our Prime Ministers issued special messages on the occasion, and our two foreign ministers authored a joint op-ed in leading newspapers. A centuries old association between our two peoples was imbued with modern day symbolism – a reminder, at once, of both our distant and recent histories.

As it normally happens, it is the more recent events that are more vivid in our collective imagination and recollection – a reason enough to revisit the significance of how much the last 30 years have changed the landscape of India-Israel bilateral relations, especially in the last few years. In post-Independence times, the first 40 years of our formalized relations during 1950-92 were largely kept under the wraps. The next 25 years during 1992-2017 were sought to be underplayed, with a conspicuous absence of a visit to Israel by an Indian Prime Minister. It is only in the last seven years since the historic visit of Prime Minister Narendra Modi that the relationship moved into a qualitatively different trajectory, with our two countries

becoming strategic partners and accelerating cooperation across a wide range of fields ranging from agriculture to security to innovation.

This milestone is also an occasion to acknowledge the contributions made by all those who have made such progress possible: our political leadership, diplomats, analysts, scholars, businesspeople, artists, media and students. Among these supporters have been the Ananta Aspen Centre, Tel Aviv University and the CII who have, through their collaboration as the India Israel Forum since 2008, tried to pave the way forward by putting the focus on – and developing concrete action plans for – varied issues such as water, educational exchanges, semiconductor fabs and cyber security. I am happy, therefore, that they are continuing their valuable inputs through a publication of this special compendium on the occasion of the 30th anniversary of our full diplomatic relations. And I am sure that their thought leadership would continue to add ballast for further deepening our bilateral relationship.

Sanjeev Singla

Preface

NAOR GILON, ***Israel's Ambassador to India***

CELEBRATING 30 YEARS OF friendship is an important and festive milestone for both countries. India and Israel historically have many common values and traits: both represent ancient civilizations that gained independence around the same time (in 1947 and 1948, respectively), both were born out of chaotic partitions and have sustained democratic regimes ever since under adverse circumstances. In the last 30 years the relationship between India and Israel has evolved in countless different ways. We have cooperated vastly in health, agriculture, water, innovation, culture and many other fields.

As a matter of fact, the relationship between our two ancient civilizations can be traced back much before the recent 30 years, it goes back thousands of years. The Jewish community in India had a peaceful and prosperous life for generations with almost zero evidence of anti-Semitism. For the Jewish people that is not a given and we do not take it for granted. That shows the positivity and inclusivity of Indian culture and society, this connects the people from both countries in a very special bond.

Since the establishment of full diplomatic relations in 1992 our ties have expanded dramatically. Today the close friendship between India and Israel has blossomed

into a strategic partnership. One of the indications of that is the high-level visits on both sides in the past few years and we hope to see more in the coming year.

For me, personally, being the Israeli ambassador to India is truly a unique and special experience. On the professional side of things, the opportunities and avenues for cooperation are limitless. More importantly on the personal side, being an Israeli in India is a pleasure. We really feel the love and appreciation from our dear friends in India and we enjoy every minute of it. There is warmth in Indian culture and people that makes it feel just like home.

Together, Israel and India, have made great achievements, and I'm sure that this is only the beginning. The scope and depth of the relations allows us endless possibilities and I really do believe that we can do wonderful things together that would benefit both sides and the entire world.

I wish to take the opportunity to thank Tel Aviv University and the Ananta Centre their important and fruitful work in India Israel Forum that helps bring our two countries even closer.

Naor Gilon

Introduction

—Pramit Pal Chaudhuri & Raanan Rein

The late Israeli president and prime minister, Shimon Peres, was among the most fervent advocates of a different kind of India-Israel relationship. During one of his many visits to India, he told journalists of a conversation with the founding father of David Ben Gurion. In the 1950s Ben Gurion had retired to a kibbutz. Speaking to Peres and a few others who had visited them, he suddenly told them, "One day India and China will wake up. Unlike the Europeans they have no history, good or bad, with us." It was essential, he said, that when these two countries awoke, all of them should ensure that these countries saw Israel as a friend.

When it comes to India it can safely be said: mission accomplished.

It wasn't evident that Israel and India would come to see each either as trusted partners. Though both countries experienced bloody religious-based partitions when they were born – India in 1947, Israel in 1948 – they went their separate ways in the decades that followed.

Diplomatic relations were frozen at consular levels and India became a loud if largely rhetorical supporter of Palestinian nationalism.

The collapse of the Soviet Union and the end of the Cold War in 1989 had profound knock-on effects. One was to suddenly open the door to the possible resolution of some of the world's most intractable conflicts. These included the end of apartheid in South Africa, the sectarian forever war in Northern Ireland and, in the form of the Oslo Accords, a negotiated settlement between Israel and the Palestinian Liberation Organisation.

India, shaken by the demise of its Cold War verities, used the opportunity offered by Oslo to normalize its relations with Israel. This volume celebrates the thirty years of remarkable accomplishment that followed that path-breaking decision.

However, as the then Indian prime minister, P. V. L. Narasimha Rao, admitted privately to Israeli officials, New Delhi's primary motivations for normalization were external to Israel itself. He recognized that in a post-Soviet world India would have to pivot closer to the United States and one of the paths to do so was through Israel. India's military situation was also dire. Russia was in chaos, unable to provide even the spare parts needed to keep India's arsenal in working condition. Again, Israel was seen as a bridge to cross these troubled waters.

Though the bilateral relationship went from strength to strength over the next two decades, Israelis would joke India treated them as a "mistress" – intimate in private,

but distant and aloof in public. Israel was desirable, but had to come and leave by the service elevator. New Delhi had no compunctions in asking Israel for military assistance and terrorism-related intelligence or asking the redoubtable Israeli lobby to assist them in Washington, even while voting against Israel in the United Nations. New Delhi pleaded the need to keep on the good side of Arab states on which it was dependent for energy and remittances and a political desire not to excite emotions among its large Muslim minority.

The Israeli establishment also had their doubts. Conservative politicians in Israel questioned whether India's talk of a strategic partnership was genuine. Given its public statements, they suspected India was using Israel for reasons of convenience and would return to its nonaligned ways when the opportunity arose.

Over the years, these doubts were put to rest. Israel stepped up to the plate with arms and intelligence whenever India faced major defence crises, such as the Kargil conflict with Pakistan and the more serious border showdowns with China. The curious anomaly of a relationship whose earliest advocates were Israeli liberals and Indian conservatives was gradually replaced with a more broad-based domestic consensus in both countries. President Ariel Sharon's 2003 state visit to India satisfied the Israeli rightwing that India was more than a fair weather friend. Attempts by a foreign minister of the Congress-led government of Prime Minister Manmohan Singh to turn the clock back in favour of Palestine were publicly rejected by his government. By then the depth

of the defence relationship had reached levels that even Shimon Peres would probably have not dreamt. And by then agriculture, technology, tourism and more had become integral to the relationship as well.

The final chapter in this geopolitical play has been enacted by the government of Prime Minister Narendra Modi. Over the past seven years, India has shed its last few inhibitions regarding Israel. India's policies towards Israel and Palestine were officially and openly de-hyphenated by the prime minister. External factors helped fast track the process. The Palestinian cause lost both friends and relevance to the point that no one, India included, linked the thawing of ties to a revitalized peace process. The Abraham Accords saw Israel succeed in decoupling the Palestinian issue from its regional engagement and paved the way for a nascent multilateral effort that included Indians, Israelis and Arabs.

The road ahead is not without its challenges. India's overriding security concern today is China, a country with which Israel has an extensive and profitable economic relationship. Israel is already under pressure from the US over its ties with China and navigating India's uneasiness on this front is an issue that is clearly looming on the horizon. Bilateral trade and investment are noteworthy because they continue to be laggards.

A sign of the relationship's resilience was that when Israeli Prime Minister Benjamin Netanyahu fell from power in 2021, after dominating Israeli politics for a dozen years, within months Modi and the new Israeli leader, Naftali Bennett, met in Glasgow to renew their bilateral

vows. Bennett told Modi of his experience with Indians as an entrepreneur, "When I ran a hi tech company. We merged with an Indian company – the two I's, India and Israel in Manhattan. In the office, there were a bunch of Israelis and Indians, and getting together created a remarkable dynamic of innovation."

This volume of essays serves to celebrate the last thirty years of ties and look ahead at the relationship. The essays in this collection dissect the bilateral relationship, looking at key issues like water, food security, space, defence, migration, diplomacy and trade. Their sheer range tells a tale of how far the Israel-India relationship has gone. External factors have been the key to why in the past the two countries moved closer, whether the Soviet collapse or 9/11. Today it is probably safe to say that the relationship rests on its own logic, that neither government looks for cues elsewhere when thinking about the other, and it has both the width and breadth to absorb any surprise shocks that may come up in the years to come.

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THE ESSAYS

THIS COLLECTION OF ESSAYS is designed to stimulate a conversation about the partnership, reflect on the past and imagine the future. The edited volume is a joint effort by Tel Aviv University and its S. Daniel Abraham Center for International and Regional Studies and the Ananta Centre. This joint effort builds on a 15-year long

partnership, encapsulated by the India-Israel Forum that the two organisations have run, along with the Confederation of Indian Industry (CII). This Forum has met regularly in both countries to widen and deepen ties and identify ideas to promote this process.

The collection begins with two diplomats who were involved in constructing this new India-Israel relationship. Alon Ushpiz today is the senior most diplomat in the Israeli foreign ministry and brings a high–level perspective of the bilateral relationship in the broader context of Israeli diplomacy. He combines this with a worm's eye view of the relationship having served previously as Israel's ambassador to India. Arun K. Singh, presently on the National Security Advisory Board and a former Indian ambassador to Israel, brings a similar expert description of how diplomatic ties went from effectively nothing to their present highs in just a few decades.

In his thoughtful note, Professor Asher Susser assesses the geopolitical dynamics of West Asia and gives a fascinating insight into how these inform and shape the warming bilateral partnership. Pramit Pal Chaudhuri similarly shows how India's policies towards the Persian Gulf and the Levant evolved as the international environment changed, from the collapse of the Soviet Union to the Abraham Accords, and helped move the bilateral relationship forward. The recent announcement of a small "quad" – featuring the US, Israel, UAE and India – is just the latest example of how a new world order is helping bring India and Israel together in new and innovative ways.

Security and defence are the hard core of the relationship as well as evidence of the degree of trust that exists between the two countries. In his essay on cybersecurity, Giora Yaron looks at the world's growing cyber vulnerability and the exciting opportunities that this issue offers for bilateral cooperation. In a fast-changing world, where cyber is becoming an asymmetrical security challenge but also a lucrative business issue, his essay sets out some ideas on the opportunities for cyber collaboration. Jamshyd Godrej, head of one of India's largest conglomerates and a long-time collaborator with the Israeli defence sector, describes why and how Israel has been able to embed itself so firmly in India's military industrial complex because it has adjusted to the defence policy priorities of New Delhi.

Then there are the areas where Israel's accomplishments are world-beating and the real question is how can India learn from them. Ram Fishman's and Ashok Gulati's essays explores collaboration in food security and agriculture. Likewise, Hadas Mamane, Lior Asaf and Nikhil Sawhney from India highlight the exiting opportunities of the two counties to collaborate on water. This is already major bilateral issue and this essay underscores its merits. Raanan Rein's essay, penned with help of leading former Israeli space officials, provides insights into what the two counties can do in this frontier realm. Ajay Lele echoes the great potential in space collaboration and points to the collaboration already exists in military reconnaissance and the opening up of space to the private sector by India. Ipsita Satpathy and

Nirabhi Sharma compare the vibrant start up and venture capital ecosystems of both countries and what India can learn from the original Startup Nation. Colin Price and his colleague Anirban Guha provide a micro-study being done by Israeli scientists in India on lightning, an example of the niche studies that are the building blocks of scientific collaboration.

Smita Tiwari Jassal combines anecdotes and academic analysis to dissect the Indian Jewish migration to Israel and how the community, which never experienced prejudice in their thousands of years in India, has retained a connexion to their original homeland. Israel Makov, a former CEO of the Israeli pharmaceutical firm Teva and now chairman of the Indian company Sun Pharma, predicts that bilateral trade is set to expand dramatically and belie its reputation for stagnation.

Our thanks to the sponsors of this project, the Pears Foundation and the Stanley and Marion Bergman Family Foundation. We are also indebted to the authors, and the teams involved in editing this collection.

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Chapter 1

Diplomatic Relations: Natural Partners

—Alon Ushpiz

ON FEBRUARY 28, 1952, a Pakistani airplane made its way from the city of Karachi to New Delhi. Only a few people onboard were aware that among its passengers was Dr. Walter Eytan, the director general of the Israel Ministry of Foreign Affairs, who had been sent on a historical mission: to examine the possibility of establishing diplomatic relations with India.

Hosted with great respect, the director general stayed in the capital for a full week in the presidential palace, as a formal guest of the Indian government and held warm meetings with prominent figures, including President Rajendra Prasad, future prime minister Indira Gandhi, Sheikh Abdullah, prime minister of Jammu and Kashmir, and others.

At the heart of the visit were three separate meetings between Director General Eytan and Prime Minister Jawaharlal Nehru. One can only imagine the exchanges between the two erudite scholars, who

had graduated from rival universities—Oxford and Cambridge, respectively.

During the discussions, Prime Minister Nehru committed to promoting normalization with Israel. Subsequently, in June 1953, Israel was granted permission to open a general consulate in Bombay. However, it took forty years before full, formal diplomatic relations between India and Israel were established, in January 1992. Ever since, both the scope and intimacy of the relations have continued to grow from strength to strength.

I had the privilege of serving as Israel's ambassador to India, between the years 2011 and 2014, and witnessed how deeply rooted these relations are. Historically, the Jewish communities in India suffered neither persecution nor anti-semitism, and have always been treated with respect. They continue to play a major role as a bridge between our peoples.

One might ask what two countries like India and Israel have in common that have led to the development of such close ties. Indeed, the two nations are poles apart in terms of size and population, but I have always been impressed by the similarities in character between my Indian and Israeli friends: the strongest, almost uncontrollable desire to succeed, to do better for themselves and their families, and to survive and prosper in the face of the harshest challenges.

In 2022 we are celebrating thirty years of this strategic partnership between our countries. Looking back at our joint achievements over the last three decades, it is quite remarkable to see the level and depth of our current

cooperation. I see this milestone as a great opportunity to demonstrate our mutual successes, and potentially, to advance together towards an even better future.

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Agriculture and Water Cooperation—the Bread and Butter

Since the start of our relations, agriculture has always been a significant pillar of our bilateral partnership. As 60 percent of Israel's lands are desert, we have been developing sustainable agriculture and water technologies, as well as solutions to desertification, for decades, to the degree that Israel today is a primary water and food exporter in the region. The Israeli experience is extremely relevant to India's challenges, and we are more than happy to work together, in order to advance, hand in hand, utilizing both of our capabilities, know-how, and no less important—our traditions. Agriculture is not only an occupation but also an important part of our national identity.

The pinnacle of our agricultural cooperation today is the Indo-Israeli Agricultural Project (IIAP), which operates twenty-nine fully active Indo-Israeli Centres of Excellence (CoEs) in twenty-one states across India. The centres focus on crop diversity, increased productivity and water efficiency. Every year, these CoEs produce 25 million high-quality vegetable seedlings and 387 thousand high-quality fruit plants, and provide training to millions of Indian farmers with the latest agricultural technologies.

A unique feature of the CoEs is their specifications to the needs of each region. After jointly identifying the challenges, the centres provide a learning ground for Indian and Israeli agriculturists to create the best solutions, tailored to local conditions and needs of Indian farmers. This is in line with the vision set by Prime Minister Narendra Modi of "doubling farmers' income".

In the field of water, Israel and India are cooperating intensively by sharing knowledge, technologies, and expertise. Both countries are working together on the ground to translate Israel's expertise in water management and technologies into India's local needs and demands. Israeli drip irrigation technology, for example, has been used in India since 1993, and currently, there are over thirty Israeli water projects in India.

During Prime Minister Narendra Modi's visit to Israel in 2017, the leaders declared that cooperation in the field of water would be the next pillar of strategic relations between the countries. In order to achieve this goal, two agreements were signed to increase cooperation in water conservation and use, in addition to the appointment of Israel's first water attaché to its embassy in Delhi.

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Covid-19—Working Together for Global Solutions

The intimacy of our relations was demonstrated during the Covid-19 pandemic. At the early stages of the outbreak, India's timely facilitation of exports of necessary

life-saving equipment to Israel was of paramount importance for the safety and well-being of the Israeli population. Many Israelis owe their lives to this Indian contribution. The collaboration continued throughout Operation Open Skies, during which Israel sent an advanced research team to India that worked jointly with Indian scientists in the research and development of rapid testing for Covid-19.

When the devastating second wave of the virus hit India, Israel immediately set up a special task force with the purpose of gathering all available supplies and medical equipment in an effort to assist. Through a combined effort of the Israeli government, the business sector, NGOs, and the people of Israel, we managed to send India some 60 tons of medical supplies, including oxygen generators, 1,710 oxygen concentrators, and 420 ventilators.

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Economy and Innovation—a Natural Partnership for a Better Future

Relations between India and Israel extend well beyond the spheres of government. Our partnership encompasses B2B (business to business) endeavours, people to people activities, and GPS to GPS (government, people, and private sector) collaborations.

India is one of Israel's most important economic partners. The ideal pairing of India's industrial capabilities and technological genius, on a scale unimaginable in Israel, with Israel's unique technological capabilities bears

an immense potential for mutual prosperity. Over the years, we have seen a substantial increase in commercial ties and business ventures between Indian and Israeli tech companies. However, in order to further develop the scope and volume of trade, a free trade agreement is essential, and is something both sides are working towards.

Israeli start-ups and innovation companies are always looking outward to the global market, and have found a natural partner in India. In recent years, various agreements have been signed between the two countries to strengthen innovation and technological ties, including an India-Israel industrial R&D agreement and the establishment of a technological fund to encourage partnerships between Israeli and Indian innovators.

Another important field of cooperation between the two countries is defence, a long-standing pillar of our growing partnership, which has intensified as our bilateral relations have strengthened. It is therefore only natural that with such a close and well-synchronized relationship, Israel was the first country to take up the call for the "Make in India" vision. In his visit to India in 2016, former president of Israel Reuven Rivlin clearly stated: "We are here to make in India, to make with India."

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Regional Opportunities and the Path Forward

Five weekly Air India flights, operating between the Indian cities of New Delhi, Mumbai, Kochi, Goa, and,

Tel Aviv, reflect a new reality in the Middle East since for the first time ever, commercial planes from Israel flying eastwards can pass over Saudi Arabia and the Gulf states. Peace and normalization in the region and the Abraham Accords are already bearing economic fruits, attracting business people from Israel and India eager to seize the opportunities for regional investment and cooperation.

This indeed is a major development that paves the way, potentially, for the strategic relations between our countries to extend beyond the bilateral arena into a true bridge-building policy that can change the landscape of our region; indeed, change the lives of millions of people.

The warm meeting between Prime Minister Narendra Modi and Israeli Prime Minister Naftali Bennett, at the COP26 climate summit in Glasgow, illustrates the continuation of this friendly chapter in the history of our relations. I believe that we will see many more of these high-level exchanges in 2022, and I am confident that our incredible achievements in the last thirty years will only pale in comparison with those of the decades ahead.

We have been blessed with the ability to look far into the future, beyond immediate opportunities and challenges. This attribute, I believe, is what will ensure the continuation of the ambitious nature of our partnership.

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Chapter 2

Diplomatic Relations: Made in Heaven

—Arun K Singh

The India-Israel relationship has now evolved to a point that it was described in January 2018 by the then Israeli Prime Minister Benjamin Netanyahu, as a "marriage made in heaven".[1] There was an unprecedented airport welcome for Prime Minister Narendra Modi during his visit to Israel in July 2017, similar to what was hitherto reserved only for visiting United States presidents.[2] It was also the first ever visit by an Indian prime minister to Israel, despite full diplomatic relations having been established in 1992. In his arrival statement, Modi articulated that "in our path of sustained high growth and all-round development, India counts Israel among its important partners".[3] As a special gesture, the Israeli prime minister accompanied the Indian prime minister through almost all his engagements during the visit,[4] including a walk along the beach.

Within six months Netanyahu visited India, in January 2018, and assessed that "we have had diplomatic relations

for 25 years but something different is happening now".[5] Modi pointed out that Netanyahu was India's "first honoured guest in 2018".[6]

In another marker of evolution in the India-Israel relationship, as well as in the changing dynamics in the West Asia region, the visiting Indian External Affairs Minister S. Jaishankar joined his Israeli counterpart on October 18 for a virtual meeting with the US secretary of state and United Arab Emirates foreign minister, launching what has since been commonly described as the "West Asian Quad".[7] An in-person meeting is planned in early 2022, and specially designated senior officials have been meeting since to take forward an agenda for cooperation in energy, food, water, health, transportation and space. There are obvious inferences from such an arrangement coming together. It is a sign of change in how India is looking at its relationships and its willingness to engage with Israel outside a strictly bilateral framework. It needed the Abraham Accords of 2020 to bring UAE and Israel on the same platform; and it reflects a post-unipolar US supporting new architectures of cooperation in different regions of the world.

Jaishankar, unlike the earlier short duration and infrequent visits of his predecessors, stayed for several days,[8] carried out extensive engagements, highlighting different facets of the relationship: defence, economic, technology, people to people.

Speaking to a group of Indian origin persons and scholars of India on October 17, he said that "it is rare in Jewish history that you have had a long, continuous

period where you have thrived in freedom and equality, as you did in India".[9] As the Ambassador of India in Israel (from 2005 to 2008), I was often told of how India was among the few countries in the world where there was no anti-semitism, that the Indian origin Jewish community in Israel had migrated due to "pull (Zionism, economic opportunity) rather than any push (discrimination) factors". The community remains proudly Indian in many of its cultural manifestations. No Jewish property had been attacked in India, and the attack on Chabad House in Mumbai on 26 November 2008 had been carried out by Pakistani state-sponsored terrorists from outside India.

After Jaishankar's call on Israeli Prime Minister Naftali Bennett on October 20, the Israeli statement said that the two "discussed strengthening the strategic alliance, expanding bilateral ties, and deepening the warm friendship between India and Israel".[10] In the meeting, Bennett had said that "we love India. We view India as a friend and we are looking forward to expanding our relationship in all fields and all dimensions".[11]

Speaking separately to a business group, Jaishankar identified "innovation, digital, green growth and health" as areas for future cooperation,[12] and suggested that the two countries would initiate a free trade agreement discussions later in the year, with the aim of finalizing it by June 2022. In an interview with the *Times of India* on October 18, 2021, Alon Ushpiz, director general in Israel's Foreign Ministry, focused on "artificial intelligence, quantum computing, big data and cyber" as the new technology areas holding potential for deepening cooperation.[13]

Israel has tremendous strengths in technology and is often referred to as the "start-up nation". These areas are now also being emphasized in India, which has strengths in the size of its skilled workforce availability. Speaking to Indian and Israeli businesses in January 2018, Prime Minister Modi emphasized that "Israel has sharpness and edge. India has size and scale".[14]

Ushpiz went on to say that "the level of professional proficiency and trust between the Indian armed forces and the Israeli forces, defence industries is very high".[15] Speaking in the Israeli Knesset on October 14, 2015, marking the first ever visit to Israel by an Indian president, Pranab Mukherjee conveyed that "India remembers with gratitude the help that Israeli government provided in rushing critical defence supplies to India when we required them most urgently in 1999 (during the Kargil conflict with Pakistan)".[16] Defence has been one of the long-standing areas of cooperation. Supplies from Israel have built up since the 1990s, at times occupying a significant share of Israel's exports and India's imports, and at technology levels at times not available elsewhere for India. There has been cooperation in co-development of technology for short and medium range surface-to-air missiles. There were reports of Israeli supplies to India during the 1962, 1965 and 1971 conflicts, even before establishment of full diplomatic relations.

The India-Israel relationship now commands support across governments in both countries. Some of the earlier wariness in the Arab countries will fade away as they pursue their own cooperation in the wake of the

Abraham Accords. The level of business and political exchanges between Israel and UAE is intense, contrary to a sort of cold peace that Egypt and Jordan had observed after they had established diplomatic relations with Israel decades ago.

However, it was not an easy path, and marked by many challenges on the way. India had voted against the establishment of the State of Israel at the UN in 1948. This was on account of our own experience, and vision of leaders of India's struggle for independence from the British, that different religions could co-exist in one country rather than establish states on the basis of religion. In the immediate post-independence period, India held back from full diplomatic relations, concerned about possible reactions in India's Muslim community and the Arab world, following partition of the country. Efforts were revived in the mid-1950s, but received a setback when Israel joined former colonial powers Britain and France in carrying out attacks against Egypt in 1956, following its nationalization of the Suez Canal. Eventually, the dissolution of the Soviet Union in 1991, recognition of Israel by Russia, China and others in early 1992, provided the space for India to move ahead with establishment of full diplomatic relations in January of that year. For a long time after that, while substantive cooperation forged ahead, high-level political exchanges were limited. The first visit of an Indian president took place only in 2015, and that of a prime minister in 2017. The first visit of an Israeli prime minister was in 2003, with a long gap thereafter. Despite strong defence cooperation, defence

ministerial visits were rare, although those at official levels and of service chiefs were regular and frequent.

All this has changed since 2014. Now there is public political acknowledgement of the depth of the relationship, and desire to strengthen it further. There is also a clear effort to delink the bilateral relationship from the Palestine issue, while maintaining the principled position of support to a Palestinian State. Both the Indian prime minister in 2017 and Foreign Minister Jaishankar in 2021, did not combine the visit to Israel with a hitherto obligatory visit to the Palestinian authority in Ramallah. Prime Minister Modi made a separate visit to Palestine in February 2018.[17]

There will be challenges in the relationship. Aside from strengths in defence, technology and counterterrorism cooperation, convergence has also been provided by India's adversarial relationship with Pakistan, which does not have one with Israel, and has been anxious about the nature of the defence cooperation. But, Israel, from its own perspective, would welcome it if Pakistan were able to move forward, following the Abraham Accords. Foreign ministers of the two countries had a secret meeting in Turkey in September 2005, but cooperation could not advance due to political opposition within Pakistan.[18] In the India-China context, Israel will be constrained a bit by China being its largest trading partner in Asia. During an earlier visit to China, Netanyahu had described the Israel-China relationship also as a "marriage made in heaven".[19] Even US officials have cautioned Israel on occasion about technology sharing with China, and had acted to prevent

defence cooperation between the two in 2005. Israel is also extremely hawkish on Iran, which has still not recognized its "right to exist" as a separate State, and sees a threat also from its proxies in Lebanon, Syria and Gaza. India has energy and connectivity interests through Iran to Afghanistan, Central Asia and Russia.

On the positive side, the Israel relationship gets India support from the more than 5-million strong and influential US Jewish community. They are among the forceful advocates for a stronger India-US relationship. In February 2016, some of the Jewish organisations had joined India in opposing the sale of F-16 fighter aircraft to Pakistan proposed to US Congress by the administration of Barack Obama.

The world today is perceived to be at an inflection point. The US withdrawal from Afghanistan is seen as marking a decisive end to the US unipolar phase. Multipolar competition, especially between US, China and Russia, is expected to mark the coming few years. The bilateral India-Israel relationship will be useful to both for strengthening their respective defence and technology sectors. There will be potential also for building new frameworks, particularly for economic, technology and counterterrorism cooperation in West Asia.

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ENDNOTES:

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Chapter 3

Digital Revolution: Opportunities and Threats

—Giora Yaron

THE PANDEMIC WE ARE currently experiencing has accelerated the "digital revolution". This transition from the physical to the digital world has unleashed a flood of cyberattacks which have affected our lives fundamentally. Hospitals have been shut down and manufacturing lines have come to a halt, while ransomware demands have been made. The digital/information revolution will continue to affect our lifestyles and societies in a myriad of ways for decades to come, as will continually more sophisticated cyberattacks.

We are witnessing advances in education, communication (Zoom), transportation and mobility (autonomous vehicles), work patterns (remote work and the use of robots), commercial and financial transactions, logistics, digital healthcare, and more. As the digital revolution touches upon almost every aspect of our lives—through digitization and automation—it also increases exponentially our vulnerability and exposure to cyber

security threats. Cyber has emerged as a pressing national security issue.

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India and Israel: Key Enablers

Both India and Israel are undergoing the digital revolution coupled with accelerated cyberattacks. Major projects like India's Aadhar (UID) and the Unified Payments Stack (UPI) are graphic examples of how these developments have affected the world's largest democracy and demonstrate their huge transformative advantages. Israel is applying these new technologies in order to help it cope with security and other existential challenges.

But beyond domestic transformations and the clear benefits of these processes, both countries are major enablers and economic beneficiaries through IT service companies and disruptive product start-ups. Israel and India have leveraged their ingenuity and human capital to play leading roles in the new knowledge-based economy that the digital revolution has unleashed.

India has created a significant services industry, and the likes of TCS, Infosys, and Wipro are trusted system integrators (SIs) for the world's leading corporations. Israel, which has long designated itself a Start-up Nation, has emerged as a formidable force in digital innovations and applications. Some examples include data storage, artificial intelligence (AI), Machine Learning, data analytics, software as service (SAAS) applications and the

Internet of Things (IoT), to name but a few. There is however one area in which Israel has truly emerged as a formidable force—cyber security.

In both countries the digital revolution has led to the establishment of new companies and knowledge-based economy ecosystems, generating wealth and employment.

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The Perpetual Cyber Challenge

The very nature of the digital revolution and its innovations, however, is that it consistently creates opportunities for attackers and, hence, a need for new defences. With progress comes vulnerability. Indian SIs have front-row seats to many of the most high-profile attacks and, in some cases, they themselves are sometimes targets. Increasingly, major Indian SIs have been working closely with Israeli start-ups to fortify their cyber capabilities. Wipro and Wipro Ventures have been especially active, as has TCS. The latter has a local presence in Israel through its pro-active Co-Innovation Network—COIN. HCL and Infosys are also active in Israel.

Israeli and Indian companies in both the public and private sector are increasingly finding themselves dealing with cyber challenges. In the last few months of 2021, Israel saw major hospitals,[1] water infrastructure,[2] an insurance company, a gay dating site, a bus company and a slew of other companies, targeted. Ransomware attacks in particular are on the increase. This growing threat

has compelled Israel to develop a robust set of tools to deal with these threats. Israel has taken advantage of its offensive and defensive cyber work developed for national security purposes in order to create its dominant cyber ecosystem.

Some recent Israeli cyber unicorns include Wiz, Orca Security, Armis, Sentinel One, Axonius Solutions, and Aqua Security. So called Soonicorns (companies approaching the $1 billion valuation mark) include CrowdStrike, Vulcan, and Cyberpion, to name but a few. In the first quarter of 2021, Israeli cyber security companies raised at least $1.1 billion. This compares with $2.68 billion in all of 2020.[3]

There is no reason to believe that India cannot also do the same. India, too, is fast gaining momentum as an emergent product provider. A company like Freshworks is a great example of India's march beyond services to product. India is also well placed to lead in the nexus between cyber and fintech and digital payments. India processes the largest number of digital transactions in the world and the payments revolution— enabled by UPI—is only in its nascency. With three score unicorns created in 2021 India indeed is a potential claimant to the mantle of start-up nation. By mid-October 2021, India had minted 33 unicorns compared with only 11 in the previous year.[4]

When all is said in done, there is greater complementarity and synergy than competition between the two countries in the realm of technology and cyber.

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Common Threats—Joint Opportunities

I submit that the realm of cyber security is one area especially ripe for deep and wide-reaching bi-national collaboration in the coming three decades. If the first three decades belonged to defence and the old economy (diamonds, chemicals, and industrial goods), the future will bring collaboration in the realm of knowledge-based economies and the digital revolution.

Cyber is the perfect meeting point. Cyber vulnerabilities are an inevitable and unavoidable externality of the digital revolution. As it changes our societies and economies, these weaknesses also leave us more susceptible to malicious actors. The threats that India and Israel face are common. In many cases, the attackers are the very same state actors who, through non-state proxies or state agencies, threaten the national security of both counties.

Based on effective collaboration between India and Israel in the realm of defence, security, and space, the cyber domain offers a rich vista for cooperation. Through defence collaboration, great trust and a common work understanding have been developed—and this despite considerable cultural differences. Israeli impatience is often frustrated by Indian patience. Yet unlike security and defence, which are primarily government-to-government (G2G) engagements, cyber requires both a G2G strategy and promises joint collaboration between the two private sectors (B2B) and the academic and research communities (A2A). Cyber offers our two countries a topic around which we can collaborate not

only more deeply and widely but more creatively and proactively.

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What Might a Long-Term Bi-National Agenda Look Like?

To my mind, the relationship has at its core three different time scenarios on the joint cyber journey:

1) Immediate term—joint threat assessment and sharing best practices of remediation, defence, and skilling;
2) Medium term—collaboration between IT companies and Israeli start-ups servicing global clients and addressing domestic needs;
3) Long term—collaboration on emergent cyber challenges like quantum cyber security.

Immediate needs and opportunities are in threat-sharing and skilling. The threat-sharing domain is mainly a G2G matter and governments and their respective cyber agencies are already building joint modi operandi. Israel and the United States, for example, have ramped up their collaboration in dealing with ransomware attacks.[5]

It is in the realm of skilling that private actors and academia in communities can collaborate. Israel might consider replicating and adapting the outreach and knowledge sharing models it has deployed in India in the water and agriculture domains. A huge opportunity exists for creating centres of excellence (COEs) that are

asset-light and offer training programs—both in person and via Zoom. As in agriculture, Israeli experts can share experiences. Beyond skilling, the effort will also help build the Israeli brand and facilitate the sale of Israeli solutions. It also makes sense for Israeli companies to intensify their efforts to hire India's talented and hard-working engineers. Israeli companies are faced with a major shortage of workers. Amdocs has shown the way in this regard.

Another idea to explore related to threat-sharing is creating a list of best-in-kind Israeli and Indian solutions that the two private sectors can consult on and deploy when faced with attacks. This also means that both governments, as well as SIs and Israeli cyber companies, would share—on a real-time basis—emerging attack trajectories and effective responses. This is a medium-term intervention and would involve expanding the existing G2G dialogue.

It is also worth exploring ways in which Israeli cyber start-ups can work with Indian SIs to access global clients. Indian SIs have the trust of major corporations and understand their needs, and a growing number of Israeli companies are building robust partnerships along these lines.

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LONGER-TERM ISSUES

LOOKING AHEAD, THE TWO COUNTRIES COULD BE WELL placed to create programs that look at emergent cyber

issues. Here, academia with the support of the two governments have a huge role to play. Such an effort requires funds. A rudimentary step is to support deeper A2A collaboration by creating well-endowed and targeted doctoral and post-doctoral fellowships to allow for Indian students to study in Israel, and to create joint PhD programs and COEs, among others.

Governments would need to invest in a bi-national research fund in order to stimulate collaboration on a competitive basis. As a start, a dedicated fund, with each government committing $5 million a year for a decade, would be required. The fund would focus on emergent threats such as quantum, cyber, and cryptography.

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Chapter 4

Defence Relations: From Missiles to Bytes

—Jamshyd N Godrej

IT WOULD NOT BE AN exaggeration to say Israel has become among the most integral and trusted defence partners of India. The bilateral defence partnership has been an extraordinary success story, starting quite literally from nothing two decades ago to becoming one of the most broad-based military-industrial relationships that India has today. Israel is unique in its ability to be able to upgrade weapons platforms, from fighters to tanks, with munitions or advanced electronics. Israel has formidable experience and track record in developing and producing niche defence technologies and systems which India can benefit from. These capabilities have been deployed in transforming India's earlier generation military equipment to contemporary ones. By some estimates, Israel has supplied fully-formed armaments and prime subsystems worth over $40 billion since the establishment of full diplomatic ties with India in 1992, thirty years ago.

Israel benefits greatly as well. India has proven to be a good market for a country that must export arms on a large scale to sustain its domestic defence sector. India is one of the largest customers for Israeli defence companies, contributing 40% of Israel's annual arms exports. When asked if India is not becoming overly dependent on Israel for its defence needs, Israelis often respond, "The dependency runs both ways".

If there has been a secret sauce to the partnership it is the care Israel has taken to understand India's military technology requirements and invest in winning strategic trust at the highest level. When the Soviet Union collapsed, Israel had solutions when India found itself saddled with a large number of platforms for which it was unable to get spare parts and know-how to upgrade. Israel offered solutions to India's unique missile and air defence requirements and has probably done more than any other country to help digitize large swathes of India's arsenal, and done so without requiring a root-and-branch overhauling of the Indian armed services.

Today we are seeing a similar degree of flexibility by the Israeli defence industry as India's security concerns begin to change and New Delhi becomes much more focused on developing indigenous defence production capabilities. The robust partnership between Indian and Israeli defence MSMEs (micro, small and medium-sized enterprises), for example in aerospace, is helping India plug into the sort of global supply chains – a key aspiration of New Delhi.

India's other overseas defence partners have their strengths and are able to provide defence needs that

Israel cannot, notably in the area of large airborne and naval platforms. Yet it is safe to say that Israeli model of defence cooperation with India is vital given the unique benefits it offers.

The two governments do not openly discuss the full extent of defence cooperation and many of the critical program carried out together, such as in cyber security or nuclear technology, are not in the public domain and this chapter reflects these limitations.

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Early Relations

India fortuitously discovered Israel's defence sector when the 1989 collapse of the Soviet Union left it with a mammoth inventory of fighters, artillery guns, battle tanks and infantry combat vehicles for which it lacked the ability to upgrade or service. No Western government was in a position to help. Israel, however, had considerable knowledge of Soviet weaponry. Tapping this know-how after India established full diplomatic relations with Israel was a great help. The consequences can be seen even today with extensive use of Israeli components, subsystems and know-how in the upgradation of inventory of T-72 tanks and the BMP-2 infantry fighting vehicle, as well as platforms like the MiG-29, MiG-21 Bis, MiG-27 fighters and Mi-17 helicopters.

During the government of Prime Minister Atal Bihari Vajpayee, Israel also opened doors for India's state-owned

DRDO (Defence Research and Defence Organisation) to formalize joint defence R&D initiatives with Israeli defence companies. This played a part in the success of DRDO's extensive ballistic missile defence and military satellite program. This relationship has continued to evolve over the years. The most striking fruit of this collaboration was the co-development of the Barak surface to air missile. A naval version designed by DRDO and Israeli Aerospace Industries was released in 2016 while the land version, the network-centric MRSAM (medium range surface-to-air missile), was announced by the Indian government in September 2021. Versions serve in the armed forces of both countries.

While Israel's profile with India rose dramatically because of such collaboration, Israel also won the trust of the Indian political and security establishment through its willingness to provide emergency military and technological assistance during security crises. In the 1999 Kargil border war, Israel rushed much-needed artillery ammunition, precision-guided munitions and airborne missiles to India. The precision-guided munitions, apparently came out of Israel's own war reserves. Israel also provided crucial imagery captured by their satellites. This and other similar events earned Israel many points with the Indian establishment, and is a key reason for the degree of confidence Israel enjoys with New Delhi.

One sign of how important Israel has become for India's emergency weapons purchases: in July 2020, the two countries formalized an arrangement under which Indian armed services can procure weaponry and related

equipment from their Israeli counterparts and Israeli defence companies and pay for them later. Under existing arrangements, weapons and platforms that are currently in service with the Israeli Defence Forces can also be leased by India.

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Israeli Footprint

The range and breadth of Israeli weapons, components, core and subsystems in the Indian arsenal is impossible to catalogue fully. In command and control and navigational electronics, the Israeli contribution has been overwhelming. It is estimated that nearly 60 percent of the weapons and platforms used by the Indian armed forces have benefited from Israeli technology.

Israeli assistance has been crucial to the core technologies used for missiles, electronic warfare systems, radar systems, ammunition, electro-optical systems, avionics and navigations systems, weapon control systems, and other sensors that are designed and produced by DRDO. Israeli firms also contribute to India's Arjun main battle tanks and Tejas fighters. Many of the materials used by DRDO and some Indian state-owned defence firms for various defence-related technologies and systems are supplied by Israeli firms, including special alloys, composite materials, and nano-coatings.

Surveillance is a military area where the Israeli footprint is unusually large, reflecting Israel's own competitiveness

in this area. Israel is the single largest external provider of surveillance platforms and technology to the Indian military. This includes the Phalcon AWACS (airborne warning and control systems), Aerostat balloon radars, Heron and Searcher drones, air defence systems such as the Barak and Spyder, multiple types of C4ISR (command, control, communications, computers and intelligence, surveillance and reconnaissance) systems and land-based and shipborne radars, and the aforementioned MRSAM systems. Likewise Israeli firms are major suppliers of equipment for internal security.

Missiles and drones, and systems to counter both, also have an Israeli imprint. Many Israeli missile and precision-guided munition names – Derby, Python, Spice, Crystal Maze and Popeye – have become familiar to the average Indians because of constant media references. Spice missiles were used in the retaliatory airstrikes by the Indian Air Force against the Balakot terrorist camps in 2019. Loitering munitions and drones like the Harpy and the Harop are integral parts of India's arsenal against her adversaries.

There is an Israeli presence even in defence equipment like artillery guns, ammunition and firearms. Indian special forces have long been equipped with Tavor X95 rifles.

The three Indian armed forces have projected a joint requirement of a ballistic missile grid or network of air defence systems to counter all types of airborne threats, including drones, fighters, tactical and ballistic missiles, and Israel is the frontrunner in fulfilling this $6 billion

project. The system would require anti-missiles of eight different ranges, from 25 to 1000 kilometres, and would require several dozen missile systems in each range category. It would also mean the deployment of several dozen 3D PESA (passive electronically scanned array) radar systems and long-range tracking radar systems. In many ways, this would be a resumption of negotiations India had begun with Israel in the early 2000s to acquire the parts of a missile defence system. India had bought the Phalcon and Green Pine radar systems and was looking to Israel's under-development Arrow and David's Sling missiles to complete the network when the talks were suspended.

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MAKE IN INDIA

ISRAELI DEFENCE FIRMS HAVE BEEN THE MOST NIMBLE foreign companies to adjust to the Make in India priorities of the Narendra Modi government. Today over 100 domestic defence companies depend on Israeli companies for raw material, subsystems, niche military technology and systems for various Make in India defence projects. Some of these are co-production or co-development, others are off-the-shelf components and systems that now have an Indian firm involved in their manufacture or assembly.

Collectively these have become a near parallel economy for Israel defence companies in India, separate from the sale of full or partial weapon systems to the armed forces.

Indian public and private defence companies currently manufacture armaments worth $12 billion annually where Israeli defence companies are the largest technology and/or core systems providers.

As the Make in India policy has become increasingly ambitious, Israel has emerged the frontrunner among foreign partners by offering a new type of G2G defence deal mechanism. The most ambitious example is an Israeli offer to supply the Phalcon AWACS and tactical UAVs (unmanned aerial vehicles) under the Make in India policy by which all these complex platforms will be integrated, assembled, and manufactured in India in partnership with domestic companies. Israel has offered integration of two Phalcon AWACS aircraft for $800 million and joint production of 20 tactical Heron drones by IAI (Israel Aerospace Industries) costing $750 million in partnership with state-owned HAL (Hindustan Aeronautics Limited). The offer says IAI will integrate Phalcon early-warning radar systems on two IL-76 aircraft at the HAL facilities in Bangalore with help from state-owned Bharat Electronics Limited and the Centre for Airborne Systems, which is under DRDO. These India-built AWACS aircraft will have 40 to 50 percent local-made systems. IAI has also offered complete technology transfer of weaponized Heron drones to HAL. It is the sort of offer that it is hard to see any other country being able to even consider let alone conceptualize.

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Future Moves

As India's defence concerns have expanded, Israel was one of the countries it turned to after the violent confrontations at the western Himalayas in 2019. The accelerated purchase of Harop and Harpy drones and Spyder air defence systems was one fallout.

Israel has become important to India's ability to have eyes and ears on its borders. To keep an eye on military build-up at the border, India on 27 October signed a G2G contract with Israel for use of the Ofek 16 spy satellite. Under this deal, Indian armed forces will immediately receive 24x7 real-time imageries of troops and weapons deployments. The Ofek 16 is equipped with a Jupiter Space camera which has a resolution of up to 50 centimetres from a height of 600 kilometres and can capture 15 square kilometres in a single shot, enabling the Indian Army to keep a watch over the whole border region.

Looking to the future, the two counties held the 15th joint working group meeting on defence cooperation in Tel Aviv on 27 October 2020 with two co-chairs, Indian defence secretary Ajay Kumar and director general of the Israeli ministry of defence, Major General (rtd) Amir Eshel. During the meeting, India sought help in the development of new destructive technologies, cyber warfare, artificial intelligence-enabled C4ISR systems, electronic warfare and sensor-enabled military space technologies. India also wanted to co-produce secure hardware encryption devices, GPS anti-jamming devices, and 4G/LTE (fourth generation long term evolution) tactical local area network systems.

A sub-working group on defence industrial cooperation was set up in September. Under this initiative, India will learn about defence technologies like new engineered materials, navigation sensors, electromagnetic spectrum sensors, satellite protection, defensive countermeasures, laser communication, and kinetic energy and laser weapons from Israeli defence companies.

The two governments have entered into a bilateral innovation agreement to promote innovation and accelerated R&D in start-ups and MSMEs of both countries for the development of dual-use technologies. This agreement was signed between DRDO and the Israeli defence ministry's directorate of defence research and development on 9th November 2020 in New Delhi.

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Room to Improve

As in the case of any bilateral relationship, no matter how close, there is always room for improvement. India has run into obstacles when it has sought a full transfer of technology for crucial joint development defence projects with Israel. One example is the DRDO's joint development of the MRSAM and its sister LRSAM (long range surface-to-air missile) with IAI and Rafael of Israel. In both cases the IAI and Rafael are the sole design authority and DRDO is the only buyer. The plans are for the Indian Navy to procure 12 LRSAM systems for over $2 billion, the Indian Air Force to induct 18

MRSAM systems for $2 billion and the Indian Army to induct 14 MRSAM systems for $1.5 billion. Yet DRDO has complained that the Israeli defence companies have been less than forthcoming on handing over critical missile-related technology, and been unhappy that the intellectual property rights of the missiles remain with IAI and Rafael.

The Indian defence forces have also felt that there is opportunity for improvement in securing service and repair/maintenance support for Israeli weapon systems. Indian defence officials often say that though Israeli defence systems are comparatively cheaper than their Western counterparts, after-sales service can be expensive and marred by delays and cost overruns. New Delhi has occasionally imposed penalties on Israeli defence companies for not completing their offsets obligations. However, similar complaints are often levied against all of India's defence partners.

The India-Israel defence relationship has been strongly supported by successive Indian governments over the past 30 years, irrespective of political ideology. It was launched under the Congress government of P. V. Narasimha Rao and is now entering a new phase with the Modi regime's "Make in India" focus. India's path to indigenized defence production will be a long and winding path, with the road leading to localized research and innovation being particularly arduous. Israel's defence industry and remarkable technology ecosystem will remain partners for many decades to come. And keeping in mind that no country is ever fully independent in the military industrial sphere, it is certain that Israel

will remain a key strategic partner as both countries nurture this bilateral strategic relationship.

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Chapter 5

Regional Context: Israel's Partner in Asia

—Asher Susser

THE WORLD ORDER IN which Israel and India were on opposing sides of the international divide came to an end in the early 1990s. For almost half a century the Cold War had placed Israel and India in two different camps. Israel was positioned firmly at the heart of the Western alliance, and as of the mid-1960s, in an intimate relationship with the United States. India, on the other hand, was closely associated with the Soviet Union, and was one of the architects of the Non-Aligned Movement in the mid-1950s, together with Israel's arch enemy, Gamal Abdel Nasser's Egypt (or the UAR as of the 1958 union with Syria). India was a natural ally of the Arabs in their conflict with Israel.

Israel's formal diplomatic relations with India, concluded in 1992 and presently entering their thirtieth year, were a remarkable sea change framed by the end of the Cold War and by the radically changing strategic context of West Asia. The Indian-Israeli relationship has

in turn contributed to a further reshaping of the strategic architecture of West Asia, in which the enhancement of Israel's international stature and relative regional power have become key components.

India has evolved into the centrepiece of Israel's burgeoning relations with Asia, which include expanding ties with China, Japan, South Korea, and Singapore. Trade with India has increased by leaps and bounds, focusing on hi-tech, military hardware, agricultural expertise, and more.

Young Israelis flock in their many thousands to India as their destination of choice in their post-military service tours of the world. The growing interest in Asia has led to the development of East Asian studies in Israel's leading research universities and has produced some of the largest departments in the various faculties of humanities. But this is all relatively new, emerging from a rather "uncharitable" beginning.

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The "Consistently Uncharitable" Early Years[1]

India and Israel both emerged as independent states from the contracting British Empire in the late 1940s, but aside from this coincidence they had very little in common. The dominant Indian attitude towards the Zionist movement and Israel was negative. Indian leaders like Gandhi and Nehru believed that Palestine was an Arab country and that the demand for a Jewish national home

in Palestine was "intrinsically wrong".[2] India, as a member of UNSCOP (the UN Special Committee on Palestine), opposed the partition of Palestine in 1947. Though it granted Israel de facto recognition in 1950, it declined to establish diplomatic relations with the Jewish state.

India's troubled relations with Pakistan gave rise to concerns in New Delhi that a pro-Israel posture would encourage Arab support for the Pakistanis and might also arouse disaffection among India's own sizeable Muslim minority. Generally speaking, India's policy towards Israel was measured in terms of its likely repercussions on India's interests in the Arab world where it sought the friendship and confidence of the Arab states, not to mention the necessary flow of much needed oil to India. Israel, on the other hand, attached much importance to obtaining India's goodwill and favour as an "entrée to the society of Asian nations", but its efforts were in vain. In 1953, India agreed only to the establishment of an Israeli consulate in Bombay (Mumbai), "India's diplomatic Siberia", rather than in New Delhi, the country's capital.[3]

From the late 1950s and into the early and mid-1960s, against the background of India's increasingly conflictual relations with Pakistan and China, relations with Israel were said to have been "subject to maximum misunderstanding". India was especially keen to appease the Arabs as China and Pakistan seemed to be increasing their influence in the Arab world. India actively pursued the friendship of Arabs states, showing solidarity with fellow non-aligned countries, particularly the UAR, in an effort to "checkmate the growing influence" of Pakistan and China.

It became imperative for India "not to fritter away" what goodwill it had in Arab states at a time when it needed it most. In New Delhi it was understood that India's best interest was to support unequivocally Arab causes in order to prevent Pakistan and China from "weaning the Arab states away in an anti-Indian grouping".[4]

To these one must add the Soviet dimension which became an important factor as relations with China and Pakistan continued to deteriorate and India became increasingly reliant on the Soviet Union for military and other vital support. Indian dependency eventually culminated in the signing of the Indo-Soviet Treaty of Friendship and Cooperation in 1971. Similar treaties were signed by the Soviets with Arab states like Egypt (1971), Iraq (1972), and Syria (1980), at a time when the Soviet Union was not only fully committed to supporting key Arab states but was overtly hostile to Israel. India had thereby departed, in practice if not in theory, from its long tradition of non-alignment, and India and Israel were further apart than ever before.

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The Changing Arab-Israeli Balance of Power

Almost every factor that militated against close Indian relations with Israel in the early years gradually dissipated from the late 1970s onwards, coming full circle by the 1990s and thereafter.

The Egypt (or the UAR) of Gamal Abdel Nasser was

the lynchpin of India's relationship with the Arab world in the 1950s and 1960s. As the founding fathers of the Non-Aligned Movement, Nehru, Tito, and Nasser were fellow leading statesmen of the developing world. Arab nationalism under Egypt's leadership, better known at the time as "Nasserism," had a messianic appeal to the Arab masses and was seen worldwide as the promising wave of the future. The Nasserist version of Arabism was to advance the passage of the Arab nations to modernity, economic development, power, and international prestige.

But these hopes were shattered by the shocking defeat of Egypt by Israel in the 1967 Six Day War, which exposed the Nasserist flagship as an empty vessel. Egypt had not modernized successfully, as the economy and the education system could not keep up with rapid population growth. Education standards fell and the economy failed to produce the jobs required. Already in the late 1930s, shortly after Egypt's independence, two Egyptian scholars produced works on the Egyptian economy in which they argued that unless Egypt embarked on rigorous economic reform the country would court disaster because of rapid population growth. They predicted that Egypt's population would exceed 20 million by 1957,[5] a forecast that already occurred by 1950; by 1975 the population had nearly doubled again to 38.5 million. Egypt's population has presently passed the staggering 100 million mark and is expected to reach 160 million by 2050.

The wars with Israel were far too costly. In the aftermath of 1967 and the subsequent War of Attrition, fought between Egypt and Israel along the Suez Canal (1968–70),

Egyptian intellectuals began to question Egypt's role as "the blood bank of the Arabs". When Egypt combined with Syria to launch a surprise attack on Israel in October 1973, the Egyptian objective was to jump-start the diplomatic process to achieve an agreement with Israel. The Egyptians performed well in 1973 and in the first few days the Israelis suffered severe setbacks and very heavy casualties.

The Israelis overcame their initial shock and prevailed in the end. But both sides were now exhausted by war and ready for peace talks. Israel and Egypt finally signed a peace treaty in March 1979, thereby bringing the interstate dimension of the Arab-Israeli conflict to an end. The remaining Arab states were no match for Israel without Egypt in the Arab order of battle. Israel has fought against various non-state military forces (the PLO, Hizballah, and Hamas) over the years since then, but it has not faced war with an Arab state for almost half a century.

The peace with Egypt was a dramatic turning point in the history of the region. It reflected the far-reaching change that had taken place in the balance of power between Israel and the Arab world and set the stage for more of the same. In the mid-1970s, before the peace treaty with Egypt, Israel devoted some 30 percent of its GDP to defence. This figure has since declined sharply to just over 5 percent,[6] paving the way for impressive economic development. Israel's economy advanced as technological prowess transformed the country into a well-known "Start-up Nation." In 2020, in terms of GDP per capita (over $40,000), Israel was ranked nineteenth in the world, just ahead of Canada, New Zealand, and the UK.[7]

During the same period, the Arab states for the most part (main oil producers excluded) projected steadily deteriorating socio-economic and political performance as population growth stifled economic progress. These developments were in stark contrast to the initial assessments of Israel's founding fathers. In the early years after independence the leadership was pessimistic about the balance of power between Israel and the more numerous and wealthier Arab states. The prevailing assumption was that it would become increasingly difficult for Israel to maintain its power advantage as the Arab states advanced on the road to modernization and increased their conventional military might. It was this logic that drove Israel to embark on its nuclear program in the late 1950s. In the 1950s and 1960s India was cautious not to offend the Arab states in conflict with Israel. Like Israel's leaders, India's rulers also assumed that the Arab states had impressive developmental potential and significant representation and weight in the international arena where Israel was relatively isolated.

But instead of the gap between Israel and the Arabs growing steadily in the Arabs' favor, by the 1980s Arab power was in noticeable decline. The Arab-Israeli conflict was concurrently receding and was therefore evaporating as a constraint in India's calculations of its relations with Israel. The oil boom that shook international markets in the 1970s and early 1980s came to an end in the mid-1980s as oil prices and export earnings came tumbling down.[8] The visible decline of the Arab states had been temporarily delayed by the windfall of oil wealth, but by

the 1990s and the turn of the century the Arab crisis was in full swing and plain for all to see. The oil-producing Arab states no longer enjoyed the levels of income and wealth that allowed them to prop up the non-oil economies of their poorer Arab brethren.[9]

The Arab Human Development Reports, published annually by the UN from 2002, painted a rather pessimistic picture. They highlighted three critical drawbacks of the Arab states: a lack of political freedom, first world education systems, and gender equality. The first two prevented Arab countries from competing as equals in the globalized economy of hi-tech, creativity, and innovation. The absence of gender equality further compounded the Arab predicament. Women tended to have lower education levels in most Arab countries and generally very low ratios of participation in the labour force, leading to poorly performing economies and high birth rates—a combustible combination heralding unavoidable economic disaster.

The Arab world could not sustain its population which had grown from 280 million in 2000 to over 420 million by the early 2020s. On the shaky foundations of ailing economies, numerous Arab states entered prolonged periods of escalating domestic crises, conflict, and civil war stemming from sectarian, ethnic, and tribal tensions that had been swept under the carpet while the going was good. In 2016, the number of displaced people in Arab countries had risen from 12.7 million in 2010 to 29 million. Though the population of the Arab states was only 5.4 percent of the world total, they had 37.5 percent

of the world's refugees.[10] The so-called "Arab Spring" was not a democratic breakthrough by the masses, as some in the West initially believed, but an outburst of anger and hopelessness by the younger generation that was facing a bleak future.

The socio-economic crisis of the Arabs was amplified by the end of the Cold War. The great power support of the Soviet Union disappeared as the USSR gradually dissolved between 1988 and 1991. The regional balance of power shifted further in Israel's favour as the United States, Israel's staunch ally, emerged as the sole remaining superpower. The crumbling Soviet Union allowed massive Jewish emigration, bringing about a million, generally well-educated people to Israel within a decade. These immigrants made a major contribution to Israel's universities, hi-tech industry, the professions and the arts, propelling Israel into the twenty-first century with much added vitality.

On the other hand, these were hard days for the Arabs as time seemed to be working in Israel's favour and against them. The pessimistic mood was intensified by the crushing defeat of Saddam Hussein's army in the Gulf War of 1991, when the United States forced the Iraqis to retreat from their invasion of Kuwait. The Arab order of battle was weakened further by the Iraqi collapse and players like Jordan, the PLO, and even Syria, were willing to join a US-inspired peace process with Israel that was launched in Madrid in October 1991.

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The Restructuring of Indian-Israeli Relations

The changing international context set the stage for the restructuring of Indian-Israeli relations. The Cold War was over, the Soviet Union had dissolved, and the non-aligned movement had become a shadow of its former self. The Soviet Union, which had severed diplomatic relations with Israel in 1967, renewed official ties in 1991, while the Arabs, including the Palestinians, were engaged in peacemaking with Israel. Thus the former logic of India's abstention from relations with Israel was becoming increasingly irrelevant as the political inhibitions of the past lost their validity. Moreover, from the Israeli point of view, "the New Middle East" as a block of international trade that some in the country had imagined, did not really emerge—mainly because of market incompatibilities and reservations in Arab societies on normalizing relations with Israel. Therefore, it was only natural for Israel to look beyond the horizon of the West Asian periphery to Asian giants like India.

Israel and India established formal diplomatic relations in January 1992 and soon became major trading partners and political and strategic allies. In the 1950s and 1960s trade with Israel did not have much to offer India and it certainly did not justify risking a rupture with the Arab states. At the time, it was believed in India that neither Israel's resources nor its export or import potential were likely to be of "any consequence to the foreign trade of India". Trade with Israel was negligible compared to trade with the Arab states and was limited to artificial diamonds, citrus products, manure, chemicals

and fertilizers. India concluded that there was no need for an exploration of the Israeli market.[11]

However, in the new circumstances of the 1990s Israel and India had plenty to offer each other and interacting with Israel had virtually no cost for India in the Arab world. The Arabs themselves were coming to terms with Israel and in their troubled situation were in no position to take punitive action against India, nor did they have any inclination to do so.

Trade with Israel was no longer about manure and citrus products. India became the leading procurer of cutting-edge Israeli hardware (including drones, anti-tank missiles, anti-ship missiles and surface-to-air missiles), and Israel was second only to Russia in military supplies to India. Israel and India also cooperated in industrial research and development, and in the advancement of agricultural and water technologies, space and science.[12] As countries with hostile Muslim neighbours, they shared intelligence on, for instance, Muslim terrorism, and engaged in joint military training and in the joint development of advanced weapons systems. Relations with Israel also made sense at a time when some Arab states were still sympathetic to India's "sworn enemies like Pakistan".

In the meantime, developments in West Asia further weakened the hand of the Arab states. The US invasion of Iraq in 2003 turned the tables on the Sunni Arab world. The overthrow of Saddam Hussein and the Ba'thi regime in Iraq removed the Sunnis from centuries of domination in Iraq, and empowered the Shi'ite majority, which had traditionally been marginalized in Iraqi politics. The

balance of power in the Arab East was altered radically in favour of the Shi'is.

Saddam's Sunni-dominated Iraq had been the gatekeeper of the Arab East for decades against the advances of Shi'ite Iran. But Shi'ite-dominated Iraq was a natural ally of Iran providing a stable bridgehead to Syria, under the pro-Iranian Alawi regime, and from there to Lebanon where the Shi'ite militia of Hizballah had long been the pre-eminent player in the local political quagmire. The new circumstances allowed for the emergence of an Iranian "Shi'ite Crescent" of influence, as King Abdallah of Jordan called it,[13] from Tehran to the Mediterranean, the likes of which had never existed in the modern era. As the Arabs continued to struggle, the two other non-Arab regional powers, Iran and Turkey, along with Israel, became the leading powers of West Asia.

In comparison with Israel's early years of relative international isolation, by the 1990s it had established a solid global network of ties which greatly reinforced its regional stature. Israel's strategic relationship with France in the 1950s and early 1960s was replaced by an increasingly intimate association with the United States, which has lasted for over half a century. Traditionally, Israel has had stable relations with the countries of Latin America and Western Europe and, after the fall of the Soviet Union, its relations with Russia were resumed as were ties with the other former members of the Warsaw Pact in Eastern Europe. In the 1950s and 1960s Israel made impressive progress in its relations with the emerging nations of sub-Saharan Africa, only

to be disappointed by the break with Africa under pressure of the global oil crisis of the 1970s. But during the 1980s and 1990s ties with African states were gradually restored, while in Asia, Israel established firm relationships not only with India, but with China, Japan, and other nations as well.

Israel's growing power was a major factor that paved the way for the partnership with India; in turn, burgeoning ties with a major Asian and international player like India was another boost to Israel's enhanced stature in West Asia. Sunni Arab states, like Saudi Arabia, the United Arab Emirates (UAE), and Bahrain, began to look to Israel for support against the regional expansion of Shi'ite Iran. As oil producers, they were increasingly concerned about their economies in the rapidly approaching post-oil era. Considering a future heavily reliant on hi-tech, Israel was an obvious source of know-how.

In August 2020, Israel, the UAE, and Bahrain signed the Abraham Accords for peace and normalization. These were followed shortly thereafter by similar treaties with Sudan (in October) and Morocco (in December), in exchange for political gestures from the United States (removing Sudan from the list of states sponsoring terrorism and recognizing Morocco's claim to Western Sahara).

Relations between Israel and India have not been problem-free. On the list of foreign countries trading with Israel, China is ahead of India, and Chinese firms are involved in Israel in hi-tech and in numerous critical infrastructure projects, such as the light-rail network in Tel Aviv and the construction of a container terminal in

the port of Haifa. As rivalry between the United States and China has escalated, the former has brought intense pressure to bear on Israel to change course on Chinese involvement in the Israeli economy.[14] It is clear that India also has concerns about Israel's relations with China. On the other hand, Israel is troubled by India's close ties with Iran. India has vital interests in Iran related to oil and to the management of its conflict with Pakistan, which is bordered by Iran to the west.

Though the grievances on both sides relate to serious matters, they have not been allowed to disrupt the basic harmony of the India-Israel partnership.

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ENDNOTES:

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Chapter 6

Regional Context: Three Shifts in Indian Policy

—Pramit Pal Chaudhuri

Until late 2015, India's policy towards the Middle East, commonly referred to in New Delhi as West Asia, was a set of distinct bilateral relations and much of India's diplomatic efforts were directed to ensuring these did not get entangled. New Delhi tread carefully around the various fault lines in the region using a strict set of roadmaps. In the Levant, it hyphenated its diplomatic and political relations with Israel and Palestine, publicly treating them on par. Any visit by an Indian official to Israel would also include a stopover in Palestine. Its most important economic relationships were with the Sunni monarchies in the Persian Gulf notably the United Arab Emirates, Saudi Arabia, Kuwait, and Qatar. These were its primary regional trading partners, homes to several million Indian workers, and the principal sources of its oil and gas imports. However, political relations with these countries was kept to a bare minimum. India also maintained good relations with Iran, to some extent over oil imports, but

more because of the country's strategic importance in buffering India against the sources of its main external security threats, Afghanistan and Pakistan. When Iran and the Sunni monarchies had problems with each other India could be counted on to maintain a strict neutrality.

One consequence was New Delhi had little influence on developments in the region. India turned the other cheek when Saudi-dominated venues like the Organisation of the Islamic Conference would criticize its Kashmir policy or Iran sponsored United Nations resolutions against countries that had not signed the Nuclear Non-Proliferation Treaty — aimed at Israel, but also damaging to India. Though various conflicts in the Gulf resulted in high oil prices and disrupted the Indian economy, India avoided being involved in any regional peace initiatives. The exception proved the rule of New Delhi's passivity. India became an observer of the Oslo peace accord at the invitation of the Palestinian leader Yasser Arafat. India played so little a role over the following year that in 1993 the Israeli prime minister, Yitzhak Rabin, in a conversation with Indian journalists, invited New Delhi to join under the impression India was not party to the accord.[1] Israel did later ask India to serve as a go-between when its relations with Iran began to fall apart. While New Delhi dutifully passed on the messages, Indian diplomats and officials involved expressed wariness about having to play the role.[2]

From the 1990s onwards, this hand's-off approach became increasingly disconnected from ground realities. The Israeli relationship grew in leaps and bounds, with

Israel becoming one of India's most important defence and security partners even as popular Indian interest and support for an increasingly Islamicized Palestinian nationalist movement dwindled. The gap between the two bilateral relationships made hyphenation increasingly untenable.

Similarly, the economic relationship with the Sunni monarchies in the Gulf came to dwarf the relationship India had with Iran. When Iran fell under sanctions, New Delhi forced Indian refineries to buy Iranian crude to maintain a minimum flow of Iranian oil imports to support its broader relationship.[3] The Iranian relationship also struggled because Tehran was a difficult business partner. But when it came to handling India's regional rival, Pakistan, Iran was traditionally more helpful than the Sunni monarchies, many of which had close relations with the Pakistan military.

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Modi Policy

Prime Minister Narendra Modi came to power in April 2014 with a worldview that placed little emphasis on West Asia, other than an ideological interest in Israel. His government initially retained all the elements of the traditional Indian West Asian policy. Modi had ambitious plans for India's external economic policies, with an emphasis on attracting investment, technology and infrastructure finance but did not envisage a major

part for West Asia. Then Foreign Minister Sushma Swaraj explained in August 2016, "In our diplomatic engagements in the last two years, you will therefore find that a major focus now is using international partnerships to advance domestic flagship programmes…This tight meshing of domestic and diplomatic goals is in fact one of the hallmarks of the Modi Doctrine".[4]

The new government did urge Persian Gulf-based sovereign wealth funds to consider investing in Modi's ambitious infrastructure and manufacturing plans. These appeals began within a few months of Modi's elections and became embedded in any official comment relating to West Asia. But it was the only point where the Persian Gulf intersected with Modi's domestic agenda and New Delhi did not place much hope in the Gulf monarchies.[5]

A restatement of India's traditional West Asia policy was laid out by the senior diplomat in charge of the region in April 2015. While expressing concern at the region's political chaos, the diplomat stressed India was "non-prescriptive and non-judgmental" about events there and "not in the business of exporting democracy". India's policy was a success as "bilateral relations with virtually all countries of the region have been progressing… we have managed to insulate our core interests from the negative fall-out of regional developments." The country's had a number of relationships in the region, India's goal was to ensure these did not cross and multilateral approaches were avoided. "We would not wish to create parallel mechanisms that will affect our bilateral relations," he said.

The standard explanations for this policy were laid out. One, as home to the world's third largest Sunni and Shia populations, "we need to be sensitive to the perceptions of our own religious and ethnic mix in the population." India had to be "cautious" that its "approach to the region should not be misconstrued as being partisan or sectarian." He admitted India had been asked to play a "more active role in the Middle East", however "we need to assess this based on our strategic leverages and realistic consideration of our strengths and limitations." He critiqued the Arab Spring as having "exacerbated regional fault lines, heightened regional rivalries with competing ideologies and skewed the regional balance of power." Insofar New Delhi had any solution, it was to hope Washington would play its traditional role and restore order to the region. "India believes the US…remains an important player for regional stablity" and, in an oblique reference to China, felt other countries which have "gained in appeal as a counterweight to the West in the region" had questionable "economic capacity and sustainability".[6]

The sense of policy continuity in the early Modi period was reinforced when India voted against Israel over a United Nations Human Rights Council in July 2015, a resolution over which even European governments had abstained. While in keeping with India's past rhetorical support for the Palestinian cause, it ran against the ruling party's admiration for Israel.[7]

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Abu Dhabi's Offer

In early August 2015, the Indian government surprisingly announced Prime Minister Narendra Modi would make a state visit to the UAE on August 16-17. While one of India's largest trading partners, there had never been much strategic or political meeting of minds between India and the UAE. The last Indian prime ministerial visit had been during Indira Gandhi's time. Though senior Indian officials had been making visits to the region in the six months after Modi's election they had focused on Israel and Iran, giving little attention to the UAE. The UAE, along with most of the Sunni Gulf monarchies, had a long-standing military relationship with Pakistan under which Islamabad promised to provide boots on the ground in case of a major security crisis — and possibly even deploy its nuclear arsenal on their behalf if needed. India had assumed no deep military or security ties with these countries were possible under these condition.[8]

The scope of the agreements Modi signed with Abu Dhabi's Crown Prince Mohamed Bin Zayed were remarkable. After decades of non-existent defence and security cooperation, the two agreed to work together on terrorism finance, hold half-yearly national security advisor meetings, consider the manufacture of arms in India and hold regular military exercises. In the economic sphere, the statement spoke of a "transformative economic partnership". The UAE committed to invest $75 billion in India from its main sovereign wealth fund to help "India's plans for rapid expansion of next generation infrastructure". The UAE also agreed to store a portion

of its strategic oil reserves in Indian reservoirs with the understanding India could tap these reserves in an emergency. According to a number of Indian officials, the initiative for this drastic upgrade in relations was taken by the Abu Dhabi royal family. When India pressed the UAE on its relationship with Pakistan, it agreed to disallow Pakistani-backed terrorists from finding physical and financial haven in Dubai.[9]

In the Indian assessment, the Abu Dhabi royal family was driven by four strategic concerns. One, Abu Dhabi was eager to change the UAE's reputation as a black hat financial haven into something more respectable. "Their vision is to make Dubai more like Singapore," said an Indian official. "In that picture, India and its large corporate make more sense than Pakistan".[10] Two, the UAE was infuriated with Pakistan's refusal to send its soldiers to fight in the Yemen civil war. The UAE had come to see that war as part of a larger Sunni-Shia struggle for the mastery of the Gulf. Pakistan was seen as having violated this foundational understanding of its relations with the Emirati. Three, like many Gulf countries who had allied themselves to the West, the UAE was increasingly wary of the direction of Washington's policy, including increasing talk of withdrawal from the Gulf and rapprochement with Iran. India's rising military and economic capabilities and the possibility it could become a major external player in the region led Abu Dhabi to feel it was worthwhile to invest more in relations with India.[11] The Abu Dhabi royal family also indicated to Modi that it was speaking on behalf of other Gulf monarchies. Modi was to subsequently visit

Qatar and Saudi Arabia and receive further promises of large-scale investment.[12]

This turn of events meant many benefits now accrued to New Delhi. In a pattern seen with Japan earlier, New Delhi found it could leverage the geopolitical interest of the Gulf states to make them commit to long-term capital investment that did not require immediate commercial returns. An additional benefit of working with the UAE was isolating India's regional rival, Pakistan, and raising the barrier for Pakistani-based terrorist groups raising funds from or transiting through the Gulf.

New Delhi has been more cautious in its engagements with Riyadh. India was persuaded that the new ruling faction of the Saudi royal family was genuinely interested in moving closer to India but New Delhi believed the Saudi-Pakistan military relationship, though weakened, was still considerable. Riyadh was quick to show its determination to make large-scale energy investments, both upstream and downstream, with a generous but unsuccessful bid for the second largest private oil company in India. Saudi officials say they provided intelligence to help India identify the Pakistani terrorists who carried out an attack on an Indian air force base in Pathankot in January 2016. Saudi Arabia, say Indian officials, also became "more responsive" to New Delhi's complaints about Saudi-based funding for extremist Islamic mosques and seminaries inside India.[13]

Modi's visit to the UAE was a turning point. West Asia came to be seen as not only important but even crucial to the success of his economic agenda. "The Persian Gulf is

now important as a source of investment and less as a source of energy," said a senior Indian diplomat. Within this Abu Dhabi held a special place. India's then foreign secretary, S. Jaishankar, in a March 2016 speech laying out India's foreign policy agenda said India was becoming more active in the areas to its west. He noted that India's West Asia policy in the past had been "an evolutionary happening that was relatively autonomous of strategic calculations." He spoke of India developing a "Think West" policy where it leveraged growing overseas interest in India to develop connections to other parts of the world. While Modi had used the phrase "Link West" in earlier speeches, he had tended to incorporate all regions on that side of India, including Europe and North America. The phrase began appearing regularly in official statements by late 2016. In May 2017, the Indian foreign ministry spokesperson promoted the policy further by referring to a "Go West" connectivity and outreach policy with West Asia.[14]

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Different Gears

In 2015, in a second shift in India's West Asian policy, the Modi government also began shedding the foreign policy inhibitions that had been imposed by its bureaucracy regarding Israel. The then president, Pranab Mukherjee, became the first Indian head of state to visit Israel in October that year and was followed by the then foreign minister, Sushma Swaraj, in 2016, though both

maintained the hyphen and visited Palestine. The prime minister began leaving his imprint on Indian rhetorical positions as well. India abstained in a July 2015 UN vote condemning Israel for "war crimes" in Gaza and changed its stance from anti-Israeli to neutral between two votes in April and August on the same UNESCO resolution critical of Israel. Finally, Modi made a state visit to Israel in July 2017, not only becoming the first Indian prime minister to do so but also becoming the first Indian official to not include Palestine in his itinerary. The prime minister did make a state visit to Palestine in February 2018 but avoided going to Israel, making it clear India would now treat the two relationships as separate.[15]

Implicit in all these developments was not only the rightwing Bharatiya Janata Party's support for Israel, but also the relative decline in Iranian importance for India. Reeling under sanctions and with little to offer other than oil, Iran had little to contribute to the sort of sweeping plans that Modi had for the Indian economy. The Modi government's most important strategic convergence with Iran was support for the non-Taliban regime in Afghanistan. The tangible manifestation of this convergence was the container corridor that India was trying to put together from the port of Chabahar on the Persian Gulf to Herat in Afghanistan, designed to reduce Afghanistan's geographical dependence on Pakistan. However, it had taken a dozen years just to get the first trial runs of container movement to take place in 2014. Tehran and New Delhi had regularly sniped at each other via the media, claiming the other side was the

obstacle. Iranian and Indian officials privately blame their respective bureaucracies and a lack of sustained political interest in both capitals. Fortunately for Modi, he came to power just as the corridor seemed to be coming together. In May 2016, he traveled to Iran to sign a transport and transit agreement between India, Iran and Afghanistan. But a more ambitious North-South Corridor that would have provided a more sustainable commercial path to Central Asia via Iran and which was of strategic interest to New Delhi because it provided a long-term counter to the Belt Road Initiative of Beijing remained on paper, largely because of Iranian disinterest.

The Modi government was also determined that, following the lifting of UN sanctions against Iran, Tehran should fulfil an earlier commitment to provide India an equity share in the Farzad B gasfield. Iranian prevarication led India to retaliate by reducing its purchases of Iranian crude, an aggressive stance that Indian officials say had sanction from Modi. Ultimately Tehran showed itself to have little to contribute to the Indian leader's domestic agenda and that even when it came to more traditional Indian interests, it was a less than dependable partner. Tehran had its own doubts given India's increasing closeness to the US and Israel.[16]

The Persian Gulf and West Asia between 2015 and 2019 became much more integral to Modi's foreign policy. In turn, this led New Delhi to believe it could be more active in shaping developments in the region, though it remains unclear how it can convert thought into action. Speaking about West Asia in March 2015, the Indian

foreign secretary said, "We are no longer content to be passive recipients of outcomes…Our growing capabilities and stronger national branding, in fact, makes us a credible partner." Later, in his annual summary of Indian foreign policy in January 2017, he gave an indication of how much more thought was being given to West Asia. "While the East was more an exercise of consolidation with ASEAN, the reaching out to the Gulf Cooperation Council and Iran have been among one of the hallmark initiatives of the current government," he said. "As a result, India is involved in the Middle East in a manner in which it has not been for many decades".[17]

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Western Quad

The third major shift in West Asia's regional dynamics was the Abraham Accords of August 2020. The accords, brokered by the administration of US President Donald Trump, led to the normalisation of diplomatic relations between Israel and the UAE, with Bahrain, Sudan and Morocco signing up subsequently. The Israeli-UAE agreement reflected the growing security convergence between the Gulf monarchies and Israel over the growing influence of Iran in a swathe of countries including Syria and Iraq. It also mirrored Emirati ambitions to become a global financial and technology hub in a post-hydrocarbon economy, an ambition that required spokes in Israel, India and other parts of the world.

The UAE had already begun developing an economic corridor, with large investments in connectivity and technology, with India whose origins began with the transformation of India-UAE relations in 2015. The UAE earmarked $7 billion in infrastructure investments to develop a "food corridor" with India under which the latter would serve as a secure agricultural supplier to the Persian Gulf. The UAE's two major sovereign wealth funds also began investing heavily in India's burgeoning digital technology sector.

Much of this was matched by similar UAE investments in Israel. The UAE has nearly completed the Etihad Rail network which would link the Emirates, through Saudi Arabia, to Jordanian and Israeli ports like Aqaba and Haifa. By some estimates, when completed, this Mediterranean to Indian Ocean corridor would reduce the time to move a container from India to Europe by 40 percent.[18] The UAE had also become a major financier of start-ups in Israel, seeking to ride on Israel's blockchain, cybersecurity, quantum computing and AI capabilities and matching them with UAE's smart city advances and financial capabilities.[19]

In much of this, the UAE was quietly mirrored by Saudi Arabia. While it was politically still difficult for Riyadh to recognize Israel, Saudi Arabia was a large investor in India's tech sector and a partner in projects like Etihad Rail. Saudi Arabia also tacitly accepts that Israel is more friend than foe given Riyadh's hostile relations with Iran. In 2020, the Saudi Public Investment Fund was the single largest investor in India's private equity market, spending $3.3 billion over three deals. Two

UAE sovereign wealth funds, Mubadala and Abu Dhabi Investment Authority, invested $2.1 billion each during the same year. These two Gulf nations, in other words, represented over 10 percent of the total $62.2 billion investment that India's private equity markets received in 2020. Almost all of this investment was in high technology sectors of the economy.[20]

The UAE reportedly took the lead in joining these two spokes of its grand strategy and getting India and Israel to agree to the formation of a technology and investment economic forum that has been since dubbed by the media as the "western Quad". The US was brought in at the end as its own tech sector and geopolitical blessings were seen as a necessary glue. The door that opened to allow this, however, were the Abraham Accords, something Indian diplomats have publicly acknowledged. Israel was eager to see if India, one of its closest strategic partners in Asia, could be brought into the new regional opportunities. Israeli's seniormost diplomat, Alon Ushpiz, explained to a private Indian audience his country wanted to see "how can the new situation in the Middle East have an Indian angle to it".

The western Quad, at the time of writing, remains a work under progress. But the initial statements are about the four government's facilitating the coming together of their private sectors in cutting-edge technologies. This would include not only the integration of financial systems but also understandings on technology standards, human mobility and trade facilitation. One consequence was the restarting of free trade negotiations between India and

Israel, New Delhi now having a sufficient incentive to take up the idea again.

Foreign Minister Jaishankar, during a visit to Dubai, said, "Start-ups and the tech space provide an arena where Indian capacities and markets can be combined with UAE investments. This is the spirit that underlies the new partnership between India, Israel, UAE and USA to collaborate on projects in our countries, and in West Asia. We intend to leverage synergies and complementarities in technology, skills, finances, and project execution capacities to augment global good".[21] Of special interest to all the western Quad members is the promotion of a green tech corridor that can become a global source of research, finance, software and manufacturing for solar and wind energy components, electric vehicles and batteries.[22]

Much of this remains in the future, but reflects a massive shift in how geopolitics and economic competitiveness is viewed in West Asia and by India. This does not mean the original bases of bilateral relationships have eroded. Indian officials are clear that "energy security and human resources" remain the pillars of their country's relations with the UAE. Similarly, diamonds and defence dominate the tangibles in the India-Israel relationship and will do so for the immediate future.

But the hope is that the new Quad will plant the seeds of something quite new. A Quad-backed green transition programme could in time displace the traditional oil and gas relationship that India has with the Gulf states. The Modi government is working out how to make the movement of labour to the Gulf easier using online

platforms as well as push it up the value-added ladder to include tech workers. This has already been done with the UAE and Saudi Arabia. New Delhi is contemplating how it can eventually negotiate a mobility agreement with Israel as well.[23]

The tectonic change in West Asia's regional dynamic is allowing and being matched by major shifts in India's policy to the region. The Modi government ended India's public ambivalence about Israel. The abrupt US withdrawal from Afghanistan and the return of the Taliban have also diluted the strategic importance of Iran to India. The UAE has concluded that its economic and strategic future lies in building bridges of technology and finance to countries like India and Israel, a perfect fit for similar ambitions in New Delhi and Jerusalem. Prime Minister Modi's commitment to transiting India away from fossil fuels also reduces the long-term importance of oil and gas exports from the Gulf. The western Quad is the strongest outward reflection of India's new West Asian turn. Foreign Minister Jaishankar outlined this point of view in an interview, arguing that West Asia had "suffered from a want of political attention" until 2015. India was not consciously multilateralising its regional policy but this was happening as part of a "natural evolution". India had three strong relationships in a "small geography" and that rather than remaining with three separate relationships, for India to "maximize the gains" it made sense to create a joint body. He described it as a "management solution" rather than a multilateral body but admitted that the "collective" element had added a new layer to India's

West Asian policy.[24] To put it another way, after decades of separate West Asian relationships, India has begun to not only connect these separate threats, it has also begun seeing the Levant and Persian Gulf as the same policy region. With India beginning to see West Asia as being at the heart of the economic and technological changes it believes are its tickets to great power status, the pole positions are already held by Israel and the UAE.

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Chapter 7

Agricultural Cooperation: Past and Future

—Ram Fishman

ADMIRATION FOR ISRAEL'S agricultural successes is widespread in India. It is shared by bureaucrats, experts, and farmers, and extends from government offices to remote villages. The common sentiment is that Indian farming has much to gain by learning from Israel. This is also a mantra that is repeated during virtually every official visit between the two countries, including and often by our prime ministers.

But even a precursory look at the agricultural economies of the two countries raises questions about how natural the India-Israel agricultural connection is in reality. Israeli agriculture is strongly dominated by high-value, technological, export-oriented horticultural cultivation. Indian agriculture is still heavily grain-based and focused on domestic consumption, with relatively low productivity and use of modern technology. These differences reflect Israel's effective abandonment of any sort of self-sufficiency in food, and India's continued

adherence to its success in achieving it. Indeed, in 2010, the cereal dependency ratio (net cereal imports as a share of cereal consumption) was only 3 percent for India and 98 percent for Israel (FAO data). In 2015, Israel's farmers constituted about 1.5 percent of its population compared with almost 50 percent in India. The agricultural value added per worker was about US$1,500 in India, while in Israel it was some 50 times greater (FAOSTAT data).

What then, if any, is the real basis for the enthusiasm around the prospects of Indo-Israeli collaboration in agriculture? Does it reflect a real opportunity or wishful thinking based on a superficial reading of reality? It seems that among all the hype there have been few careful and critical discussions of this question. In this essay, I will try to offer a few thoughts that may contribute to such a discourse.

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Looking Back and Looking Ahead

Historically, in the field of agriculture, both India and Israel have come a long way in their relatively short lives as independent nations. From its humble beginnings, Israeli agriculture has succeeded in becoming one of the most economically productive in the world, whether measured in value per worker, hectare, or cubic metre of water. Indian agriculture has also come a long way in the same time span, having successfully implemented the green revolution in some (but not all) of its vast agricultural lands, enabling it to become self-

sufficient in food. Today, land availability constrains the further expansion of cultivation in both countries. However, as noted above, while Israeli agriculture has focused on high-value horticulture, India has remained focused on grains—cereals, pulses, and oil seeds.

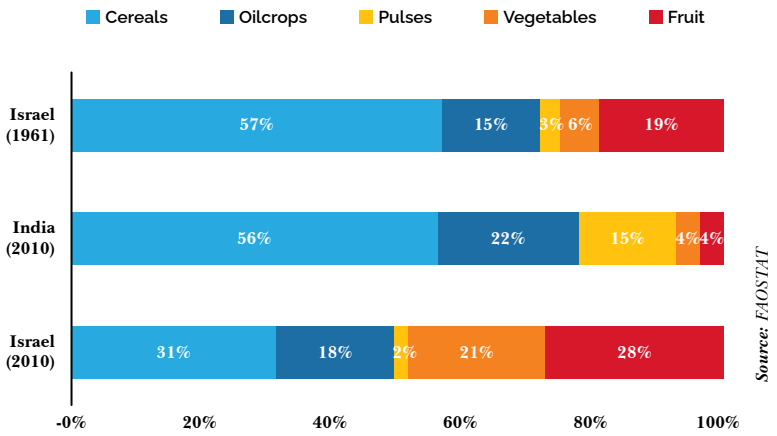

Figure 1: *Distribution of Cultivated Land by Crop Type in India and Israel.*

This difference is clearly visible in Figure 1, which demonstrates the distribution of cultivated land between fruit, vegetables, cereals, pulses, and oil seeds. According to data from 2010, more than half of India's agricultural land was cultivated with cereals compared with only 30 percent in Israel. Only about 8 percent of Indian land was used for horticulture (fruit and vegetables), compared with almost half in Israel. However, the figure also shows that the land distribution in 1961 Israel was not as different as that in 2010 India. In the 1960s, however, fruit still occupied a larger share of land in Israel than it

did in 2010 India, but 57 percent of land was cultivated with cereals, as in India, 2010.

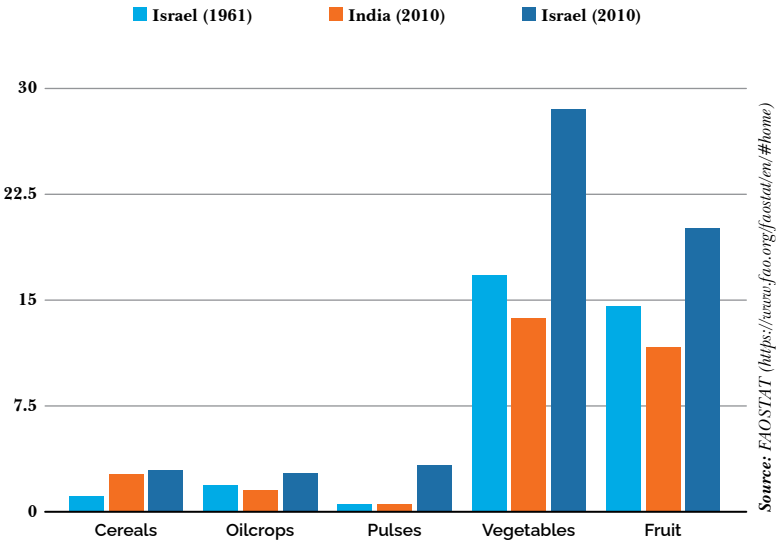

Figure 2: *Yields of Various Crops in India and Israel.*

Figure 2 shows the yields (in tons per hectare) of the same crop groups in India and Israel in 2010 and 1961. The 2010 yields in Israel were much higher than they were in India for all crop groups, and especially for fruit and vegetables, the focus of Israeli agriculture; in fact, yields were almost twice as high as in India. However, yields of most crop groups in 1961 Israel were very different from those in 2010 India.

Thus, in some ways, while the agricultural systems of the two countries have become starkly different today, Israeli agriculture in 1961 was not drastically dissimilar

from where India's was in 2010 in terms of crop coverage and yields. This provides some basis for the idea that the Israeli experience in agricultural development over the past half-century may be of relevance to India's path forward. If India wishes to pursue a development strategy that includes diversification towards productive, efficient high-value horticulture, there may be technologies employed in Israel's own development that may be relevant, especially given the somewhat similar agro-climatic challenges faced by both countries (see below).

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Structural and Socio-Economic Differences

And yet, despite this similarity, there are also deep structural, social, and economic differences between India's and Israel's current situations, as there were even in the 1960s. Overlooking or discounting these differences can lead us to naive extrapolations about the potential for India to apply and benefit from elements of Israel's historical experience.

Even in its early days, the Israeli farming population was exceptionally highly educated and motivated in relation to the country's economic development. During the twentieth century, historical circumstances brought a young, educated population of workers to Israel's farmlands, with an idealistic zeal for farming but with basically no prior experience or claims to the land. It is hard to imagine an agricultural labour force that was more

atypical than their counterparts in present-day developing countries like India. In the latter, the agricultural labour force is aging, has a low income and limited formal education, and has been engaged in farming for many generations, at least in part for subsistence. The young are usually thought to have little taste for farming and are leaving villages to seek non-farming employment in urbanizing centres. These stark differences in the human capital of the agricultural labour force between early post-independence Israel and present-day India are crucial, because they have strong implications for the potential adoption of novel technologies, crops, and cultivation practices by Indian farmers.

There are also important differences in the agro-institutional environment and the structure and operation of agricultural input and output markets. Farms in India are small, and often shrinking in size, making them prone to diseconomies of scale. Israel's farms are also relatively small (though not as small as India's), but its farmers are extremely well organized through its well-known cooperative and communal movements (the *moshav* and kibbutz), allowing them to overcome many market imperfections. These, and other differences, mean that a simplistic approach to technology transfer between the two countries may not be very productive.

Admiration for Israel's success in agriculture has its place, but it should be qualified. Israel was endowed with enormous human capital and external infusions of finance, and has never had to deal with the complex

socio-economic challenges faced by developing countries. This does not mean, of course, that its technological achievements should not be put to use in other countries.

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TECHNOLOGY TRANSFER: THE EXAMPLE OF DRIP IRRIGATION

WITH THESE IMPORTANT CAVEATS IN MIND, I WILL outline some of the Israeli experiences most often cited as worthy of emulation in the Indian context, starting with the technology for which Israel is most well-known, irrigation. In order to attain their present-day achievements, both India and Israel have had to deal with severe climatic and water-related constraints by developing an irrigation infrastructure. Without irrigation, both countries would be at the mercy of a single rainy growing season with highly variable performance. But while Israel is considered by many to have fully overcome its water problems, India's success may have been temporary. Even in those regions in India where irrigation was successfully developed, it is inefficient and unsustainable, with water resources being depleted through wasteful forms of irrigation.

What enabled Israeli agriculture to overcome its water constraints and what parts of that experience are relevant to India?

The most notable achievement in this respect is its successful development and almost ubiquitous adoption of

precision irrigation technologies, initially micro-irrigation like drip and sprinkler, followed by numerous advances leading to digitization and soil moisture sensors, with progress still ongoing. These technologies have enabled Israeli farmers to dramatically improve the value of production achieved per unit of water, or as it is popularly known in India, "more crop per drop".

Technologies that can maintain production with less water are certainly crucial for India as it battles increasing water scarcity, and micro-irrigation has been repeatedly proven on Indian soil. In recent years, the spread of micro-irrigation technologies in India has become one of the most successful instances of Israel-India technology transfer. Israel's largest micro-irrigation companies are either actively selling in India or have been bought up by Indian companies, while multiple Indian manufacturers have also sprung up. However, this success is still limited to a few regions. Only a small fraction of Indian farmers have adopted micro-irrigation, and even those who have often do not use it to its full potential. Moreover, additional "beyond drip" water-saving technologies from Israel have scarcely been adopted in India, even though they may well be necessary in order for it to overcome its water woes. Despite steady improvements, irrigated water use efficiency, measured in monetary value per unit of irrigation water, is still 6–10 times lower than in Israel, showing the potential for additional improvement.

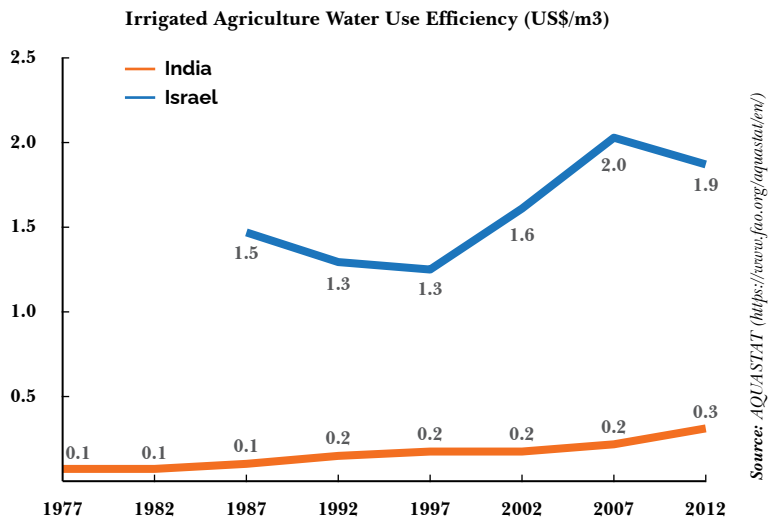

Figure 3: *Irrigated water use efficiency in India and Israel over time.*

Both the success and its limitations provide us with important lessons. Whether a technology is adopted is determined not only by its function and performance but also by economic and institutional factors. And in these latter dimensions, Israel and India differ dramatically.

First, structural issues in Indian agriculture, such as access to finance, reduce profitability, making the technology difficult to afford. Second, the monetary incentives to conserve water are quite limited in India. In Israel, water resources have been government property from day one, and water use is subject to aggressive metering, quotas, and prices that have been tightened over time. This has helped create strong incentives for efficient usage. In India, in contrast, water use is unregulated, unmetered and unpriced. This has led many experts

to argue that a lack of incentives to conserve water is an obstacle to the adoption of water-saving technologies.

That Indian farming has not yet *fully* followed the Israeli success in irrigation is likely to be a result of the above, at least in part. But that it has followed this path to *some* extent shows that these structural differences should not be regarded as insurmountable barriers.

Israeli agronomists, diplomats, and businessmen commonly advocate for full metering and pricing of irrigation water (and the energy required to pump it) as essential in order for Israeli technologies to spread more widely. This is not necessarily a baseless idea, but it is often voiced with very little appreciation of the subtle social, economic, and political complexities involved in such a policy shift, complexities with which Israel has never had to contend. Such sweeping recommendations are impractical and unhelpful, at best, and condescending, at worst. Indian development policy will not be decided simply by whether it allows more Israeli technologies to be adopted in India.

A more constructive approach to Indo-Israeli collaboration is to accept the economic and institutional reality in India as a given and work together to overcome the associated barriers in creative ways. Isn't that what "jugaad" is all about?

Technological adaptation may be able to respond to the needs of Indian farmers, by reducing costs, for example. The technology offered by the N-Drip company offers one such recent solution. Modified business models more suited to Indian farmers can also be developed. This

is what the Indian government effectively chose to do by heavily subsidizing micro-irrigation, which has likely been a key driver of its expansion to date. This subsidy program represents what is probably the most ambitious and expensive attempt by the Indian government to implement Israeli technology in India. Whether it constitutes an efficient policy is debatable (probably not much more efficient than flood irrigation), and subsidies may not offer a scalable model for other technologies that will be needed in the future. But rather than just criticizing it, we should be collaborating on finding more precise ways to enhance technology transfer and diffusion. Not nearly enough of that is taking place right now.

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NOT JUST TECHNOLOGY?

THERE ARE ALSO NON-TECHNOLOGICAL LESSONS FROM Israel's development that may be relevant to India (but here we tread on thinner ice), as "social technologies" are much more sensitive to context than their physical counterparts. I am not referring here to sweeping big policy recommendations like water regulation or market reform but to more decentralized approaches.

Cooperatives are one example. An absolutely crucial ingredient in Israel's agricultural development, cooperatives offer groups of small farmers the advantages of scale, from stronger bargaining positions in input and output markets to shared investments in machinery.

Many attempts are being made to create cooperatives or producer organisations (POs) in India, but it is unclear yet how effective they are. Anecdotal observations suggest that forming effective and functional cooperatives may require more than regulation since they may necessitate the organic social conditions that enabled Israeli cooperatives to emerge, making them hard to replicate.

The tight interlinking of agricultural R&D with extension and the private sector is another "secret ingredient" in Israel's historical success. Israeli farmers have always taken an active part in the R&D carried out at local research stations, as well as on their own farms, whether carried out by government agronomists or private companies. This collaboration has had numerous benefits for the innovation ecosystem, but is rare in other countries. India still struggles with making such a connect. To some extent, KVKs (Krishi Vigyan Kendras) were designed to play related roles. But it is difficult to create the conditions under which farmers are both keen and trusting enough to experiment with unfamiliar technologies, especially when it is so hard for extension agents to form strong relations with the overwhelming numbers of farmers they are supposed to serve.

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What's Next?

My narrative thus far has conformed to the old story of "Israeli technology to help India". But economic

divisions are increasingly as strong within countries as they are between them, and the nature of the problem is shifting rapidly. India's vast agricultural system is indeed facing difficult challenges with global implications, but India is now a technological and economic superpower of its own. Indo-Israeli collaboration should now centre on the two countries' innovation communities working together to develop and offer India's farmers a "green" model of growth. Existing Israeli technology may have something to offer, but this is about adaptation and innovation in both the technological and the human dimensions.

What should the two countries set out to achieve? Strategically, a focus on semi-arid geographies and their unique challenges is a natural goal. Indo-Israeli collaboration should concentrate on adapting agriculture to climate change, with the extreme temperature and precipitation variability it will bring to both countries; the use of ICT to improve precision in irrigation, fertilizer application, and crop protection; and climate-friendly agriculture that reduces emissions and makes use of solar energy in farming, including through dual-use (agri-voltaic) systems that are needed due to the land constraints of both countries.

The more difficult question is "how". The current flagship of Indo-Israeli agricultural cooperation is the network of Indo-Israeli centres of excellence (CoE) that implement and demonstrate Israeli farming practices for various crops and locations across India. Dozens of such centres have been set up to date and are functioning independently in what undoubtedly is

a remarkably successful endeavour, but little is known about their impact on the farming populations outside their boundaries. The CoEs should be the platform for an even more ambitious and impact-oriented program that functions more like Israeli R&D centres than traditional agronomic demonstration centres. They should become a platform for bi-national private-sector innovation and farmer engagement, and proactively reach out to farmers with adapted solutions and business models at scale. The Israeli government should re-direct resources used in its R&D systems to solve domestic needs and to address the challenges faced by Indian farmers by linking to the CoEs in a similar way to their interaction with the Israeli network of agricultural research stations.

Helping commercial innovation in both India and Israel direct its energies towards the needs of Indian farmers is crucial. While there are some large Israeli companies that sell their products in India at scale, only a modest fraction (about a quarter) of all Israeli agri-tech innovators consider Indian farmers to be potential customers, and a much smaller fraction is actually active in India.[1] The public sector should do more to help bridge the wide gap between the world of Israeli and Indian innovators and the reality of the typical Indian farmer. Our experience with the Nitsan lab at Tel Aviv University has shown how academia can play an important role in bridging that chasm. Mere financing for commercial cooperation, like that offered by the I4F bi-national fund, while useful, may not be enough (especially if it is heavily conditional).

Our two governments must recognize that finding real and scalable solutions is a matter for a combined technological and economic research program. We need to start systematically testing and evaluating potential solutions to strategic challenges in a coordinated fashion across networks of sites spanning diverse agro-ecological typologies. Today, we do not even have credible evidence about what drip irrigation achieves when operated by Indian farmers, let alone about more advanced technologies. Without even such basic information, decisions on government investment, subsidies, and other policy models simply cannot be made intelligibly.

More creative approaches should also be considered. For example, can we think of ways of engaging Israeli farmers to get directly involved in Indian farms? Can we develop a platform that will encourage Israeli farmers to help cultivate farms in India in a way that can benefit both sides?

In order to respond to the challenges of our time, Indo-Israeli collaboration in agriculture will need to accelerate. Our two governments should take bolder, more ambitious action, and our leaders should cease being content with rhetoric. This is no longer just about increasing farm productivity in India. It is about establishing a partnership to promote sustainable development, address agricultural contribution to climate change, and find solutions that can be applied at scale across the developing world. Both countries have much to gain from succeeding, politically and economically. And unlike in the past, both are now equally prone to the environmental and food security implications of failure.

ENDNOTES:

1 *https://milkeninnovationcenter.org/wp-content/uploads/2019/02/119-Final-Dror-WEB.pdf.*

Chapter 8

Agricultural Cooperation: Model Farming Nation

—Ashok Gulati & Ritika Juneja

FOR ANY SOVEREIGN STATE to exist and be meaningful to its citizens, it must provide at least two things: defence security to protect its borders and food security to save its people from starvation. Israel is a glowing example of how it has survived and thrived since its birth in 1948. It has achieved the twin objectives of defence and food security against very harsh conditions, both in terms of its neighbours as well as with respect to nature's resource endowments. How it did that is nothing short of a miracle, and as its founding father David Ben-Gurion said, "In Israel, in order to be a realist, one must believe in miracles."

India became an independent nation in 1947 and faced a bloody partition. It also had challenges on defence and food security, which became very stark in the 1962 war with China, and two successive droughts in 1964-65 and 1965-66 when India had to live literally "from ship to mouth", dependent on food aid coming from the United

States under the PL 480 scheme. That dire situation gave birth to the Green Revolution in India and later the White Revolution in milk. Today, there is not only ample food available in India but the country is the largest exporter of rice with 17.7 million tons exports in 2020-21 in a global market of about 45 million tons. But there is still the challenge of economic access to nutritious food for many Indians, given their low levels of income.

In brief, both nations have been success stories in their own ways. Under such a situation, how can India and Israel collaborate and benefit from each other? We focus here basically on agriculture, although both are also cooperating in the defence sector. India currently has a population of about 1.4 billion and Israel has just 8.8 million people. Israel is known as a "land of innovations" and many of these innovations, if scaled up in India, can benefit not only both these nations but also a large mass of humanity on this planet. Despite acute water shortages and poor land conditions, Israel has not only secured national food security but also emerged as a global leader in agricultural productivity and water management technologies.

How did it transform its agriculture? As they say, necessity is the mother of invention. It was a question of survival in a desert land, and that too being surrounded by unfriendly countries. While its approaches are unique, the exemplary performance against all odds is a treasure of lessons for many developing countries like India that are experiencing rapid population growth, have limited water, and find it a challenge to produce enough food,

feed and fibre for their populations (Abraham, Ngoga, Said, & Yachin, 2019). This paper, therefore, highlights how Indo-Israel's collaborations in agriculture has the potential to benefit large numbers of people through knowledge sharing and technology transfers, provided these innovations are supported by right mix of policies and incentives.

On the food and agriculture front, despite overwhelming challenges, Israel has emerged as a significant producer of horticulture produce, particularly, of citrus fruits. Overall, fruit production in Israel accounted for 45 percent share in the total agriculture output (2018). In the case of tomatoes, Israel has achieved a yield of 300 tons/hectare compared to an average of 50 t/ha across the world. Another crop that Israel revolutionized is melons, especially the hybrid Galia melons. It is worth noting that more than 90 percent of melons in Israel are produced in the hyper-arid region of the Arava and Jordan Valleys — which is a deserted, barren and swampy landscape (Abraham, Ngoga, Said, & Yachin, 2019). Israel's deserts are home to olive groves, fish farms and vineyards. It is also the world's largest producer of jojoba, a crop that produces oil for cosmetic products, accounting for 50 percent of the global production (Abraham, Ngoga, Said, & Yachin, 2019). Through an investment-driven and innovation-centred approach, Israel has reversed the trends of desertification and made its deserts green. As per the Volcani Research Institute, overall 40 percent of Israel's vegetables and field crops are grown in the desert.

Further, in the livestock sector, which accounts for around 40 percent share in the value of agricultural output, Israel records highest productivity for cow milk across the world with more than 13,000 litres per cow per year yield compared to 10,000 litres in North America and around 6,500 litres in Europe. India, which is the world's largest producer of milk, lags way behind at around 1700 litres per cow per year yield (Faostat, 2021).

The following section discusses several Indo-Israeli collaborations and learnings in the field of agriculture, with special focus on three innovations. One are the centres of excellence to introduce precision farming in India. The technology allows to produce out-of-season crops, improve yields and decrease pesticide use significantly. Second, application of advance micro-irrigation technologies to improve water-use efficiency; reusing recycled waste water as effluent water for agriculture; and desalination of sea water. Third, power generation by capturing thermal solar energy in desert lands.

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Agricultural Centres of Excellence

Growing food in adverse climate conditions with very limited resources was made possible using controlled environment agriculture. Israel, Netherlands and Spain are among the leading players worldwide that have pioneered the art of precision farming. The technology allows to grow high-value crops within sophisticated

climate-controlled plastic houses where all operations are controlled by computers and sensors. These plants are custom designed to yield maximum productivity, ensure water and power saving, while reducing fertilizer and pesticide use (Leichman , 2020).

To learn how Israel made its deserts bloom, the Indian government joined hands with the Israeli government on May 10, 2006, to lay down the work-plan for technology dissemination under the Indo-Israel Agricultural Project, implemented by Mission for Integrated Development of Horticulture and MASHAV — Israel's Agency for International Development Cooperation. The project aimed at improving productivity, quality, crop diversity, and resource use efficiency by transferring innovative applied research and technologies to the farmers and capacity building. Under the project, agricultural centres of excellence were established in different parts of the country. The key principles that guided the operations of these centres were: applied research; subject matter specialization; and field extension officer and the progressive farmer. These centres are categorically arranged in clusters based on crops such as for vegetables, mangoes, pomegranates and citrus, to provide crop specific demonstrations and training about various best practices to the farmers (Aluf, 2014).

Currently, 29 centres of excellence for horticulture are fully active in India, in the states of Bihar, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Mizoram, Andhra Pradesh and West Bengal (MASHAV, 2016). The Annexure gives

a list of these centres and various crops grown therein. However, to achieve sustainable holistic development, the need of the hour is to scale up the technologies adopted in these centres, transfer them to the farmers' fields and link their produce to lucrative markets. This would require further investment in developing demand-driven agricultural-value chains for the high-value crops.

But before doing that, it is important to assess the economic viability of these centres as they involve heavy capital costs. Though the government provides subsidies so that interested farmers can take the plunge, the economics of these centres needs to be very clear before the technologies can be adopted in fields at a respectable scale. Without looking at the economics of these centres, and how to scale them in a holistic value chain approach, these centres may not serve the purpose they were established for. It is high time that an independent evaluation is done of these centres as the credibility of two national governments is attached to it.

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Water Management Technologies

Water accounting in Israel is exemplary. With annual availability of just 90 m3 renewable water per capita (Abraham, Ngoga, Said, & Yachin, 2019), Israel has developed one of the most efficient water management systems in the world. Recycling waste water is one of

its notable achievements. As per the estimates, about 93 percent of the wastewater in Israel is recycled and reused for agriculture purposes as effluent water, which is much higher than the 34 percent figure for Singapore, 18 percent in Australia and meagre 9 percent in the US (Abraham, Ngoga, Said, & Yachin, 2019). It is worth noting Israel was the first country that made effluent recycling a central part of its water management system. Today, almost all agricultural crops in Israel are produced using effluent water. Therefore, of the total water produced in Israel, more than half is consumed by the agriculture sector for irrigation purposes.

Next, desalination of sea water is another unique innovation of Israel's water management strategy. According to Mekorot, a state-owned enterprise, desalinated sea water is used to fulfil between 60 to 85 percent of water requirement for domestic and industrial purposes. Above all, 40 percent of drinking water is basically desalinated from the Mediterranean Sea (Abraham, Ngoga, Said, & Yachin, 2019).

Use of drip irrigation in agriculture to water each plant or tree across fields is one of the most astounding innovations in Israel, and it has made Israel a world leader in desert agriculture. The technology allows the production of crops in the most efficient manner by delivering precise amounts of water and nutrients directly to the crops at the correct time during the cropping cycle (Frankel, 2021). In terms of efficiency, drip irrigation records the water-use efficiency of more than 90 percent unlike the wasteful flooding technique

we see in India (ET Prime, 2015). It is said that no fresh water can go waste in Israel, it is treated, recycled and reused several times while ensuring more crop per drop. Technological innovations and their success in Israel offer many valuable insights and practical lessons for India where the agriculture sector consumes nearly 78 percent of the water drawn from freshwater sources, and a deadly cocktail of policies such as free power, highly subsidized urea and open-ended procurement is depleting this natural wealth (Gulati, 2021). As per the estimates, over exploitation of groundwater has made India one of the three highest water risk hotspots in the world, besides California and north-eastern China (Gulati & Juneja, 2021). This raises a red flag for country's resource endowment for our future generations.

Under the Joint Declaration for Cooperation in Water Technologies (2012) between the Indian Ministry of Urban Development and the Israeli Ministry of Industry, Trade and Labour (Kumar, 2014), Israeli agriculture professionals are assisting Indian farmers in adopting water management practices such as drip irrigation and fertigation by demonstrating the effectiveness of these technologies in terms of higher resource use efficiency. Israel's largest drip irrigation company Netafim has made a big move by launching its largest project, a "family drip system" in India at Ramthal, Karnataka. The project has shown significant success in terms of yield improvement of tomato, chilli, cabbage, capsicum, potatoes, ginger and other crops. These results, however, are yet to be verified by an independent evaluation research. It is interesting

to note that India's largest drip irrigation company — Jain Irrigation Systems Limited, which was incorporated in 1986 — took over Israeli's drip irrigation company NaanDan (owned by Kibbutz Naan) partially in 2007 and fully in 2012 to become world's leading player in water management, irrigation and the agriculture sector.

Further, under several collaborations, Israeli experts are also helping India reduce the cost of desalination of water by using steam driven desalination solutions in addition to recycling the water for industrial purpose. An Israeli company, IDE, has established a network of reliable and economical desalination plants for producing high quality water for industry production, while ensuring significant energy savings. IDE's largest desalination plant in India is situated in Jamnagar and has an installation capacity of 160,000 cubic metres per day (ET Bureau, 2009). Other Israeli companies such as Mekorot, Tahal Group, Aqwise and Metzer Group, are also venturing to establish similar plants in India by joining hands with various state governments. However, use of distilled water for agriculture is yet to be genuinely explored in India. India has a long coastal line and this area of cooperation can expand further, provided desalinization is done in a cost effective manner, and the treated water is priced to recover the costs of desalinization. Else, we are afraid, this model based on pure state subsidies may not find too much traction.

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Thermal Solar Power Generation

Israel's innovation ecosystem is a catalyst of change in agriculture and water management. However, generating power using heat from the desert sun as a clean alternative to fuel- and carbon-fired electricity is another game-changing innovation pioneered by Israel. The 390-hectare Negev Energy Thermal Solar Plant at Ashalim in Israel where nothing grows, is a testimony to this innovation. There are three plots of this plant, embarked to produce solar energy using different technologies. According to the Israel Electricity Authority, together these plots generate more than 300 megawatts power, enough to provide electricity for 130,000 households or approximately 5 percent of its population (Solomon, 2019). The first two plots of the plant include a 250-metre-long solar tower, standing tall and shiny in the desert, which generates thermal solar power, and a sea of parabolic mirrors with metal frames, focusing the sun's rays onto the tower. The mirrors, which are used as thermal reflectors, are designed in a way that they can rotate to track the sun and capture the heat which is then transferred to water to generate steam that enables the turbine to produce electricity (Solomon, 2019). The third plot uses photovoltaic solar panels to convert sunlight directly into electricity.

Overall, this entire thermal solar energy plant is capable of generating and storing energy, even when the sun goes down (Solomon, 2019). This lays down an important lesson for other developing countries, particularly India, which has good landscape to harvest solar power in the deserts of Rajasthan and Gujarat.

Replicating Israeli innovation of a thermal solar plant in Jodhpur, the Sun City of India, holds great potential to transit from fossil energy towards cleaner sources.

Photo Courtesy: *BrightSource*

The tower of thermo-solar power station, Ashalim, Negev Desert, Israel

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Conclusion

By developing an ecosystem of agri-tech innovations, Israel has successfully transformed its hot and arid regions, where almost nothing grew, into an oasis of sophisticated farming by unleashing its intellectual prowess. Israel's success story shows to the world that technology and a market-oriented approach together can do wonders. However, the need of the hour is to magnify Israel's notable performance far beyond the present levels to benefit larger populations on this planet. India offers that opportunity. India with its cheap and skilled labour

can take up these innovations to several countries in Africa as well, where water is scarce, land mass is not very fertile, and population growth is the fastest. Together, India and Israel can benefit billions on this planet by enhancing productivity in agriculture, augmenting farmers' incomes, and also promoting more sustainable and environmentally benign models of development.

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ANNEXURE:

List of Agricultural Centres of Excellence under the Indo-Israel Agricultural Project .

State	District	Produce
Bihar	Vaishali	Mango and Litchi
	Nalanda	Vegetables
Gujarat	Junagadh	Mango
	Vadrad, Sabarkhantha	Vegetables-Protected Cultivation
	Nani, Reladi, Bhuj	Date and Banana-Palm Post-harvest Management
Haryana	Gharaunda, Karnal	Vegetables
	Mangiana	Fruits
	Kurukshetra	Beekeeping
	Hisar	Animal Husbandry and Milk
	Hisar	Flowers
	Ladwa	Mango
Karnataka	Kolar	Mango
	Bagalkot	Pomegranate
	Dharwad	Vegetables
Maharashtra	Dapoli	Alfonso Mango
	Nagpur	Citrus
	Rahuri	Pomegranate
	Aurangabad	Keshar Mango

State	District	Produce
Punjab	Ghanora, Hoshiarpur	Fruits
	Jalandhar	Vegetables
Rajasthan	Kota	Citrus
	Bassi	Pomegranate
	Bassi	Vegetables
	Jaisalmer	Date Palm
Tamil Nadu	Thally, Krishnagiri	Flowers
	Reddiyar Chathram Dindigul	Vegetables
Uttar Pradesh	Basti	Vegetables
	Basti	Mango
	Kannauj	Vegetables

Source: (MASHAV, 2016)

Chapter 9

Water Policy: What Israel can Teach

—Hadas Mamane & Lior Asaf

DEFINITION OF WATER

IN HEBREW, "WATER" IS *maim*, A THREE-LETTER WORD that begins and ends with the same letter, showing its circularity. In Judaism, there is a belief that water is like a mirror: the face you see in it is reflected back at you. In Sanskrit "water is life"—*apomayah pranah*—manifested in its ability to moisten other substances, coagulate various mixtures, soften things, drive away heat, fill water reserves, slake thirst, cause satisfaction, and maintain life.

Water has endless dimensions. This essay discusses various aspects of the relationship between India and Israel on this subject from two Israeli points of view: the academic and the governmental/institutional.

"There are a hundred times more water molecules in our bodies than the sum of all the other molecules put together" (Ivar Olovsson). Thus, while we consider ourselves humans this all depends on the scale by which we measure ourselves. According to the molecular scale, a

water molecule, H_2O, interacts with other water molecules by bonding with hydrogen to create the liquid known as "water", which is essentially endless H_2O molecules that join together to form clusters. In order to understand water, we need to develop an understanding of inter-dimensionality—from the intermolecular to the bulk flow of water—and that is where the magic lies. As a universal solvent, water has a capacity to accept all molecules within it and it can easily adapt to phase change. Thus, water is malleable and can transmute between ice, liquid, and air as tiny droplets known as aerosols. During the COVID crisis, we learned that the coronavirus is an airborne virus transmitted by small aerosols, which in fact are water-virus carrying vesicles in the air.

Surprisingly, water is not a priority for scientific research. A recent bibliometric analysis of research on climate change mitigation showed that water is not at the top of the agenda of most climate scientists around the globe. According to predicted changes in precipitation, by the end of the century some regions will have a lot less water (the Mediterranean) and some a lot more (the tropics, parts of Asia). In India, the Himalayan glaciers are melting at an alarming rate, creating major rivers and groundwater recharge for hundreds of millions of people across India. However, climate change will also increase the risks in low-lying coastal zones due to cyclones and coastal and inland flooding, storm surges, and sea-level rise threatening communities along the Indian coastline. Climate change is impacting natural ecosystems and is expected to have substantially adverse effects on

agriculture and water resources, causing an increased frequency of extreme events such as floods and droughts. These in turn will affect India's food security and the prosperity of rural communities. Thus, freshwater must be managed and wastewater treated and reused more than ever, with emphasis on quantity and quality.

When we consider water, we should think of both the beautiful and the ugly. How easy it is for us to imagine a beautiful stream of fresh clean water. But this is not always the reality. About 70 percent of the water we drink is transformed by our bodies into sewage. In order to deal with this problem, we have developed technologies for reversing sewage back to water. In Israel, we convert more than 90 percent of sewage to water for agriculture, leaving almost no untreated water molecules behind. In essence, since mass is conserved nothing is created or destroyed—which means that removing the one percent of impurities from sewage recreates water, and this concept is deeply-rooted and accepted as a water source in Israeli culture. Moreover, according to Israeli law, "the country's water resources are public property, controlled by the state." These include all water sources such as springs, streams, rivers, lakes, and reservoirs whether surface or groundwater, natural or artificial, standing or flowing, including drainage water and even sewage. In Israel, "a person's right to land does not entitle him or her rights to water sources in that land."

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Water from the Strategic Point of View: Israel-India

The differences between Israel and India in size, population, and water use are shown in the table below. It is because of their remarkability that mutual opportunities for collaboration between Israel and India are found. India is large in size, population, and available water, with six-fold more freshwater per capita available for use than Israel.

	India	Israel	Factor
Area, km^2	3,287,263	22,000	~ 150
Population	1,400,000,000	9,400,000	~150
Usable freshwater BCM*/year	1123	1.2	~935
Usable freshwater CM*/year per capita	802	127	6.3
Freshwater for agriculture	1010	0.535	1887
Reuse (treated wastewater) for agriculture	0.168	0.667	0.25

** BCM—billion cubic metres; CM—cubic metres*

Despite its limited natural resources, Israel has succeeded in providing a sustainable water supply to all users year round. In addition, it exports water to its neighbours (Jordan, the Palestinian Authority, and

the Gaza Strip), and exports a large proportion of its agricultural production throughout the world. In India farming uses up 90 percent of the country's water; in fact, just three water-intensive crops continue to use 80 percent of agricultural water, while the basic water needs of millions of people, including safe drinking water and protective irrigation, are not always met. India generates approximately 62,000 million litres per day (MLD) of domestic sewage in urban centres. There are 920 sewage treatment plants (STPs) operated primarily by municipal corporations, with a treatment capacity of almost 23,000 MLD (8.4 BCM)—merely 37 percent of generation. Only 33 percent of India's urban wastewater is treated, and an even smaller portion is reused (about 2 percent).

Possible areas of India-Israel water cooperation could include:

1. Integrated water resource management master plans, including groundwater and surface water resources for state or large areas through peer to peer (P2P) cooperation.
2. Advanced irrigation, farming practices, and water management in the agriculture sector.
3. Desalination—efficient reverse osmosis (RO) desalination plants have been constructed in Israel with the lowest price per cubic metre.
4. Treatment and reuse of sewage effluent for agriculture—in Israel approximately 90 percent of wastewater is reused for agriculture and the country is first in the world in such reuse.

5. Managing urban water systems and non-revenue water by Internet of Things (IoT) technology—Israel suffers an average of 7 percent non-revenue water or losses vs. 40 percent for India.
6. Water security—emergency water management practices.

Specific collaboration between the two nations could include water resource management (groundwater and surface water) at the national level. On the Indian state level, areas of collaboration could include the preparation of comprehensive master plans for agricultural water supply, domestic consumption, and industry. Such a program with the Israeli national water company Mekorot exists for the state of Panjab and is being prepared for the state of Maharashtra. While Israel can provide its expertise in water management, India can offer its skills in the deployment of these programs on a large-complex scale, providing benefits to both countries on an international level.

Other areas for collaboration between the Indian-Israeli governments could include management of brackish water, the construction of desalination facilities and—in an attempt to reduce costs—creating an integrated model for the design and construction of desalination facilities for brackish and seawater. Israel is a small and dry country, with more than 60 percent of its area receiving less than 500 mm/year of rain, forcing it to deal with every marginal water source, including saline aquifers, monitoring, and building hydrogeological

models for the management of coastal aquifers, as well as the development, design, and execution of efficient desalination facilities. Consideration may be given to setting up desalination plants on various scales that supply desalinated seawater to cities, as well as small and medium desalination facilities for brackish groundwater to be supplied to small towns and villages; the latter project would involve also training stakeholders in managing the saline aquifer, in order to make the solutions sustainable in the long term.

Another exciting area of partnership between Israel and India is the development and demonstration of an integrated and synergistic model for wastewater treatment and reuse for industry and agriculture, as an alternative to gardening or flowing to the river/sea. In Israel, farmers use treated wastewater because the government takes care of transmission and infrastructure for availability and reliability of supply at a significantly lower cost compared with freshwater. In India, due to the low cost of freshwater, a different model could work, providing farmers with a higher income, possibly by connecting wastewater treatment plants with transmission systems, combined with agricultural knowledge and drip- and micro-irrigation systems. Indian and Israeli companies such as Netafim, Jain Irrigation, and Ribolis could play a major role in this initiative. Wastewater treatment plans would need to include standardization corresponding to the local social and economic structure, based on a holistic and systematic solution that will incentivize farmers, especially at the community level, with fieldwork and a

POC (Proof of Concept) project executed to scale by the private sector.

Further areas of partnership could include high technology initiatives such as leak detection to minimize non-revenue water through IoT, and management and maintenance of urban water systems.

Joint Israeli-Indian centres of excellence (CoEs) for water can be established in several places in India with various areas of expertise in accordance with local water needs and challenges, and with the support of Israeli skills in the four suggested areas of collaboration. These centres can partner with academia or companies in both the Indian and Israeli private sectors to create a business model and support R&D, as well as adapt products and technologies to the Indian market.

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Water from the Academic Point of View: Israel-India

An area of untapped possibilities is that related to collaboration between Israeli and Indian academia, which can be triggered through the establishment of CoEs described above. Governmental programs for Israeli-Indian collaboration currently centre on B2B (business to business) and G2G (government to government). These could benefit greatly, however, by incorporating passionate scientists from academia who are already working together without a structured funding program.

The CoEs, for example, could incorporate practical academic collaboration between Indian and Israeli institutions. There are also opportunities for cooperation between India and Israel in innovation, as both peoples have a strong entrepreneurial DNA, with a flexible mindset, enthusiasm, and an adaptive culture. Water innovation and thinking "out of the box" means that we can bypass traditional mental processes for accelerated innovation by developing disruptive water technologies that leapfrog over current practices in order to provide treated water for various applications at an affordable cost. New advanced harnessable technologies range from novel materials and processes to clean-up water, to the use of artificial intelligence and big data to nowcast and forecast water contaminants, and the management of water and wastewater treatment plants. However, there is a gap in the implementation of new technologies and materials for cleaning water in the field in a scalable, affordable manner, especially with point-of-use applications.

Water treatment can be developed at various points along the scale of centralized to distributed or decentralized systems. In many scenarios, poor access to technology, among many other factors, limits the effectiveness of centralized solutions. Distribution of infrastructure can be thought of as a scale, essentially a ratio between the number of units of core technology and the total population served. To meet the challenges, it is necessary to develop interventions with decentralized, effective, scalable, and adaptive technologies in order to address the enormous diversity in water-quality parameters and targets. There is

a huge spectrum in water tech innovation. However, both social and technological-based parameters are required for the adoption of new water treatment technologies or services and to demonstrate their social impact, especially on rural communities.

The United Nation's 6th Sustainable Development Goal (SDG 6) calls for universal and equitable access to safe and affordable drinking water by 2030. Monitoring the quality and accessibility of water collected and consumed by low-income households will be essential to achieving this goal. A joint project between Tel Aviv University and Amrita University, Kerala, was designed to complement and support existing efforts to develop an integrated approach to water-quality monitoring. To the best of our knowledge, our tool is unique in three key dimensions. It incorporates not only biological but also chemical and physical measurements of water quality. This is a necessary shift in response to the changing composition of water-related health risks, especially in areas where agricultural and industrial pollution is increasing rapidly. Moreover, we collected a variety of both subjective (self-reported by households) and objective (measurement-based) assessments of water quality, as well as information about the households' knowledge, attitudes, and practices (KAP). This is intended help determine whether households are able to identify the main types of contaminants in their water and the associated morbidity risk, relative to the actual measured risk, towards designing targeted information and educational activities. It can also evaluate the aspects of households' subjective assessments that can be informative and useful in water-

quality assessments, enabling the design of more cost-effective tools for large-scale quality monitoring.

Another area of collaboration between Tel Aviv University and Thapar University, Punjab, relates to wastewater treatment of sewage ponds in rural India without additional energy investment. Improving the efficiency of wastewater treatment, typically through aeration, constitutes a massive proportion of the energy demand. One way in which this demand might be met is through the use of floating substrates in wastewater ponds, which we call the coupled indigenous bacterial micro-algal biofilm (CMBB) process, applied without external aeration. A combination with similarly cohesive micro-algal biofilms produces an oxygen-rich environment, further accelerating the bacterial treatment effect. Possibly, it can also be used as an in-situ treatment for contaminated rivers. Challenges can be set to inspire scientists to develop technologies that address real pain points as solutions for preventing polluted waters from entering rivers by implementing in-situ technologies such as biochar-based filters on drains. Additional practices could include passive water oxygenation by adapting, for example, supported algae-bacteria carriers enclosed in the mesh as a permeable reactive barrier (PRB) and in-situ nature-based solutions (NBS) such as river-floating treatment wetlands.

A third example of collaboration is that between Tel Aviv University and IIT Madras, which concerns the development of special porous adsorbent materials made of aerogels which are 90–99 percent air. They use a metal-organic framework for the removal of contaminants such as

dyes, arsenic, and mercury from water. This development has demonstrated how smart material-smart reactor design concepts can be applied for water purification. Practical solutions with these novel materials are rare due to the complexity of embedding them in an efficient reactor using natural water and ambient conditions; our goal is to challenge ourselves and demonstrate practical solutions to solve real problems. The best way to develop deep ties between Indian and Israeli academia is for the Israeli/Indian scientist to have a sabbatical in Israel/India, and advise joint students and post-docs, and support student exchange. From personal experience and numerous visits to Bharat, we found that many Indian scientists are open-minded to combining science, intuition, and spirituality; this was revealing, releasing, and transforming, and can only happen in Bharat.

The relationship between India and Israel is still largely unexplored. The pandemic has by no means loosened ties, and although this essay describes technical areas of partnership between India and Israel, the domains where India and Israel can collaborate, share information and experience, and provide mutual support, are as deep as water can be. Israel and India can lead the way for sustainable development by establishing tailor-made and state-of-the-art solutions for India, in order to mitigate the major impacts of climate change, and to promote new water management programs, advanced agricultural solutions, and reuse of wastewater on various scales in accordance with the specific social, economic, and political conditions of the country.

Chapter 10

Water Policy: Why India should Learn

—Nikhil Sawhney

WATER HAS ALWAYS PLAYED an important role in all bilateral conversations between India and Israel – whether on policy, trade, investments, academic research or technology transfer. As we celebrate 30 years of a formal relationship between India and Israel, there is a need to assess whether this conversation is on track and delivering value on the ground.

Historically India has had an abundance of water, both through rainfall as well as through its perennial rivers. Early settlements in the Indo-Gangetic plain as well as other river basins in the country are testimony to this fact with habitation and farming going back millennia. While Israel boasts of an equally historic past its civilizations never had the same luxury with water that India did. Both countries gained independence around the same time and rightfully prioritized agriculture from a water use perspective. But over time the policies of both countries have diverged considerably, both in terms of political will

as well as comprehensiveness of approach.

Today, India has 18% of the global population and around 20% of the world's livestock population. Around 80% of our rivers are rainfed and due to climate change the monsoon days have reduced from three to four months to sometimes a maximum of one month.

Underground water depletion is a challenge. India has a major dependence on underground water, around 45% of water used for all purposes is extracted from the ground–which is the highest such figure in the world. As per the Central Ground Water Board of India, out of a total 5,723 water-blocks[1] that are being monitored 28% of the blocks are either overstressed, critical or semi-critical.

While India receives around 1,100mm of rainfall annually, with a low water retention capacity as well as rapid population growth, India's per capita availability of water has declined from 5,500 cubic meters at the time of independence to around 1,486 cubic meters today. In terms of harvesting, India's total bearing capacity is four billion cubic meter out of which 2 billion cubic meter is considered the harvestable component; all while not having the infrastructural capacity to retain even more than 15% of this quantum. While the availability of water in India has become a problem with unsustainable water consumption as well as poor incentives and oversight, the accessibility of water and wastewater services has been equally poor.

Recent policy decisions by the government of India have pushed this cause for both drinking water as well as sanitation, nevertheless the accessibility to these services is

woefully inadequate. Augmented capacities are less than 30% of sewage generated in urban areas while utilization capacities are even poorer. The rural areas have been largely ignored until recently.

Compared to India, Israel has had a near constant gross per capita availability of water of around 280 cubic meters all while the population has grown over 10 times since independence, and also while only receiving an average of 170mm of rainfall annually.

Israel has been lauded the world over for its management of its water resources as well as having the highest level of sustainability/ recycling as well as productivity in the use of water. This has been possible through a determined effort politically to view the sector in a market centric and comprehensive manner, as well as a critical natural resource.

The World Bank credits the success of the system to several factors. First among them is the comprehensive view for linking the entire water system in the country, thereby validating other success such as large-scale reuse of treated wastewater in agriculture as well as large investments in desalination of water. Equally its investments in harvesting water by using aquifers as reservoirs as well as interception and diversion of water run-off and recharging the aquifer with the same, have allowed Israel to become water secure. These measures have been supported with demand side initiatives, technological innovations as well as deep public awareness. All while viewing the financial sustainability of the sector from a market centric perspective. Incentives as

well as penalties are very much part of the system. While subsidies are given for certain applications the system is geared towards near full cost recovery through tariffs.

Despite the acute water scarcity in Israel, the country has become the envy of the world in terms of its ability to now been deemed as water surplus. Indian policy makers, usually state governments, have long made a beeline to the annual Israeli water conference, Watec, as well as to other forums to understand the best practices and innovations that have led to this success. The usual learning has been that technology has played a disproportionate role in Israel's success. From drip irrigation to desalination, these were the technological innovations that Indian states wish they had implemented to benefit their stakeholders.

Indian corporations bought equity in Israeli water technology companies so as to bring these innovations to the Indian market. Israeli companies too have set up operations in India to seize the market opportunity presented by the large Indian market. Some may claim success, but largely the market as well as the outcomes have fallen short of expectations. Despite these efforts the availability of water for an Indian has continued to decline and the accessibility of water and wastewater services is still woefully inadequate.

The Ananta Aspen–Confederation of Indian Industry –Tel Aviv University India Israel Forum has often considered the subject of bilateral water cooperation through focused expert groups and dialogue. The focus here too was initially on technology and the role that the private sector could play in bridging this gap. Good

progress has been made on this front where we can confidently say that technology is no longer a barrier for India to achieve its water sector goals. Subsequent Forums have had MoUs signed between CII and TAU to develop a more comprehensive cooperation on water. Discussions at the expert groups have also progressed towards aquifer mapping and management.

Despite the private sector led efforts and those of the respective governments, bilateral collaborations have not yielded the anticipated results. This begs the question whether the correct learnings have been prioritized while trying to ensure India's water security, as well as whether the development of sustainable infrastructure to ensure universal water and wastewater services is achievable without massive subsidies. The success of Israel's model, in my opinion, has been driven by the comprehensiveness of scope and the ability to price water as a scarce natural resource, incentivizing "recycle and reuse" as well as public partnerships with the private sector while at the same time ensuring adherence to laws and mandates.

The question is not whether India will import water or Israel will export water, it is about how India and Israel can learn from each other's successes and failures so as to be able to move forward together. For that to happen, India needs to first seek to understand the drivers that have led to the success of Israel's model for water. This is important to identify if India can implement a similar model for water.

I would argue that political will alone is not enough to implement a complex model which addresses water

security as well as sustainability of water resources. Equally important are the implementation mechanisms, including the complete integration of the sector. I would argue that India's experiences with reforms in electricity, petroleum, coal and so on are not singularly translatable to the water sector. India's water sector is different from the rest of the economy because it viewed as a right and not as an economic resource.

Only by viewing water as well as wastewater as economic goods, and pricing them accordingly for various applications, will it be possible for India to create a sustainable model for infrastructure development as well as water management. There is no doubt that applications like drinking water for human consumption would need to be priced appropriately such that some basic minimum quantity of water is provided free or at an extremely subsidized rate. But, as according to the Indian Central Water Commission, with around 85% of total national water consumed by the Indian agriculture sector, it would be difficult for us to have a holistic solution without catering to the overuse as well as inefficiency of this entirely unregulated segment of water users. Political compulsions will always push back measures to adequately penalize farmers for overdrawing ground water and incentives on demand management have been largely unsuccessful. Enforcing water rights on farmers or charging them for ground water use will be extremely difficult without the provision of adequate infrastructure to minimize water use, augmentation of water supply as well as measures of education to change land use and

cropping patterns. This sector will probably be the last to undertake market centric reforms.

In the Indian context, Industry usually bares the costs – both economically as well as in terms of availability of water, due to the disproportionate use of water in agriculture. The business case is already established for recycling sewage for the use in industrial applications, as the ground water in heavily industrial clusters is overexploited and there is little alternative. But this is a move which has to be adopted more widely as well as legislatively. Moves are underway to enforce such measures which will aid in the availability of treated recycled water for industry. The pricing of recycled water in India is somewhere in the region of $0.40 to $0.50 per cubic meter, which is less than half the price of desalinated water.

Israel's progressive approach to water pricing has promoted water conservation while also ensuring public and private investment in water supply are sustainable. The current tariff for most water users is around $2.55 per cubic meter which provides a dependable revenue stream for utilities as well as ensuring a strong profit motive for companies whose technologies and processes can further reduce water use.

The Narendra Modi government recognizes its obligations to the citizens of india and significant reform and capital allocation has taken place to bridge this gap. More has been done on delivering drinking water and wastewater services to India's rural areas than ever before. Capital outlays are approved, ministries have been merged and a new water policy, the third in 15 years, is ready to be

announced. The clarity and priority that the prime minister and the central minister, Gajendra Singh Shekhawat, have to tackle India's water problems are laudable.

However, under the federal structure of India, the governance and management of water is a state and urban local body matter. This is where the failures arise and where a better understanding of the Israeli model can go a long way in ensuring a sustainable model for India's water security. After all agriculture constitutes the largest share of water use in India, and agriculture is also a state matter. Correct incentives and penalties are necessary for sustainable use of water in agriculture. Similarly, proper and universal tariffs are necessary for a sustainable and interconnected water and wastewater infrastructure.

Major legal and institutional reforms will be required by states in India, with regulatory and pricing policies to approach the financial sustainability of the water sector as a whole. This includes changing the pricing principles of water from a public and social good to a commodity, institutional reforms with corporatization of service providers and the establishment of a strong regulator at the level of the state.

It may so turn out that the greatest learning that India and Israel could have in the area of water is the strategy around raising public awareness on the water situation and then reinforcing it with the political will to charge appropriate tariffs.

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Chapter 11

Space Cooperation: Final Frontier

—Raanan Rein & Avi Blasberger

AS THE INDIA-ISRAEL relationship enters its fourth decade, space represents one of the most strategic and futuristic frontiers of collaboration. Though the respective national programs in both countries pre-date formal diplomatic relations, the mindsets underlying them are comparable. Moreover, the synergies are huge. In this essay, we will explore the roots of Israel's national space programs and policies and point to common objectives and concerns shared by both countries. We will also ponder the numerous commonalities and synergies. We next look at the emergent area of space tech and ways to foster collaboration between the two emergent space economies. Finally, we turn our attention to the issue of joint research collaboration and the role of academia in this area. We hope to be able to catalyze a needed wider debate on ways to build on the fundamentals—deep trust and a mutual understanding of space policy—in order to make this a meaningful partnership for both countries.

Roots of the Space Programs

In 1980 India was seventh in the world to develop and launch its own satellite, while Israel followed suit in September 1988. Since its inception in 1962, the Indian Space Research Organisation (ISRO) has emerged as a leading global agency. ISRO's mission is to "harness space technology for national development, while pursuing space science research and planetary exploration." In its six decades of existence, ISRO has succeeded in attaining its goals.

Some important context on the genesis of Israel's space effort is in order. The 1970s provided two events that were major catalysts for the Israeli space effort. One was a desire to develop enhanced intelligence-gathering capabilities after the Yom Kippur War. The second was the 1977 Camp David Peace Accords with Egypt, which compelled Israel to implement the peace agreement without infringing on Egypt's sovereignty. Unable to access US technology, Israeli decided to develop its own space capabilities.

In 1981 a national space program was established within the Ministry of Defence. The military space program is today managed by the Israeli Ministry of Defence Directorate of Defence Research and Development (DDR&D)—equivalent to India's Defence Research and Development Organisation (DRDO). By 1988 Israel had built and launched its own satellite, Ofeq 1. Since then, Israel has emerged as a regional space superpower, with its own capabilities of designing, building, launching, and operating satellites. It has also spun off a budding space ecosystem of suppliers and start-ups. In addition to the space program under the aegis of the Ministry

of Defence, Israel has a national space organisation, the Israel Space Agency (ISA), which falls under the Ministry of Innovation, Science and Technology. The agency focuses on founding and developing a civilian ecosystem, and furthering multilateral cooperation in space by supporting research and educational outreach in order to increase awareness of this topic.

Israel has also become a leader in nanosatellites. The country has a thriving school space education program. Three school satellites have been launched to date. One such satellite, Duchifat 3, was launched from India in 2019.[1] Currently there is a national program including eight high schools throughout the country that are building nanosatellites which will be launched in the near future. The focus here is to bring space to schools and encourage interest in the subject as part of building an eco-system. The Beresheet lunar probe mission led by SpaceIL (a not-for-profit) and Israel Aerospace Industries (IAI), another educational, technological initiative, is an example of Israel's private space capabilities. Though the mission ultimately failed in landing the probe, it succeeded in creating excitement around and interest in space in Israel, especially among youth. In 2021, Tel Aviv University launched its first nanosat, TAU-SAT 1,[2] which followed efforts of other academic institutions such as Ben Gurion University, which launched the BGUSAT from India in 1997, and the Technion, which launched the SDamson nanosatellite in 2021.

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Common Understandings and Enhanced Synergies

Both India and Israel tend to have a similar view of their space programs: they place a huge premium on national investments in science and technology for self-reliance and national development. Core to Israel's national security since its independence has been maintaining a qualitative edge. Outnumbered and surrounded by hostile states, its very survival has depended on indigenous qualitative superiority. Space is but one application. Moreover, both India and Israel share many common understandings on matters of national security and world affairs that are linked to national space policy.

It is our submission that beyond serving as an underpinning for a deeper relationship around science and knowledge, space also addresses two very real and immediate objectives for both countries: addressing national security and self-reliance in technology. The deepening defence relationship and mutual trust indeed make collaboration in space a natural frontier for enhanced bilateral ties. Besides, strategic synergies are substantial in the realm of space, and the maturity of the relationship allows both countries to fully exploit it. Hence, the last decade has witnessed a deepening of space ties.

In July 2017, ISRO and the Israel Space Agency culminated a two-decade-long process by signing three Memoranda of Understanding (MOUs) related to cooperation in GEO-LEO optical links, electric propulsion for small satellites, and atomic clocks.[3] The space dialogue was begun tentatively by Israel's then president Ezer

Weizman in 1996. In January 2002, then foreign minister Shimon Peres paid a formal visit to ISRO. This led to a November 2002 framework agreement to collaborate on space-related matters. This document was penned by Abi Har-Even, former head of the Israeli Space Program, and Dr. K. Kasturirangan, former head of ISRO. In 2003 collaboration continued with several other efforts surrounding the launch of Israeli devices. The first was Tel Aviv University's Ultra Violet Experiment, TAUVEX, then the TechSAR launch, followed by the launch of RISAT. Prior to the signing of the three MOUs, the two countries worked out areas of common research based on a series of feasibility studies. The process was launched in 2016 during the visit by then minister of science and technology Ofir Akunis to India.

To date, cooperation in the realm of propulsion has been a resounding success and it represents an area of great synergies. India is keen on developing its own propulsion activities and Israel is seeking to establish its own heritage in this realm. Hence, the Israeli space effort benefits a great deal from its work with India. Collaboration in the other two areas—GEO-LEO optical links and atomic clocks—has been less productive. With dedicated resources, however, the area of atomic clocks seems to offer great relevance to both space efforts.

This deepening collaboration is based on a recognition of complementarity in the realms of space and the needs of the two countries. India offered Israel launch capability, which Israel has utilized for its satellites. A major factor has been economic considerations, but over time Israel

has become increasingly confident in and comfortable with India's capabilities. Israel excels in developing small and advanced satellites. As for additional areas of mutual interest, one study notes that:

> *Indian defence experts are now interested in developing satellites with Synthetic Aperture Radar (SAR) platforms, which are capable of tracking large ground targets and ballistic missiles day or night and through vegetation and cloud cover. Significantly, Israel already possesses this technology.*[4]

As mentioned, the Israeli space effort may gain heritage as a result of its collaboration with India.

For these reasons and others, Paikovsky and Ben-Israel note: "Israel sees India as an important companion in the quest for exploring and utilizing space, and it aspires to increase its bilateral cooperation in this field".[5] Indeed, collaboration with India is a stated Israeli policy. The Israeli space doctrine was refined by a national space task force created in 2009 by Peres and former prime minister Benjamin Netanyahu. International collaboration was a key recommendation of this commission and India was specifically mentioned.

Another aspect is related to national security. Space and fears of "space militarization" in particular pose new threats to both India and Israel. China, for example, is increasingly militarizing its space effort.[6] Satellite jamming and interferences are one set of major emergent issues with which the respective countries must contend

and collaborate. We encourage both India and Israel to cooperate on ways to safeguard their satellites and ensure a workable space setting. Anti-satellite weapons (ASAT) are a massive area of common concern and collaboration. Israel has been supportive of Indian efforts to develop ASAT technology and we call on Israel to deepen its collaboration with India and other democratic nations in this realm. As Paikovsky and Ben Israel note: "Israel supports the Indian aspiration and effort to develop space security capabilities".

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Space-Tech

In both India and Israel, overall space activity is much larger than national security activity. This opens up multiple facets of cooperation that extend beyond the government-to-government (G2G) realm. They touch upon technology ecosystems, the private sector, people-to-people (P2P) aspects, and academia.

The primary mandate of the Israeli national space task force is to explore how scientific research and civil applications can be leveraged to allow Israel to develop a local industry that can compete in the growing global space economy. Israel's stated goal is to emerge as one of the top five nations in this realm. Both India and Israel tend to view space well beyond national security. Space, for example, is a means to project national power and prestige. It is also a major economic opportunity. For

India it can boost the Make-in-India effort. For Israel's and India's dynamic VC and booming start-up ecosystems, it offers new horizons of growth.

The world is seeing a growing role for private space actors and there is increasing excitement about space-tech. A Morgan Stanley study released in July 2020 estimates that space tech could be a $1 trillion opportunity by 2040.[7] In 2020 the opportunity was already worth some $400 billion. The so-called space economy has an impact on areas like telecoms and internet access (notably satellite broadband), the IT hardware and software industry (which is key to India's economy), aerospace, and defence. According to the study, in the quest to address the growing global data demand 50–70 percent of growth in the space economy will come from satellite broadband.

Israel already boasts fifty space-tech-related start-ups and has sought to lead in this emergent area.[8] India too is developing its space-tech start-up ecosystem. In September 2021, IIT Madras created a consortium with five start-ups to develop local capabilities in areas like rapid launch capability, satellite design and assembly, sensors, 6G communication, satellite security, data processing, and a host of additional applications. The consortium has been named Indian Space Technologies and Applications Design Bureau (I-STAC.DB).[9]

We call on ISRO and ISA to expand interactions between the two space-tech communities. In order to move beyond G2G, we propose an annual gathering of start-ups and companies involved in the supply chain of the two respective space industries. Among such business-

to-business (B2B) interactions. Israel recently created a German-Israeli Space Forum, hosted by ELNET, in partnership with the Federation of German Industries (BDI). A similar platform between India and Israel could strengthen knowledge exchange and engender collaboration. We further submit that such an effort be buttressed by government support for joint space missions.

In addition, we urge the two governments to undertake a comprehensive mapping exercise: assessing the respective space industries/economies, as well as areas of cooperation between the two space economies. If indeed, there is a $1 trillion opportunity, it makes sense for the two countries to consider joint opportunities and ways synergies between the two private sectors can best be leveraged.

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Enhanced Policy, Education and R&D Collaboration

In this section, we recommend several ideas to deepen and broaden bilateral space cooperation.

Policy-making Dialogue—increasing the frequency of interaction: Prior to the Covid-19 pandemic, leading policy-makers would meet twice a year. One setting was the annual Ilan Ramon International Space Conference, headed by the Israel Space Agency. The second was the annual International Astronautical Congress (IAC). We suggest that a dedicated annual event be arranged. In order to further its space-tech capabilities, Israeli space

policy calls for national investment in space research, on top of defence-related space investments.

Company-to-company Dialogue—encouraging the two agencies to support the travel of delegations to national space events. The Israeli Export Institute and organisations such as the Confederation of Indian Industry (CII) can assist in such efforts. For example, a delegation of companies from India could attend the annual Ilan Ramon conclave and a binational seminar (India-Israel Space Forum) could be facilitated by these organisations and the two embassies.

Academic Collaboration—establishing a dedicated binational R&D program on space-related matters: India is increasing its investment in Israel. Moreover, both India and Israel have strong research capabilities—through the DRDO, dedicated research institutes, and universities. Space therefore offers an exciting area for bilateral relations between the two academic communities. Potential areas of focus could include:

- Advanced agriculture—it is worth noting that France and Israel have strong collaboration in this realm. Climate change offers an additional sphere while communication, specifically store and forward communication, could also be considered.
- Another area of promising potential is microgravity, specifically through the application of developing pharmaceuticals and materials.

Beyond bilateral cooperation, we also propose joint research projects with additional countries—South Korea, Japan, and Australia, among others. Ad-hoc alliances for research purposes between like-minded and trusted partners

offer an exciting path for leveraging bilateral goodwill and other commonalities the respective countries may have.

We also suggest the creation of a program and budget to encourage space collaboration between Indian and Israeli schools. Such a program would support student exchanges and joint projects. Similar efforts can be carried out in the academic realm, including the establishment of a doctoral program and postdoctoral scholarships dedicated to space-related areas.

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Positive Externalities

India has signed up to the Wassenaar Agreement of 1996. Although Israel has not done so, it has adopted the Wassenaar list of dual-use items subject to control. Beyond promoting deeper space collaboration and space research, such joint efforts can produce additional positive externalities: furthering technology-based industries, developing skills for a knowledge economy, and enhancing technological capabilities in areas like tele-education and tele-medicine by repurposing space technologies for civilian use. Space offers our two countries so much scope for collaboration.

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Chapter 12

Space Cooperation: From Public to Private

—Ajay Lele

ISRAEL IS KNOWN TO HAVE the highest percentage of engineers and scientists per capita in the world. They are famous for their high-quality academic publications and the country gets recognized among the most educated societies in the world.[1] Israel uses technology as an instrument to overcome the limitations imposed by its small geographical size and unfriendly neighbourhood. Today, Israel is on top of the technology curve in a variety of sectors and space technology is one such sector. Interestingly, Israel could be said to have slightly underperformed in the space sector in comparison with their overall technology capabilities. However, this appears be an intentional choice by them and their focus has been limited to a few specific areas which have social and security relevance. There is a strong match between Israel's areas of interest in space and India's interests. India and Israel already have a very healthy relationship in the sphere of space and

this chapter takes a broad overview of their bilateral relationship in the space domain.

There are some commonalities between Israel's and India's space programmes. Both countries began reaching for the stars at about the same time. Shavit 2 was the first Israeli sounding rocket, launched on 5 July, 1961, for meteorological research. The launch of the first Indian sounding rocket from Thumba near Thiruvananthapuram, Kerala, was undertaken on 21 November, 1963, and marked the beginning of the Indian space programme. Subsequently Israel took more time to decide to focus on regular investments in the field of space. Israel Space Agency (ISA) was established during 1983, several years after the Indian Space Research Organisation (ISRO) which came into being during 1969. India launched its first satellite in 1975 with the assistance of the Soviet Union. India became a space-faring state on 18 July, 1980, with launch of Rohini satellite from the indigenously developed launch vehicle SLV-3. This launch took place at the Sriharikota Range (SHAR). Israel launched its first satellite with its own launch vehicle in 1988: the Ofeq-1 military surveillance satellite was launched on September 19 from Palmachim Airbase in Israel using the Shavit launch vehicle.

The basic difference between the Indian and Israeli space programmes is the rationale behind their establishment. India started its space programme for societal development, while Israel had a strategic logic for investing in space. India's first prime minister, Jawaharlal Nehru, and the post-independence scientific

community comprising of scientists like Dr Homi Bhabha and Dr Vikram Sarabhai made science and technology an important constituent of independent India's national policy. India's investments in space are an offshoot of this overall science policy. Dr Sarabhai and later Dr Satish Dhawan had a vision of using space technologies for education, health and meteorology. The Israeli space program, on the other hand, was a by-product of the 1979 peace treaty with Egypt. Spy planes could not fly over Sinai to make sure Egypt was not moving missiles into the demilitarized peninsula without detection. The best solution was to deploy spy satellites to carry out monitoring and surveillance. Israel did not wish to rely on any foreign partners to collect and convey this crucial intelligence and this impetus gave birth to their indigenous space program. Subsequently, there was a realization that if they could produce military satellites, why not use the same technology to produce civilian satellites.[2]

The ISA is engaged in cooperation with many foreign space agencies, including the European Space Agency, and those of the United States, Canada, Japan, France, Mexico Italy, Russia, Brazil and few others. They also have a healthy level of cooperation with ISRO as well.

In 2002, India and Israel signed a cooperative agreement promoting space collaboration between both nations. The ISA head, Colonel Avi Hareven, and the ISRO head, Dr K. Kasturirangan, signed an agreement on space cooperation between the two countries in November 2002.[3] The year after, the ISA expressed interest in initiating collaboration with ISRO. The agreed

common aim was to study the use of satellites for improved management of land, water and other resources. During then Prime Minister Ariel Sharon's visit to India in 2003, it was decided that both governments should explore the possibility of the establishment of a bi-national research and development fund for the civilian use of outer space.[4]

Israel faces a common problem among small countries in sensitive regions when it comes to undertaking satellite launches from their own soil and using their own satellite launch vehicle. This is owing to geographical and political compulsions. The launch vehicles are required to carry a payload which has to be about 30% less in weight than their actual capacity. The geographical location of Israel is such that they have to launch their civilian rockets westward, over the Mediterranean Sea, in order to avoid encroaching on the airspace of their neighbouring countries, most of whom are hostile towards them.[5] The geopolitical situation in the region is so edgy that any accident immediately after the launch, including debris falling onto a neighbouring country, could be misconstrued and even lead to a military altercation. Also, during that period Israel had less confidence about the performance and accuracy of its own launch capabilities. In September 2004, for example, a Shavit rocket failed to deliver the defence ministry's Ofeq-6 electro-optical imaging satellite.

Which is why Israel decided to turn to ISRO, which had an excellent track record for launches using its Polar Satellite Launch Vehicle (PSLV) to launch their surveillance satellites. On 21 January, 2008, ISRO

successfully launched the Israeli spy satellite Polaris into space. Considering the extreme sensitivity surrounding the launch, ISRO kept the launch a secret. This was the 300kg Israeli satellite known as the TechSAR. It was launched under a commercial contract between Israel Aerospace Industries (IAI) and the Antrix Corporation, a commercial outfit of ISRO. TechSAR was a synthetic aperture radar (SAR) technology satellite with the capability to see through clouds and carry out day and night all-weather imaging. This was a relatively new technology developed by Israel offering an opportunity to measure ground movements to millimetre-level accuracy. The launch was probably a source of some debate within the Indian government. There was an opinion that the launch would have an adverse impact on Indo-Iran relations given the tension between Jerusalem and Tehran. There were even media reports that the US had not been happy about India undertaking this launch because they did not want ISRO to gain a slice of the lucrative satellite launch market and had supposedly put pressure on India to drop the deal.[6]

ISRO was also working towards the development of SAR technology when they had launched the TechSAR satellite for Israel. New Delhi had realized that given the constant threat of cross-border terrorist infiltration, the security agencies required accurate all-weather intelligence inputs of the sort that SAR capability could provide. ISRO was working on a project to develop and launch a 1,780kg radar imagery satellite called RISAT-1. With this launch ISRO would have achieved a major

milestone in the country's remote sensing capabilities. Unfortunately, before the project could be completed, India witnessed a major terror attack. India's financial capital Mumbai came under attack on 26 November, 2008, and 175 people were killed. In what is popularly called the 26/11 attack, 10 terrorists entered the city of Mumbai via a sea route. After this, New Delhi fast-tracked getting an "eye in the sky" capability that could catch any form of border infiltration, whether day and night, rain or snow, or via sea or through thick vegetation. India turned to Israel and bought an all-weather, microwave imaging satellite from IAI. This was launched by ISRO on 20 April, 2009, as RISAT-2.

Another area of cooperation has been in micro-satellites. ISRO has launched few nanosatellites for Israel. On 15 February, 2017, during one remarkable mission, ISRO launched the largest ever number of satellites during a single mission. This PSLV-C37 mission had successfully carried and deployed 104 satellites in sun-synchronous orbits. Its cargo included a 4.3kg satellite called BGUSAT, an Israeli research CubeSat built by the IAI and Ben Gurion University. It was designed to explore atmospheric and weather phenomena through the infrared wavelength. The mission also carried DIDO-2, a nanosatellite by the Israeli-Swiss company SpacePharma. Another satellite carried for Israel during the same launch was PEASSS (Piezo Electric Assisted Smart Satellite Structure), a 3U CubeSat built by a multinational consortium, which also included states like Germany, Netherlands and Belgium. Here the objective

was to test and qualify "smart structures" which combine composite panels, piezoelectric materials, and next generation sensor, for autonomously improved pointing accuracy and power generation in space. The PSLV-QL C48 mission on 11 December, 2019, also carried an Israeli satellite called Duchifat-3 which weighed 2.3kg. This satellite was a student satellite for earth imaging and also had an amateur radio transponder.[7]

At present, both India and Israel are keen to expand their collaboration in the space domain. In July 2017, during a historic first-ever visit by an Indian prime minister to Israel, space was an important area of discussion. Both the leaders highlighted the success of ongoing cooperation between ISA and ISRO and mentioned the need for expanding the scope of the relationship further. They spelled out the plan of cooperation in the areas involving atomic clocks, a GEO-LEO (Geosynchronous Earth Orbit-Low Earth Orbit) optical link; academic collaboration and electric propulsion for small satellites. All this is expected to further enhance cooperation between the two countries. They also acknowledged the launching by ISRO of another Israeli nanosatellite.[8] More importantly, both governments are trying to go beyond the conventional types of collaboration which are only among space agencies and are trying to engage other official agencies too, including those involved in research and education.

During the January 2018 visit of Israeli PM Benjamin Netanyahu to India, India's Indian Institute of Space Science and Space Technology (IISSST) and Haifa's

Technion-Israel Institute of Technology have signed a memoranda of understanding to cooperate in space studies. Such collaborations would help both private companies and academic institutions. The IISSST was founded in 2007 and was the first-ever space educational agency in Asia, while the Technion is a specialized science and technology university with a specially strong aerospace engineering faculty. By coming together these agencies provide for focused space technologies and space science education on many layers.[9]

Owing to the Covid-19 pandemic, there has been a lull in space activities between India and Israel. But there are signs that cooperation is being revived. In August 2021, the ISRO chairman held virtual discussions with his counterparts in Israel in which they took stock of progress on ongoing projects. Also, there were discussions about possible future collaborations. There is a proposal about new Israeli satellite launches by ISRO in the near future. Currently both the agencies are deliberating about how to celebrate the 75th anniversary of India's independence and the 30th anniversary of India-Israel diplomatic relations with an appropriate event in 2022.[10]

In a less fortune act of parallel fortune, the robotic Moon landing missions of both India and Israel failed almost around the same time. In September 2019, India's Chandrayan-2 mission to Moon failed while attempting a soft landing on the lunar surface. Several months earlier, in April the same year, the mission by SpaceIL, a non-profit organisation based in Israel, which had designed and built a 1,300-pound lunar lander called Beresheet, also crashed

on the Moon's surface. This mission was launched with the help of a Falcon-9 rocket of Space X, the space company of the US Jewish entrepreneur Elon Musk. Now there is a proposal for another Beresheet-2 mission in 2024 and Chandrayan-3 may happen as early as 2022. Since both the states have a similar Moon agenda they could join hands together for future missions. There are reports that Israel is planning to join hands with the United Arab Emirates for joint Moon missions. India, in many ways a bigger player in this game given the size of its space program, is showing signs of leveraging this diplomatically. It is noticeable that the recent "West Asian Quad" announced between India, Israel, the UAE and the US includes space as one of its areas of technology cooperation.

The two-decade old India-Israel space relationship is making a satisfactory progress. Both the states are keen to take things further and are taking proactive steps. The next area may be in the private sector following the Indian government's decision to open up the space sector to private industry. It is important to take this relationship beyond government agencies and ensure and encourage the involvement of private players.

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Chapter 13

Innovation Policy: Start-up Nations

—Ipsita Satpathy & Nirabhi Sharma

AS PER WORLD BANK'S 2018 data, Israel spends almost 4.95% of its GDP on R&D. Israel is a relatively young country which is only 60 years old, has less than 8 million people, is not particularly endowed in terms of natural resources, has been torn by war incessantly and is surrounded by unfriendly neighbours. And yet, it has emerged as the "Start-up Nation", with an impressive entrepreneurial model, that India and other developing economies are keen to emulate.

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ISRAELI START-UPS

ISRAEL IS UNDERSTOOD TO HAVE THE HIGHEST NUMBER of start-ups per capita worldwide. It is world-renowned for its B2B (business to business) deep-tech and product companies providing innovative solutions to power and

scale up Indian start-ups. Israel follows a unique approach to its incubator programs. Israel's Innovation Authority (IIA) is deeply invested in nurturing the entrepreneurial minds and budding technologists in the country. Innovative and disruptive technology ideas are strongly encouraged and gingerly honed, right from conception/ idea stages into commercially viable tech products with good product-market fit. The country is also keen on developing the allied ecosystem in India – researchers, universities etc. which can participate in and contribute towards the further development of these ideas, again right from the conception stage.

Further, Israeli governments grants can be availed for at least two to three years, if not longer, by start-ups selected by any technology incubator – so long as it figures in the list approved by the IIA. The startups, of course, go through a rigorous selection process. The corpus can be as high as up to NIS 3.4 million (85% of the approved budget). State-sponsored Israeli incubators often make up the balance 15% here. The 85% amount is just a grant, to improve the odds of the start-ups' success. Interestingly, neither the Israeli government nor the IIA hold an equity stake and is not a hands-on stakeholder here. Rather, it is the IIA-vetted incubators who demonstrate healthy participation on the boards of these companies.

Apart from enjoying substantial support in terms of capital infusion, Israeli start-ups also benefit comprehensively from legal and business support, the provision of office space and so on. In other words, an Israeli incubator truly serves the role of an experienced

partner, hand-holding and closely guiding the course of the start-up.

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INDIAN START-UPS

INDIA, BEING ONE OF THE LARGEST EMERGING ECONOMIES, is acknowledged to be a very large market, poised as the top innovation destination in Asia, with a plethora of pressing needs. The Indian start-up ecosystem is largely centred around B2C (business to consumer) service providers, marketplaces and demand/supply aggregators, such as ride-hailing, food delivery, grocery delivery and so on. These basically cover the lower end of the tech spectrum.

India also has a number of accelerator models such as 500 Startups, Indian Angel Network (IAN), the Hyderabad based incubator T-Hub, SINE-IITB (Society for Innovation & Entrepreneurship, IIT Bombay), CIIE (Center for Innovation Incubation & Entrepreneurship, IIM Ahmedabad), IIT Madras Incubator Cell and Axilor. But this should be kept in context: out of the 2500-odd incubator/accelerator programs worldwide, India is home to less than 4% of them.

In stark contrast to Israel and Western economies like the US, the Indian accelerator programs are yet to demonstrate similar track-records of nurturing start-ups and are yet to match Israeli levels of success. Again, unlike Israel, the Indian start-up ecosystem has not been deeply entrenched in the universities and business

schools. Until recently, there was little impetus from the central or state governments to boost India's start-up ecosystem. Finally, there is a dearth of corporate-led accelerators in the country. Slowly, but gradually, this is changing now – for example, we now have Microsoft Accelerator and Google Launchpad.

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Cooperation

Over the years, a bunch of memoranda of understanding (MoU) have been signed between India and Israel, with an objective to foster cooperation between Israel's advanced and promising start-up ecosystems and India's fast-evolving technological landscape. For instance, in the aftermath of the Covid pandemic, the two countries have entered into bilateral agreements for the seamless integration of Israeli medical technologies and healthcare equipment in Indian hospital chain networks via an Israeli start-up called Zebra Medical Vision.

Among the most promising areas of collaboration is a September 2020 MoU signed between Israel's Start-up Nation Central and India's iCreate (International Center for Entrepreneurship & Technology). iCreate was first established by Prime Minister Narendra Modi in 2012. Recently in 2018 the new campus of iCreate was inaugurated by Modi. It maintains a focus on areas that include technology, healthcare, green energy, agro and food processing companies. Israel's Start-up Nation

Central is an independent non-profit organisation, with the objective of promoting technological innovation in Israel by connecting its budding start-up ecosystem with multinational corporations, governments, investors and the like at a global level. It has set-up an online start-up discovery portal "Finder", that has already onboarded 6,600 Israeli start-ups and technology companies. Key areas of focus are understood to be medical technology and digital health.

The September 2020 MoU signed between the two agencies paves the way for a bilateral program between the two countries to accelerate technological innovation through close collaboration among entrepreneurs from both countries, complete with tech start-ups, corporations, leading industrialists and academicians acting as cross-border mentors. Open technological requirements at the client's end are to be solicited via a wide cohort of Indian corporations and then presented as "innovation challenges" to a shortlisted pool of start-ups and/or technology providers. Start-ups with appropriate levels of technological readiness, or in advanced stages of product development can then be evaluated for product-market fit and technological relevance.

A select set of start-up technological solutions can then be piloted in India by way of an Israeli start-up plus Indian corporate matchmaking process. Here, relevant networks in both countries can be tapped into. For instance, Indian corporate houses participating in the process include names like Reliance, Infosys, Tata Consultancy Services, Zee Entertainment and Apollo

Hospitals. This strategic partnership is expected to form the cornerstone of cooperation between the start-up ecosystem and technological landscapes of the two countries, from a long-term and sustainable standpoint.

Apart from iCreate, a number of other entities are also involved in nurturing this Indo-Israel innovation bridge such as incubators like T-hub, Kerala Start-up Mission; venture capital funds like Omnivore Partners, IvyCap Ventures, Ankur Capital and Aaviskaar; BFSI (banking, financial services and insurance) players like YesBank; and consulting firms like EY and Amazon AWS.

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Accelerators

I3A (India-Israel Innovator Accelerator) the first such program was launched in February 2021. The maiden cohort of participating Israeli start-ups went through an eight-week bilateral online acceleration program- this involved mentoring by industry veterans, guidance from technical leaders, business support from leading tech corporations, workshops and networking events. Out of the six participating start-ups, five have already been paired up with relevant Indian corporate partners and investors through the matchmaking process which was described above. A few of these start-ups have already acquired access to local markets and solidified a medium-term business plan. Funding opportunities are also available (for select initiatives) through the new i4F fund under the IIA.

For instance, Israeli start-up Nanomotion designs and manufactures advanced piezoelectric motor/drive components and precision miniature motion systems without any moving parts for a diversified spectrum of industries including defence, homeland security, biomedical, semi-conductors, space-tech and natural disaster. The piezoelectric based technology being developed at Nanomotion can do measurements in nanometres and holds good promises of addressing the trade-offs in a drone-camera's attributes– between high resolution and large size (translating to wide field of view). In other words, small-sized and light-weight drone-cameras which offer better precision. The start-up has entered into a nondisclosure agreement with a large Indian conglomerate to explore use-cases applicable to the Indian industrial landscape.

Another Israeli start-up, IRP Systems, which produces cost-effective yet high performance EV powertrain systems for a variety of e-mobility platforms, is already in talks with a leading but unnamed Indian company. The start-up raised a series-C round of $31 million in April 2021, led by major Israeli institutional investors CIal Insurance and Altshuler Shaham and with participation from existing investors like Renault-Nissan and Samsung Ventures. This pegs the total quantum of funding raised by the company at $57 million. The company is currently targeting key electrical vehicle markets in Europe and the Asia-Pacific.

The other three start-ups which are also in advanced stages of forging partnerships with Indian partners are Correlata Solutions (data management solutions), Jungo Connectivity (in-cabin driver monitoring solution) and Sion

Technology (hi-tech laboratory analytical instruments). Indian e-commerce giant Flipkart has recently acquired an Israeli retail intelligence platform, Upstream Commerce. Likewise, Indian media mogul Zee Entertainment has collaborated with as many as 14 Israeli start-ups till date on various user experience improvement projects.

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Tech Focus

For this Indo-Israel partnership, the key areas of technology focus are understood to be drones, robotics, cyber security, healthcare technology, agricultural technology, artificial intelligence and machine learning, natural language processing, quantum technology, photonics, bio-sensing, and energy storage.

When it comes to drone and other UAV (unmanned aerial vehicle) technologies, there are immense opportunities for partnership between India and Israel, in areas like defence and national security; surveillance for law and order; monitoring industrial, construction and renewable energy projects. From an Indian standpoint, within the defence and national security arena, this will help counter a China which has developed advanced capabilities in terms of drone-led aerial strikes, as well as a Pakistan which has entered into partnerships with China (dating back to 2018) for co-developing long endurance drones. India's current position is that of a top drone importer, hence New Delhi's investments in steering the

development of indigenous drones while exploring both technology transfer and foreign investment.

Israel, on the other hand, is a perfect partner for this role given its globally unmatched drone capabilities, vibrant drone start-up ecosystem that spans across the entire value chain right from components manufacturing to embedded hardware and software platforms. Israel should see strategic relevance in this area, given China has emerged as top drone supplier and strategic trading partner for Israel's strategic rival, Iran. Israel, one of India's trusted defence partners as well as top exporters, is expected to play a central role in the evolution of the drone landscape in India.

One can illustrate this point using a number of instances. Recently, the two countries took their defence ties a notch further, when India's DRDO (Defence Research & Development Organisation) and Israel's DDR&D (Directorate of Defence Research and Development) signed a bilateral agreement to co-develop dual-purpose drones. The 2020 Indian Ministry of Defence Expo (better known as DefExpo) saw both Hindustan Aeronautics Limited (HAL) and Dynamatic Technologies Limited (DTL) enter into MoUs with Israel Aerospace Industries (IAI). The two Indian companies can now market, sell and distribute Israeli long-endurance drones to an Indian customer-base. Earlier on, in 2018, an MoU had been signed between India's Mahindra Defence on the one hand, and Israel's Aeronautics Limited on the other, for partnership regarding maritime drones for the Indian Navy. Similarly, a joint venture has been set up

between Israel's RADA Electronic Industries and India's Alpha Design Technologies for marketing Israeli tactical radars in India.

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Cyber Security

Another formidable area of Indo-Israel co-operation is the domain of cyber security. Driven by its objective of enhancing the competitiveness of the Indian capital goods sector by fiscal year 2025, the Indian Ministry of Heavy Industries and Public Enterprises has launched the Samarth Udyog Bharat 4.0, an Industry 4.0 initiative, which looks to leverage and boost the adoption of latest technologies like Internet of Things, artificial intelligence, machine learning, big data, cloud computing, augmented reality/virtual reality, 3D printing, 5G communication and so on. Sectors already witnessing giant leaps of change in terms of more efficient manufacturing operations and higher productivity are manufacturing, supply chain management, logistics, shipping and telecom. These booming tech and tech-led sectors of the country bestow a lot of importance on the topic of cyber security, a necessary element of any country's tech infrastructure. Israel boasts of a mature and advanced start-up landscape when it comes to cyber security and is well poised to take up this challenge. Both countries have put down frameworks, in other words best practices for sharing data and information regarding cyber security incidents, access to Israeli experts

for cyber-security training, upgrading network architecture to render it more resilient to cyber-threats.

To deepen cooperation between the countries here, in 2020, an MoU was signed between the India's Computer Emergency Response Team (CERT) and Israel's National Cyber Directorate (INCD). Israeli companies can benefit immensely by tapping into the large and as yet untapped Indian cyber market.

India has the world's second-largest agricultural acreage and among the largest populations of farmers. But India lags in technology adoption and this presents a synergistic opportunity for both countries. Israel has more than 400 start-ups in the agriculture sector including top agri-tech start-ups such as Infarm, CropX, and Taranis. India is aware of the collaborative opportunity and is already seeking Israel's expertise on issues such as growing trees including mango trees, which have been grown in India for years, in water-scarce regions. Under the 2008 Indo-Israeli Agricultural Cooperation project, Israel has set up 29 centres of excellence across India to use Israeli technology and know-how to implement precision farming techniques and train farmers.

Israel's deep-tech expertise coupled with a universal healthcare system and over 25 years of interoperable electronic medical records data makes it a prime location for medical innovations. Israel is second only to the US in terms of the number of companies working on medical technology R&D. Early this year, Anthill Ventures, an investment and scaling platform for early growth stage start-ups, entered into a partnership with Kanfit3D, an

Israeli health tech company involved in manufacturing of custom-built 3D printed medical implants. Typically, India imports medical implants from countries like Germany which are expensive as the Indian implants can't be customized and lead to infection risk and a longer recovery period. The joint effort will help the Israeli company scale tap into the large Indian market and the Indian patients get access to affordable care.

Israel is a global leader in the space of biotechnology with more than 300 pharmaceutical companies and 450 digital health companies. Israeli companies are working on cutting-edge innovations in the fields such as stem cell research and oncology. India can benefit by learning from the Israelis whose healthcare system is consistently ranked among the best in the world. Israeli companies like BiomX (microbiome drug discovery company) and Pluristem (cell therapy) are pushing the frontiers of innovation. With a population of 1.4 billion, India has the potential to be the source of valuable healthcare data unlike any other country, and tie-ups in this area should be explored.

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Next Steps

The entrepreneurial spirit in Israel is unique, deeply ingrained in the ecosystem and contagious. The very social fabric and cultural mindset is highly supportive–in Israel, an unsuccessful start-up stint is not penalized or looked down upon, rather it is simply

understood as valuable experience in that domain. The successful model of Israeli innovation rests on this plinth of unfettered entrepreneurial spirit, which is difficult to replicate and inculcate into the ecosystem of a country like India. Parallelly, government sponsorship is generous and encouraging – both financially through unique incubator programs run by the Israel's Innovation Authority and otherwise, through state-sponsored roadshows like the "Start Tel Aviv". India has a lot to emulate from Israel, along these lines.

India and Israel are natural complementary partners here. Israel brings to the table its unique entrepreneurial ecosystem and global venture capital financing pouring in into the economy, whereas India can provide access to a large addressable market and a data-rich environment to test out innovative ideas. The tightly-knit embrace between universities, corporate houses and entrepreneurs in Israel can benefit from the sheer breadth of human capital and talent pool in a large country like India with young demographics.

To ensure these initiatives to foster Indo-Israel partnership are unhindered and well-supported, we need to address and eliminate any challenges faced here. As a country, India needs to improve its "ease of doing business" score. Tight government control and deep government involvement in sectors like BFSI renders them sluggish, bureaucratic and often become an impediment to smooth and effective collaboration between budding global entrepreneurs and large domestic corporate houses. Efficiency and accountability lacunae are rampant

in the Indian government system, which gives a sense of non-transparency and unpredictability. Resolving these challenges would render India a genuinely exciting marketplace for innovation from Israel.

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Chapter 14

Lightning Indicators: Case Study in Research

—Colin Price & Anirban Guha

While thunderstorms are a fascinating and exciting scientific research topic, they are a great hazard to the public, industry, and aviation, killing more than 3,000 people every year in India alone. As a developing country, India's rapid urbanization and increase in population intensifies human exposure to lightning hasard. An increase in lightning incidents may be related directly to the climate crisis and the availability of more moisture over land due to warming. Hence, lightning was added by the United Nation's World Meteorological Organisation (WMO) to the Global Climate Observing System's list of Essential Climate Variables (ECVs) in 2016. As many as 18.5 million lightning strikes were recorded in India between April 1, 2020 and March 31, 2021, according to India's second annual report on lightning released by the Lightning Resilient India Campaign (LRIC).

In recent years, there has been a significant rise in the frequency, intensity, and geographical spread of lightning

strikes in India. The 2020–21 Annual Lightning Report, published by the non-profit Climate Resilient Observing Systems Promotion Council (CROPC), recorded a 34 percent jump in lightning strikes within a single year (http://www.cropc.org/). On a global scale it is estimated that tens of thousands of people are killed annually by lightning, with ten times more injured.

While we are interested as scientists in knowing how, why, when, and where lightning occurs, we also feel a responsibility to the public to better educate and protect them from this natural hazard and risk. Hence, both of us are heavily involved in education, public outreach, and workshops for reducing the risks in developing countries of lightning injuries and deaths. Public interest resulted in an in-person workshop in Tripura, Northeast India, in 2019, with researchers and emergency managers from the entire South Asia region. The goal was to provide information based on science to local authorities, weather services, and emergency managers about lightning and thunderstorms. Since our first workshop, an additional two online ones have taken place, while our colleagues in Africa have set up a similar educational awareness network in Africa. In 2019, the India Meteorological Department (IMD) began issuing lightning and thunderstorms forecasts, at ranges of 3–5 days, 24 hours and 3–4 hours. The Indian Institute of Tropical Meteorology launched Damini, a mobile phone app that provides a lightning forecast within a radius of at least forty kilometres around the user's phone. Multi-stakeholder engagement at the national and international level including governments

and academia is of the utmost importance in order to lower fatalities caused by lightning.

However, as the Earth's temperatures continue to rise, studies show that the number and intensity of thunderstorms and lightning strikes may increase, placing the public in even more danger. This is in addition to the growing world population that even without climate change would put more people in harm's way during thunderstorms. In India and South Asia most of the lightning occurs during the warmer summer months when farmers and children are outside, and the public is more vulnerable to lightning strikes. The opposite is true in Israel where lightning and thunderstorms occur only in the cold winter months, with most people indoors during storms. Will future climate change result in more storms? Will we see their intensity increase? Will the danger from lightning increase in the future? Can we reduce the negative impacts of lightning strikes by better education and training?

Our scientific collaboration has involved mainly field observations of lightning, using ground networks of lightning sensors in Israel, India, and around the world to study the impact of thunderstorms and lightning on the Earth's climate. The lightning within storms can be thought of as electrical activity, somewhat like their "pulse". Storms are becoming more intense and dangerous and lightning activity is increasing. Can we use lightning to track the development and location of thunderstorms remotely? Does the change in lightning activity in storms say something about the future dangers

of storms? Can we use lightning to estimate the likelihood of severe weather?

These are some of the questions we ask when we observe lightning activity. Lightning discharges in the atmosphere can be thought of as a huge radio antenna. The lightning emits electromagnetic (radio) waves in all directions and at different frequencies. There are some 7 million lightning flashes on Earth every day, and 1,000–2,000 active storms at any moment. We can observe these lightning flashes using either electric or magnetic antenna that are sensitive at two specific frequency ranges: extremely low frequency (ELF) or very low frequency (VLF) bands. These radio waves can travel thousands, if not tens of thousands of kilometers from the lightning to our detectors. Hence, our research equipment in India and Israel can also study thunderstorms and lightning in Africa and even South America. Both of us have our own lightning detection equipment constructed in our research labs, and we are part of a global lightning network that can detect, track, and follow lightning storms all over the planet in close to real time (http://wwlln.net). Using these data we can immediately calculate the location, time, and intensity of thunderstorm activity anywhere on the planet.

While global warming may impact thunderstorm activity on Earth, the thunderstorms themselves can also impact the Earth's climate. Thunderstorms act like huge vacuum cleaners, sucking up water vapour near the Earth's surface and depositing it in the upper atmosphere where it acts like a large blanket, heating up the Earth even more and adding to global warming. In

general, both climate models and observations support the idea of positive water vapour feedback; that is, higher surface temperatures will increase the amount of Upper Tropospheric Water Vapour (UTWV), further enhancing surface warming. UTWV is driven primarily by deep tropical convection and tropical thunderstorms. In our joint collaborative research project (ISF-UGC), we proposed using lightning activity to measure the location and intensity of these tropical thunderstorms. The methods involve both extremely low frequency (ELF) and very low frequency (VLF) radio waves produced by lightning discharges. Our project includes the establishment of new ELF and VLF observation networks in India. Some questions we are asking are: how do thunderstorms impact the upper tropospheric water vapour? What role do thunderstorms play in amplifying global warming? Will more thunderstorms imply warmer global temperatures as well? Can lightning be used to estimate the upper atmospheric water vapour changes?

In addition to man-made climate change, there are also large natural fluctuations in the Earth's climate that can impact thunderstorms. One of these is El Nino—Southern Oscillation (ENSO), which results in changes in the Earth's climate on a 3–7 year cycle, triggered by changes in the sea surface temperatures in the Pacific Ocean. After the four seasons (winter, spring, summer, and autumn), ENSO has the greatest impact on our local weather, both in Israel and India. As part of our joint India-Israel research we have investigated the role of ENSO on thunderstorm activity globally and regionally, while also showing that

during El Nino years there is a significant increase in water vapor in the upper atmosphere, something that may contribute to the maximum global temperature records found during El Niño years. The results show a clear link between ENSO, tropical thunderstorms, and UTWV. We see clear maxima in UTWV during the El Nino years compared with clear minima during La Nina years. In addition, we see a hint of a rising trend in UTWV at the 125 mb pressure level (~10km altitude), which may imply an increase in thunderstorms in the tropics over the last forty years. This research is under review in the journal *Earth and Space Science* (AGU).

An additional topic of our collaboration is tropical cyclones. Tropical cyclones (hurricanes) have a severe effect on India in the summer months, and one aspect of this project has investigated the impact of these intense storms on transporting water vapour to the upper atmosphere. If tropical cyclones intensify as a result of global warming, will this also increase UTWV and hence amplify global warming? We also studied the electrical activity (lightning) in these tropical cyclones, and found a clear link between lightning activity, the intensity of the tropical cyclones, and increases in UTWV a few days after the most intensive period of the storm. Lightning activity peaks before the maximum winds, and before the enhanced UTWV. The best lag between lightning and UTWV is between three and four days, where lightning precedes the UTWV. These findings have been published in the journal *Atmosphere* (MDPI) (https://www.mdpi.com/2073-4433/12/11/1506/htm).

One of the project's main goals was to establish an ELF monitoring site in India, similar to the ELF site Prof. Price runs in Mitzpe Ramon (see Figure 1). The ELF station in Mitzpe Ramon was upgraded using new, more efficient software for data processing developed by the Indian group. We have procured the instruments needed for the Indian station, and the sensors have arrived there. The installation process was expected to be completed in the second half of 2022, but the COVID-19 pandemic has delayed it. We shall also start an analysis of the VLF data for comparison with the ELF data. An indigenously built Indian Lightning Detection Network (ILDN) has been installed in several areas of India.

Figure 1:
Visit of Dr. Guha (middle) with students to Israel, at the TAU Wise Observatory, where Prof. Price (right) has ELF instrumentation to study global lightning.

We had exchange visits from both sides. In December 2018, we held our first joint meeting between the Israel-India partners on this project in Israel. In September 2019, our second joint meeting, the Round Table Meeting on Lightning and Thunderstorms (RMLT), took place at Tripura University, India. We, the two principal investigators, and our students discussed the project, goals, directions, and objectives for the coming years. We plan to continue this cooperation for our mutual benefit, for improving public safety, and for understanding the health of our planet.

Figure 2:
Group photo during the Round Table Meeting on Lightning and Thunderstorms (RMLT-2019) at the Department of Physics, Tripura University, which included both Israeli and Indian team partners.

The collaboration initiated between Israel and India will continue after the end of the present project due to shared data sets and software for ELF data sanitation, as

well as additional new topics of joint interest. The partners are now also involved in lightning safety and education in Southeast Asia and Africa, and this effort will sustain the collaboration far into the future. The Indian and Israeli researchers have brought added value to both countries through the lightning safety and education workshop, which has expanded contacts and networking to lightning researchers in the India/Southeast Asia region. Such networking has great benefits for all partners in the region.

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Chapter 15

Indians in Israel: Gentle Migration

—Smita Tiwari Jassal

WHEN I ARRIVED IN Israel in 2001, I found myself remembering life stories and narratives shared by my Jewish friends in other countries–Russia, Poland, and the U.S. Accompanying my diplomat husband I had spent almost two decades in these old and new centers of Jewry. Deeply affected by the sites, museums, and films about pogroms and persecutions, and most of all, the Holocaust, I wanted to know more. Such had been my immersion into Jewish history and culture that Israel did indeed feel like a homecoming. Standing on the soil of Jerusalem, breathing its air, gazing at its ancient stones and hills, stirred deep emotions. In the early days, a walk through the city evoked the multitudes who had for two millennia prayed to be "next year in Jerusalem". What filled me with hope was the prospect of meeting the offspring of an occasional survivor of Auschwitz, or even Warsaw, where a thriving Jewish community was conspicuous by its absence, leaving traces in the evocative gravestones of a magnificent Jewish cemetery.

Expecting to find many survivors, I also actively sought them out. People I met socially had arrived from elsewhere, invariably to escape persecution of some sort. Moving stories of daring escape and survival formed the backbone of everyday dining-room conversations at home in Herzliya Pituach. The accounts were varied, extraordinary, gut-wrenching, and sometimes, stranger than fiction. I recall a narration about a refugee mother who had given her infant son for adoption to Christian neighbours, but destined to reunite 40 years later, recognized him by his birth mark.

The impressions of my early days and months in Israel are lasting. Here I recount some moments, to provide context to this anthropologically informed understanding of the Indian Jewish experience in Israel. During my very first week for example, I attended an academic conference on Jewish Malayalam songs at Jerusalem's Hebrew University. The song collection had been assembled over decades by Shirley Isenberg and the anthropologist, Barbara Johnson, yet the star of the event was the Malayalam scholar, Scaria Zacharia, invited for expertise in interpreting the songs. These were taken from notebooks of Jewish women who had made *aliya* from Kerala in the 1950s. Israel's Nirit Singers led by Galia Hacco, were trying to revive the rich singing traditions of their grandmothers–learning, singing, and performing the songs. Identified as biblical *pattus* or rhyming songs, many were like classical Malayalam *pattus*, with content drawn from Hebrew sources.

Scaria Zacharia had explained that owing to the Midrash tradition in Judaism, unlike Christians, Jewish

women take great liberty with biblical stories, playfully retelling and reinterpreting them in the light of their own experiences. The conference inspired a desire to learn more about such telling and the rudiments of Judaic teachings, besides how Indian Jews in Israel were faring. It prompted my next search, leading to a discovery in the person of an enthusiastic teacher of Kabbalah or Jewish mysticism. I met Rabbi Shaul Youdkevitch, a Polish Jew, on the festival of Sukkot when Jews build a makeshift shelter of straw outside their homes or in balconies, in memory of the wandering biblical tribes.

In the charming setting of the Sukka, the charismatic Rabbi Shaul Youdkevitch agreed to give discourses on the weekly parashas or designated biblical portion of the week, to a group of women at my home. Over the years, our Friday meetings turned into animated discussions on subjects such as comparisons and contrasts between Hindu and Jewish beliefs and practices; techniques of meditation; the significance of dreams; and most all, layers of mystical knowledge acquired by early Kabbalists in conversation with fellow Christian and Muslim seekers in Spain. Rabbi Shaul was a marvel at explaining symbolic meanings of Old Testament stories, many familiar to Indians through the Roman Catholic filter of convent school education. Each week, while the mesmerizing discourse brought to life a different biblical character embodying eternal human conflicts and dilemmas, it also provoked a search beyond the literal for deeper metaphorical meanings in the stories. Excursions with our study group to Safed and Mount Meron in the Galilee, helped map Israel's

sacred geography of shrines, where ancient and revered Kabbalists such as Rabbi Shimon bar Yochai had either found revelation, or lived like hermits.

As my intellectual curiosity was being fuelled by Rabbi Shaul's interest in making accessible esoteric Kabbalistic knowledge, I was introduced to several communities of Jews from India who had made *aliya* to Israel soon after the formation of the new state in 1948. Unlike the experience of European Jew displaced multiple times, the majority of Indian Jews had lived in India for close to two millennia. According to some of my Jewish interlocutors, the experience of living among Hindu, Jain, Parsi, Muslim, and Christian neighbours in continuous harmony constitutes the backbone of their collective memory. Many learnt the meaning of the term "anti-Semitism" only when they reached Israel. That they had no first-hand experience of it, nor of exclusion and persecution, continues to arouse enormous interest.

Given this backdrop, the question of why Indian Jews chose to uproot themselves deserves consideration. During my stay in Israel between 2001-2004, I heard several explanations for why Jews chose to leave India for Israel. For instance, there was a sense of uncertainty about a newly independent India recovering from Partition– itself motivated by religious separatism. Second, Israel as the biblical "land of milk and honey" offered promise of fulfillment of the Jewish daily prayer. Finally, incentives from the Israeli government in the 1960s, in terms of housing and other kinds of support gave the final push to seniors who had hitherto resisted migration.

Scholarly interest in the unfolding story of Indian Jewry within Israel and beyond is fuelled by the need to document the accumulated knowledge of centuries. An account of Indian Jews in Israel is therefore as much about what was left behind as it is about the challenges of forging a new society. As I explain, the unique project of documentation undertaken by women of the Cochin/ Kerala Jewish community, mentioned above, reflects a deep desire among Israel's Indian Jews to record their Indian past, language and narratives for future generations. In the following sections I also highlight two other specific contours of major Indian Jewish communities in Israel.

The distinct communities of Indian Jews may be identified as the Bene Israel, or Marathi-speaking migrants from Bombay–descendants of survivors of a shipwreck off the Konkan coast at least 2000 years ago; Malayalam speaking descendants of Malabar Jews of approximately similar vintage, joined by new settlers to Cochin in the 15th century following the expulsions of Jews in Spain. In terms of numerical strength and community life, Cochin and Bene Israel Jews constitute the two prominent strands of Indian Jewish communities in Israel. In 2001, there were approximately 5,500 Bene Israel in India and over 60,000 in Israel. In 1947, there were 2,400 practicing Cochin Jews, of which no more than 20 remained in India, having multiplied to more than 8,000 by 2001 in Israel.

The third strand of Baghdadi Jews came as traders around the 16th century. Westernized, and closely associated with the British in India, they made their way

to the West as the era of colonialism ended. Among the few I met in Israel is the famous restauranteur, Reena Pushkarna. Beautiful and vivacious, Reena is a star. Daughter of a Jewish mother and a Sikh father, she runs a restaurant chain Tandoori, credited with familiarizing Israelis with Indian cuisine. As virtually India's permanent cultural ambassador, Reena counts among her ardent fans, Israel's political elites such as the late Prime Minister Ariel Sharon, and conductor, Zubin Mehta.

Another celebrated Indian Jew who deserves mention is Bezelel Eliahu from an ancient Jewish family in Malabar, who came to Israel in 1955. Settled in an evacuated Palestinian village with a tin shed for a home and a few goats, he was assigned to moshav Shahar with other newcomers from Morocco and Yemen. After receiving training in agricultural techniques such as hothouse cultivation, Eliahu began importing coconut peat from his native Kerala, for planting roses. The project was commercially successful, combining innovative technologies of growing flowers in endless rows of boxes four meters above the ground, with water-conserving drip irrigation. When I met Eliahu on his lush *moshav* of citrus groves, he was already a celebrity for his innovation with roses in 1994. He explained how coconut husk used to be discarded as waste until his successful experiment of using it as a substitute for soil. In 2006, the Indian government also conferred on him its prestigious award for Indians abroad. Eliahu's persona prompted questions about what might be distinctive about the Kerala Jewish experience–a theme I turn to next.

Shingly and the copper plate puzzle

Although Kerala Jews appear to have arrived in Malabar as early as Hellenistic and Roman periods, references to settlements of Jews in the region appear only from the 11th century when a Joseph Rabban received a copper plate from King Bhaskar Ravi Varma I of the Cheraman Perumal dynasty in Kodangallur. Joseph Rabban sought the alliance of the Hindu raja for cementing trade relations at a time when numerous Jewish trading communities were present on the Malabar coast. Also known as Cranganore, the region was later mythologized by the Jews as Shingly.

The copper plates read:

We have granted to Joseph Rabban
Ancuvamman, tolls by the boat
and by carts, Ancuvamman dues,
the right to employ day lamp
decorative cloth, palanquins
umbrella, kettledrums, trumpet
gateway, arch, arched roof, weapons and the
rest of the 72 privileges. We have
remitted duty and weighing fee.
Moreover, according to this copper-plate
grant given to him, he shall be
exempted from payments made by
other settlers in the town to the king,
but he shall enjoy what they enjoy.
To Joseph Rabban, proprietor of Ancuvannam
his male and female issues, nephews and sons-in-law

Ancuvamman shall belong by hereditary succession. Ancuvamman shall belong by hereditary succession as long as the World, sun and moon endure. Prosperity! (Katz 2000).

Katz writes about "Jewish pride and self-confidence, due in no small way to the love and esteem of the Hindu nobility, virtually unknown elsewhere in the Diaspora" (Katz 2000:18), illustrated in this women's song:

When he arrives on elephant back with ornament fans decorated with a thousand peacock plumes, he lavishly throws money into every lap, the jewel of a hero, the Syrian (Joseph Rabban)
Let the Jewish synagogue prosper for hundreds of years.
Let us proclaim that Jews live here!
Let us bow down at the Jewish synagogue.
Let it flourish for hundreds of years.

In the 16th century, a new wave of Jews expelled from Spain came to settle in Kochi or Cochin. Known as the Paradesis, they too sought patronage of local rulers in the face of Christian persecutions. Familiarity with languages and trade practices of European traders gave them an edge, and soon they became prosperous compared to their settled co-religionists. Since sea trade was the main source of revenue for the rajas, they welcomed the new settlers. However, a 14th century catastrophe led to the abandonment of Shingly, leading to the dispersal of Jewish

communities into small settlements all over Kerala. By the 16th century, Shingly had come to embody the mythical past of the Kerala Jews.

Although the prized copper plates were conferred on the Malabar Jews in the 11th century, they have been in the custody of the Paradesis, preserved in Cochin's Paradesi synagogue on Jew Street. This raises questions about how and why they came into the possession of the Paradesis from Spain (who, as the name suggests, means foreigners). Such unresolved puzzles hint at dissensions among different branches of Kerala Jews that plagued them since the arrival of the Paradesis.

In the only biography of its kind about life in Cochin, social cleavages between the Paradesis and older Jewish communities are described. In *Ruby of Cochin: An Indian Jewish Woman Remembers*, Ruby Daniel narrates memories of growing up in Cochin to the anthropologist Barbara Johnson. Originally from a Jewish group excluded by the Paradesis and barred from the new and impressive Paradesi synagogue, she describes her community's response – the construction of their own Kadavumbagam synagogue at the southern end of Jew Street.

The Paradesi Jews in colonial times appear to have "behaved" like a caste. For example, we learn of the trappings of power they borrowed from Nayar rulers of the time, along with practices of exclusion in imitation of the Nambudiri Brahmins. Displays and processions on Simchat Torah reveal Nayar influences, while separation and fasting on Passover exemplify fastidious observances and dietary restrictions to "out-brahminise the Brahmins".

Katz describes an attempt by a Jain friend of the Paradesis to supply meals from his home during Passover–an offer they declined in order to underline a degree of ritual purity exceeding that of Brahmins and Jains. Combining priestly-ascetic and nobility-kingly elements, Cochin Jews carved a distinct identity within Kerala's caste order. Close contact with the matrilineal Nayars might also explain the high degree of gender equality among these Jews.

They also subscribed to notions of purity of blood and ideas about pedigree, borrowed from the context. Exclusion regarding some groups and prohibitions on intermarriage with the local Malabaris Jews were practices that had been anathema within Judaism. On the other hand, unlike Spanish Jews in other parts of the world, Paradesis strove to form a separate endogamous community, downplaying their Spanish past and claiming instead, an indigenous Kerala identity rooted in antiquity.

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Jewish Malayalam Songs

To explore deeper layers of adaptation, the song collection studied by Ophira Gamliel at Hebrew University offers a rich resource. The song corpus is contained in 35 notebooks, which may have been consulted for weddings and synagogue-centred rituals. Gamliel insists that they should not be viewed as "women's songs" or even folksongs as the notebooks are a literary corpus associated with a specific Jewish-Malayalam language, and

its accompanying literature produced and preserved over many centuries. As a cultural and literary phenomenon, the songs reveal how a distinct cultural identity was forged in conversation with the literatures of both Malayalam and Hebrew.

The biblical songs traced to medieval north Malabar represent the oldest historical layer of Jewish culture in Kerala. The language and style of the *pattus*, based on old Malayalam literature between the 13th to 15th centuries, emerged within the Jewish culture deeply immersed in Kerala's socio-cultural universe. A CD collection by Barbara Johnson and Ruby Daniel entitled, "Oh Lovely Parrot" contains the Parrot Song genre, associated with women's knowledge. In Malayalam, parrot songs contain dialogues such as those between the goddesses Lakshmi and Parvati, making fun of each other's husbands. Through the narrative agency of the parrot, the story of migration could conveniently be told through a focus on the landscapes the bird traversed. Gamliel asserts that the ability to borrow and integrate themes and images from the Jewish and Keralite worlds, clearly represents a "mature" phase of Jewish identity, By the 16th century, the remarkable *pattu* style was in decline, to be replaced by narrative formulaic songs, signaling a movement away from Malayalam and greater incorporation of Hebrew and Jewish words.

The rise of Kochi as a socio-economic centre during the Portuguese period, along with the influx of Jews from Europe reduced the influence of the Malabar Jews, to whom the biblical songs are traced. The notebooks allow

us to separate the cultural production of the Paradesi strand from the earlier Malabari Jewish one, as well as identify contrasting versions of notebooks from Kochi and Parur. In the light of these social differentiations and forms of cultural production associated with each, it would be more accurate to speak of a multi-stranded Kerala Jewish community in Israel, rather than the singularity conveyed by the term "Cochin Jews".

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Bene Israel

Legends identify the Bene Israel as one the 12 tribes of Israel shipwrecked off the Konkan coast as early as 175 CE. Living among rural Hindus and Muslims as oilpressers, agriculturists and carpenters, isolation from other Jewish communities had resulted in their forgetting Jewish observances. As recently as the mid-18th century, David Rahabi, a Cochin Jew, discovered them through their observance of Jewish dietary laws and abstinence from work on Saturdays. On Sabbath, Hindu neighbours were known to milk the cows of these Shanwar Telis. Knowledge of the Shema and strictness in not consuming fish without scales, were other indicators confirming their Jewishness.

Around the same time, many Bene Israel were recruited into military service by the East India Company, enabling them to urbanize and settle in the emerging city of Bombay. Their exposure to the Bible and Judaism began through Christian missionaries, and attendance

in Bombay's proliferating Christian schools. From 1829-1875, they were influenced by Reverend John Wilson of the Church of Scotland. While mission schools were unable to convert them, English and biblical education enabled many to further their knowledge of Judaism in English and Marathi. Jewish teachers from Cochin had already introduced them to synagogues and Torah scrolls. They now helped them interpret the Bible and Jewish law. By the mid 1800s, undertaking large-scale synagogue-construction, vibrant Bene Israel communities emerged around synagogues. This religious renaissance, an offshoot of India's colonial experience, proved transformative for the Bene Israel as Bombay's early urban dwellers.

Paradoxically, Bene Israeli migration to Israel reversed this trend when they were settled in Israel's so-called "development towns" like Dimona in the Negev desert. The younger Bene Israel had migrated in search of better prospects, but large-scale emigration of the older generation between 1968-1973 was driven by Israeli state incentives. However, lack of Hebrew knowledge proved to be a stumbling block, leaving the older generation largely unemployed. Burdened with the support of families at a young age, their offspring ended up looking for jobs instead of seeking college education, reinforcing cycles of disadvantage. Poor connectivity to Israeli technical and industrial centers continues to fuel their sense of marginalization. Despite this, Bene Israel townships are oases of Indian culture. Having created cohesive thriving communities, they remain deeply connected to their Indian and Bombay roots. Their lifestyle and community celebrations feature Bollywood songs,

dances, and Indian cuisine.

Tracing the social history of Indian Jews from the perspective of those who left behind their rich social worlds evokes poignancy of loss, but also the thrill of discovery. It offers an opportunity to reflect on what India's multicultural past would have looked like. While relocation to Israel was challenging, it simultaneously triggered introspection, leading to knowledge about people's own cultural production–which in turn must inspire further creativity. The Jewish case offers just one example of modes of adaptation and adjustment, and indeed hospitality, that could equally apply to Parsis, Christians, and Muslims who made India their home. It is no wonder that Indian Jews in Israel are still often asked, "Are you Indian or Jewish?"

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Chapter 16

Trade Relations: Coming of Age

—Israel Makov

Trade and Commerce

According to the tried and tested adage, a picture paints a thousand words. The two images in Figure 3 provide a powerful insight into bilateral trade over three decades, since the establishment of diplomatic relations in 1992. In sum (non-defence) bilateral trade is heavily skewed toward diamonds and petrochemicals, reflecting the old economy.

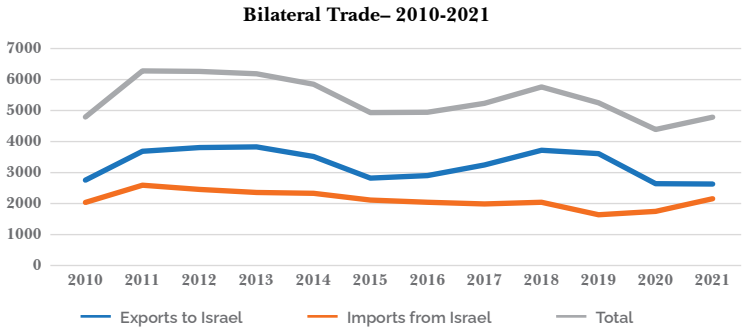

Figure 1: *Bilateral Trade, 2010–2021*

Source: *Indian Ministry of Commerce and Industry*
Note: *the 2021 figures cover the period from January to end of October.*

Bilateral trade grew from a low base of US$0.2 billion in 1992-93 to a peak of $6.1 billion in 2012-13. But since then, the figures have meandered downwards and sidewards. This trend is all the more puzzling given that both economies have grown over the past decade. Moreover, during this period the political and strategic relationship has warmed and flourished. More can be done in order to escape the apparent trade deceleration we have witnessed in recent years. We expect trade and commerce to keep pace with economic and political trends. We believe that we are poised for a secular uptick in bilateral trade and suggest ways in which trade figures can be improved. We also suggest areas of focus, from the Israeli perspective. Besides cyber and IOT, in the tech realm, affordable innovation and clean-tech and water seem to offer interesting emergent areas.

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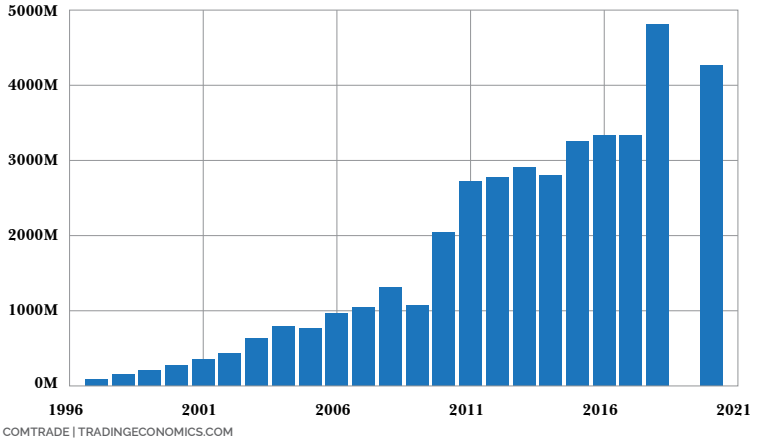
ASIA BECKONS

ISRAELI TRADE HAS TRADITIONALLY CENTRED ON Europe and the United States. Asia, however, is becoming increasingly important to Israeli trade. The advance of the Asian economic era may to some extent have been expedited by the COVID pandemic. Asian economic contraction induced by the pandemic was muted (1.5 percent in 2020) when compared with the global recession (3.2 percent) and, as predicted, its rebound has been faster and more robust.[1] In 2019, Israel exported $4.88 billion

worth of goods and services to China, which was Israel's third most important export market.[2] Indeed, in 2020, Israel saw a slight decline in trade with its two key partners, the EU and the United States, and trade with China increased marginally.[3] If anything, China has become even more important to Israel. However, the trade deficit with China is much larger than it is with India.



Source: *Trading Economics*[4]

Figure 2: *Israel's Exports to China*

India accounted for 3.51 percent of Israeli exports in 2019. This was larger than Turkey's share (2.82 percent), Japan (1.78 percent), the Netherlands (3,.8 percent), France (2.36 percent), and Germany (3.15 percent).[5] I submit that India is going to be of growing importance to Israel and its economy and exports in the years ahead.

India's development into a manufacturing economy may well offer greater synergies in areas like semiconductors, electro-optics and electronics, and pharmaceuticals. Israel

will also increase sales of advanced manufacturing equipment and related software technologies to India. IOT and cyber are examples that come to mind.

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India, an Economic Juggernaut

India's economic inflection and longer-term structural domestic trends will also improve its trade ties with Israel. These ties are linked to the steady strategic deepening of relations (space and defence), India's rapidly evolving economy, and new supply chain dynamics, triggered by COVID.

» India's economy is evolving and as the country moves towards a $5 trillion economy, with a rising per capita GDP, both corporate India and consumers will be better placed to buy Israeli products. To date, India has been a low margin, high volume market, unsuited to Israeli businesses.

» These dynamics are being aided by consolidation of the Indian economy and its increased formalization. Major structural reforms like GST, UID, and the public payments stack provide greater leverage to Indian companies to buy technology. As a result of these changes, navigating India will be easier for Israeli companies and make the market less diffuse.

» Moreover, India is developing a dynamic modern technology-driven economy, paving the way for alignment in certain areas between the two innovation

ecosystems–e-commerce, FinTech, healthcare, cyber, and AI.

» Whereas the goods trade has stagnated somewhat, the service component is rising, seemingly indicating that these three aforementioned dynamics are playing out in favour of this aspect of the trade relationship.

» Structurally, there is a renewed effort to formalize a needed free trade agreement (FTA).

» There are growing synergies in the services sector. Israel's economy is highly dependent on the availability of skilled workers and is facing a growing dearth of skilled workers to power its knowledge economy. India has an abundance of such resources. A free trade agreement and a more accommodating visa regime can deepen bilateral collaboration and hence boost trade.

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Other Mitigating Factors

India has long been perceived by Israeli commercial leaders as a tough place to conduct business. Long sales cycles and deep cultural gaps generate misinterpretation and misunderstandings. More can and must be done to address the latter issue. The good news is that there has been an improvement in what has been called the "optics of success". Thanks to transactions like Sun Pharma–Taro Pharma, Wipro–Givon and Firodia–Rivulis, as well as the inroads made by TCS, there is a sense that things can get done.

Wipro and Wipro Ventures, in particular, have been very effective through a mix of investments in local VCs, and then in start-ups that are aligned with the business areas key to the company's strategy. Wipro have emerged as a desirable go-to-market partner for leading start-ups—notably in the cyber realm. Their investments have signaled to the wider local ecosystem that the company is serious about working with Israeli enterprises; as a result, a healthy alignment has ensued between Wipro and their investee partners. Wipro have also done well in their investments in start-ups and funds, such as Demisto and CloudGenix (both sold to Palo Alto Networks), CyCcognito and IntSights (sold to Rapid 7), creating a win-win scenario for all. More must be down to showcase such successes.

Deeper academic ties are key and over time can improve trade relations. Hundreds of Indian students have completed doctoral degrees and post-doctorates in Israel. Such ties can address the cultural gaps—which are more significant than many recognize. Indian alumni from Israeli universities who end up working in leading Indian corporations or set up their own companies are a valuable bridge.

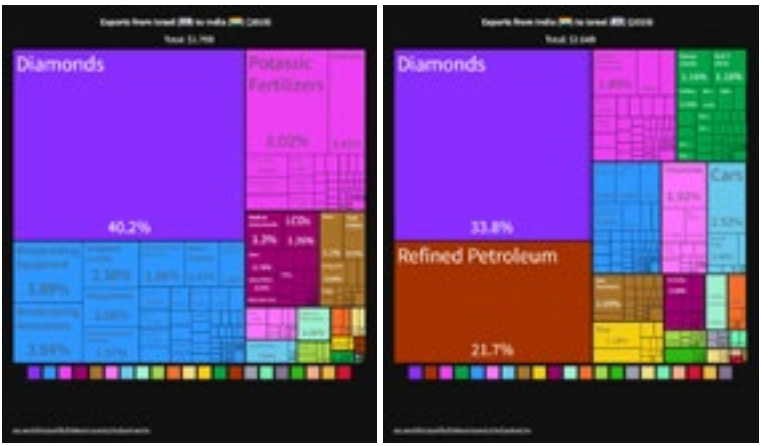
It is also worth recognizing that a growing cohort of Indian entrepreneurs are building global businesses out of India. SaaS companies like Freshworks and others compete in a global market. They recognize the need for speedier decisions and may be more attuned to the Israeli tempo of doing things. Sun Pharma is a good example of a local Indian company that has developed into a leading

global player in the pharmaceutical industry. It is the largest pharma company in India, and the fourth largest generic company globally. The company sells products in over one hundred countries and they already have strong ties in Israel through the acquisition of Taro and engagements with some research institutes and start-ups.

The cost and duration of travel between the two countries have improved greatly and post-COVID business travel will be easier. Prior to the pandemic, Air India flights were flying six times a week and were always full. Since the signing of the Abraham Accords, El Al flights to Mumbai have become shorter and cheaper, and travellers now have Emirates and Etihad as options. The Gulf-headquartered airlines not only make travel easier and more frequent, but allow Indians to get to Israel from cities like Hyderabad, Chennai, Bangalore, and others, and vice versa. Bangalore for example, is a key part of the Indian technology story and improved access to this city is key.

Israeli investments in India will grow, thereby fostering linkages and mutual understanding and interests. This process will happen in spite of negative optics of investments in Indian real estate in the early 2000s. The failures of Israeli real estate developers who had tapped local institutions—on the back of their success in Eastern Europe—scarred a generation of local asset managers. This process is driven by the growing need for Israeli institutional investors to diversify their allocations, and the increasing regulatory risk that has come to be associated with China with its poor returns—at a time when the Indian market has done well, both in terms of

returns and currency stability. This dynamic will make Israeli investors reappraise their India biases. In addition, the global flow of funds to India and the success of the budding Indian VC and start-up system (42 Unicorns in 2021) are becoming noticed. Increased investments in India will deepen ties and support other Israeli business ventures in India. We are also seeing Israeli institutions support Israeli companies in their efforts in India.



Source: *Images produced by Observatory of Economic Complexity (MIT Media Lab), https://oec.world/en/profile/bilateral-country/ind/partner/isr.*

Figure 3: *Exports from Israel to India and from India to Israel, 2019*

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Focused Efforts

For the aforementioned reasons, I am confident that we are poised to see bilateral trade volumes rise to new heights. This, and widening trade ties to include the growth of new areas (non-diamonds and non-

petrochemicals) will require that Israel learn from past efforts—both successes and mistakes—and develop a better understanding of the transformations India is experiencing. The structural reforms listed above point to areas where Israeli strength can lend itself well: cyber, IOT, AI, and advanced machinery.

Whereas Israeli cyber companies and niche-enterprise software product companies (AI, machine learning, IOT) have made inroads, especially in working with major Indian IT system integrators in addressing global clients, companies in the realm of water have had mixed success. In the case of industrial water and cyber there are end paying customers, while in that of industrial water, like drip irrigation, government subsidies are required.

Israeli business leaders, policy – makers, and trade attaches need to think in the way Israeli companies and VCs do in the healthcare space. That means asking one key question that sometimes seems to have been left in abeyance. Who pays? Until there is a real market for water, any Israeli work in the water space (outside of servicing industrial water) will be contingent upon subsidies and state funding. Water diplomacy should be seen as that and that alone. The Israeli state should address the market failure, together with the Indian government.

As India's economy evolves, the ability of Indians to pay will increase. Israelis need to think about where the proverbial puck is going.

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One For Our Future Generations

In conclusion, I believe that in bringing together the two innovation cultures, India and Israel, we can address humanity's challenges and create bilateral opportunities that are meaningful to both countries and to humanity.

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ENDNOTES:

1 "Five Windows of Opportunity for Postpandemic Asia," 18 October 2021, *https://www.mckinsey.com/featured-insights/asia-pacific/five-windows-of-opportunity-for-postpandemic-asia*

2 *https://oec.world/en/profile/bilateral-country/chn/partner/isr*

3 Doron Ella, "Trade in Goods and Services Between Israel and China in the Era of COVID-19," 2 December 2021, *https://www.inss.org.il/wp-content/uploads/2021/12/special-publication-21221.pdf*

4 *https://tradingeconomics.com/israel/exports/china Israel Exports to China - 2022 Data 2023 Forecast 1995-2020 Historical (tradingeconomics.com)*

5 Observatory of Economic Complexity (MIT Media Lab) Data on Israel, *https://oec.world/en/visualize/tree_map/hs92/export/isr/show/all/2010.2011.2012.2013.2014.2015.2016.2017.2018.2019/*

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About *Ananta Centre*

ANANTA CENTRE is a non-partisan, not-for-profit organisation that focuses on value-based leadership development and open dialogue on important issues facing Indian society, to help foster its transformation. The organisation has no political affiliation and serves to provide a platform and forum that engages civil society, business, governments and other stakeholders on issues of importance to India's development and national security through ethical leadership and constructive dialogues.

The Centre's activities focus around 3 core pillars– Leadership & Education, International Relations and Public Policy. Ananta Centre is committed to building a society that is willing to listen, understand and most importantly, dialogue. To this objective, it convenes various programs for exchange of ideas, broadening perspectives and enhancing capacities to create sustainable solutions on a wide variety of issues. The Centre addresses issues of significance through Track 2 Dialogues, Forums, Seminars, Conferences, Roundtables, Public sessions, Young leader Fellowships and Policy programs. It also brings out publications and study reports.

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About *Tel Aviv University*

TEL AVIV UNIVERSITY (TAU), located at the heart of Israel's high-tech and cultural center, represents Israel at its best – dynamic, innovative and forward-looking. TAU was established in 1956 as a small local college. It has since evolved into Israel's largest and most influential research university, with 30,000 students enrolled in 130 schools and departments across the spectrum of sciences, humanities and arts. TAU excels in the area of entrepreneurship and innovation; it ranks among the top 10 schools in the world – and the only one outside the United States – for producing successful, VC-backed startup founders (Pitchbook). It is also a Reuters Top 100 Global Innovation University.

Recognized strengths are brain studies, nanoscience, renewable energy, cyber security, AI, film, and Biblical archeology, among others. TAU's cutting-edge scientific advances are reinforced through ties with prominent research institutions ranging from the NIH and Harvard to the Sorbonne, Max Plank Institute and Tsinghua University.

The University also puts tremendous emphasis on globalizing its campus. For almost five decades, TAU International, the University's international school, has introduced over 30,000 students to everything that Israel and Israelis have to offer: academic excellence, technological innovation and cultural riches. Over 2,200

students from 100 countries enroll annually in dozens of short-term and degree programs taught in English at the undergraduate and master's levels. Programs span the academic gamut, ranging from archaeology and business studies to food security, electrical engineering and many more.

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The collapse of the Soviet Union and the end of the Cold War in 1989 had profound knock-on effects. India, shaken by the demise of its Cold War verities, used the opportunity offered by Oslo to normalize its relations with Israel. The curious anomaly of a relationship whose earliest advocates were Israeli liberals and Indian conservatives was gradually replaced with a more broad-based domestic consensus in both countries. In recent years, India has shed its last few inhibitions regarding Israel. India's policies towards Israel and Palestine were officially and openly de-hyphenated. The Abraham Accords saw Israel succeed in decoupling the Palestinian issue from its regional engagement and paved the way for a nascent multilateral effort that included Indians, Israelis and Arabs.

This volume of essays serves to celebrate the last thirty years of ties and look ahead at the relationship. The essays in this collection dissect the bilateral relationship, looking at key issues like water, food security, space, defence, migration, diplomacy and trade. Their sheer range tells a tale of how far the Israel-India relationship has gone. External factors have been the key to why in the past the two countries moved closer, whether the Soviet collapse or 9/11. Today it is probably safe to say that the relationship rests on its own logic, that neither government looks for cues elsewhere when thinking about the other, and it has both the width and breadth to absorb any surprise shocks that may come up in the years to come.