



Vivekananda  
International  
Foundation

# VIF Expert Groups Reports

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As 2023 came to a close, the Vivekananda International Foundation (VIF) deliberated on regional issues with implications for India as part of the discussions in its Strategic Issues Group. The ongoing Israel–Palestine conflict has serious implications for India and during the deliberations of this Group, it was abundantly clear that the appetite for the two-state solution seems to have dwindled on both sides. Israel's stated objective of destroying Hamas appears to be very ambitious, considering the widespread resistance to its ideology, both in the Gaza Strip and the West Bank. Another aspect that has clearly emerged is that the hitherto unstinted support of the US for Israel may no longer remain with the changing public attitudes in the US towards this issue.

The roundtable discussion on the topic “New Generation Trade Agreements: Promise, Potential and Perils” underscored the proliferation of new generation trade agreements, which include new issues such as digital trade, labour and environment issues, anti-corruption, regulatory coherence (or good regulatory practices), gender and MSMEs. This necessitates that India should change the manner in which it negotiates trade deals, whether bilateral or multilateral.

The China Study Group reviewed the current status of the Chinese economy and examined various parameters like the contraction of the Purchasing Managers Index (PMI) April to August 2023, the negative trend in the data for retail sales for consumption, the downward trend in the Fixed Asset Investments (FAI). External factors like the weak global demand and apprehensions about Chinese policies have impacted China's trade as also inward FDI. Long term infirmities like weak demand, a weakened

real estate sector, burgeoning local debt and an ageing population will continue to hobble the Chinese economy.

The VIF and Prospect Foundation (Taiwan) organised a joint webinar on “Taiwan and India’s View on the Current International Dynamics” on November 16th, 2023. The discussion highlighted some of the critical geopolitical developments taking place in the Indo-Pacific region. Various facets of relevant areas such as Cross-Strait relations, China-Russia relations, India’s vision of the Indo-Pacific region and the Global South were deliberated.

The Pakistan Study Group in its meeting deliberated on a host of issues like Nawaz Sharif’s return to Pakistan, the probable electoral alliances in the upcoming elections, the position of the Pakistan Tehreek-e-Insaf (PTI), Afghanistan-Pakistan relations and the issue of Refugee repatriation, Pakistan’s ammunition supply to Israel and Pakistan and the IMF agreement.

Under the Science and Technology (S&T) Series, the VIF organised a talk on “Semiconductor Technology: A Perspective on the Future of Intelligent Systems” by Prof Manan Suri, Department of Electrical Engineering, Indian Institute of Technology (IIT), Delhi on 23 November 2023. Prof Suri’s talk focussed on the next generation of semiconductor memory technology while touching on some case studies from his research journey in this field.

On 11 December 2023, the VIF in collaboration with Habibie Centre, Indonesia organised a roundtable discussion on “Indo-Indonesian Geopolitics: Navigating Growth Amidst Global Challenges”. Apart from discussing various facets of India-Indonesia relations, the discussion also focused on the issues surrounding Indo-Pacific and geopolitical landscape.

Some days later, the VIF organised a bilateral webinar with the Heritage

Foundation, Washington DC on the topic “Future of India-US Relations” on December 14th, 2023. The Biden-Xi summit and the Israel-Hamas conflict and their impact on India and the United States were also deliberated upon in the meeting.

For December, under the S&T Series, a talk was organised on “Secure Communication in the Quantum World: Opportunities and Challenges” by Dr Bhaskar Kanseri, Associate Professor, Department of Physics, Indian Institute of Technology (IIT), Delhi on 18 December 2023. Prof Kanseri provided a brief overview of Quantum Technology and why it is needed. He highlighted the state of the arts activities in quantum secure communication both globally as well as India’s standing in this field and what has been done in the country so far.

The coordinators and researchers associated with the expert and dialogue groups, think tanks and interactions have put unfaltering efforts to coordinate the meetings, to provide range and diversity of views as well as capture the discussion for the reports.

New Delhi  
February 2024

Perna Gandhi

## Current Developments in the Israel–Palestine War

*Prepared by Commodore Gopal Suri*

The VIF convened a meeting of its Strategic Issues Experts group on 06 November 23 to take stock of the situation in the Gaza Strip arising out of the terrorist attacks of the Hamas on 07 Oct 23. The meeting was attended by Director VIF, Dr Arvind Gupta, Lt Gen RK Sawhney, Lt Gen Rakesh Sharma, Amb Arun Singh, Amb Anil Trigunayat, Mr Tilak Devasher, VAdm Satish Soni, and Air Marshal Rajesh Kumar as also some of the research faculty of the VIF. Some salient issues of the current conflict as also the larger issue of Israel-Palestine problem, that emerged during the meeting, are highlighted below.

**Current Situation.** An overview of the current military operations being undertaken by the Israel Defence Forces (IDF) indicates a three-pronged advance to isolate North Gaza to selectively destroy key portions of the urban environment while preventing North-South movement and controlling ingress/egress of personnel to/from Gaza. Retaliation from the Hamas has seen rockets being targeted deep into Israel, as far north as Tel Aviv. Interestingly, the conflict has seen limited spread into Syria and Lebanon, despite some Israeli attacks in southern Lebanon against the Hezbollah. Retaliation from the Hezbollah was limited to rocket attacks in the northern Israeli town of Kiriyyat Shimona, possibly because of fear of a repeat of the 2006 conflict and the ensuing devastation in southern Lebanon. Iran appears to be circumspect about expanding the current conflict though it

wields considerable influence with the Hamas as also the Hezbollah and the Houthis.

**Israel's Approach.** Israel's stated objective of destroying Hamas appears to be very ambitious, considering the widespread prevalence of Hamas' ideology, both in the Gaza Strip and the West Bank. This articulation is seemingly intended to provide Israel with the political and temporal space to continue its military operations which are aimed at generating a sufficient deterrence against Hamas to preclude any recurrence of the attacks of 07 October 23. There is also a realisation in Israel that it may not be able to continue its current military operation in Gaza indefinitely, especially in the face of growing international protest about the collateral atrocities being perpetrated against the Palestinians. The economic costs of the conflict are also rising, both in terms of materiel and men, with some reports claiming an 11 percent fall in Israel's GDP. The current conflict has also accentuated the complexity of challenges faced by Israel with the increasing prominence of non-state actors like the Hamas and Hezbollah and a gradual diminishing of the threat from its neighbouring states and the larger Arab world. Iran's support for Hamas and Hezbollah increases this challenge even as support for Hamas and the Palestine cause has receded in Arab countries, including Saudi Arabia, in recent times. The occupation of Palestinian territories and the everyday subjugation, humiliation and slow violence faced by Palestinians have been largely ignored by the Arab world. Coupled with attempts at normalisation of ties between some of the Arab states and Israel, as seen in the Abraham Accords, has accentuated the feeling of neglect of their cause amongst the Palestinians, manifesting in the attacks of 07 Oct 23. Israel is riven by internal dissensions which may have been reflected in the failure of intelligence about the Hamas attacks. Public protests about curbs on the judiciary in the recent past are another manifestation of these dissensions. The increasing political heft of far-right parties is evident in the hardline approach adopted by the current Israeli government towards settlements in the West Bank. Consequently, the appetite for a two-state solution to the Israel-Palestine problem appears to

be gradually disappearing from public discourse in Israel. This has also led to increasing protests from the Palestinians about their condition that has found support in many parts of the world, not least in the West.

**US Approach.** Israel, till date has been able to continue with its approach to settlements as also to other issues, with regard to the Palestinians, largely due to unstinted support from the US and some of its allies. However, public attitudes in the US are also changing as seen in the recent anti-Israel protests on university campuses like UCLA, Pennsylvania, etc. While Jewish lobbies like the America Israel Public Affairs Committee (AIPAC) continue to remain strong in the US, the popularity of liberal Jewish groups such as J Street is steadily growing. The far-right government in Israel has accelerated the divisions within the Jewish community in the US as well as in Israel. Another aspect is the improved political organisation amongst the Arab and Muslim communities in the US which has made Muslim-Americans a significant voting bloc for President Joe Biden. Biden's overt support for Israel's brutal assault on Gaza could weaken his popularity among these communities. There is also a growing cleavage within the Democratic Party on how they view Israel's assault on Gaza.

**Two-State Solution.** The Israel-Palestine problem is likely to remain intractable as the appetite for the two-state solution seems to have dwindled on both sides. Israel's insistence to live within secure and defensible borders imply its hesitance to accept the 1967 border lines and unwillingness to give up the major settlement blocs in the West Bank. From Israel's security perspective, military control over West Bank is essential to preserve strategic depth and prevent any rocket or missile attacks from the highlands. Moreover, control over West Bank provides Israel access to the fertile Jordan valley and the aquifers. Israel's perception, that the Palestinians will never accept the two-state solution, has further hardened in recent years with the emergence of Hamas. Moreover, no Israeli or Palestine leader, in the current context, can be seen as giving up territory for the two-state solution, especially when religiously sensitive sites like

East Jerusalem and the Al-Aqsa mosque are involved. Consequently, the solution for this problem will remain a mirage though the proverbial silver lining remains with the possibility of increased involvement of the international community, especially in the light of the atrocities that are currently unfolding in Israel and the Palestinian territories.

**Assessment.** The current conflict is likely to drag on even as countries like Qatar and Egypt are making efforts to resolve the hostage situation. Much of Israel's actions will depend on the release of hostages though Israel seems determined to ensure establishment of a sufficient deterrence to prevent Hamas undertaking such attacks in the future. Considering the urban landscape of the conflict and the wide prevalence of Hamas's ideology amongst the Palestinians, Israel is likely to be limited to constraining Hamas' military capability without actually 'destroying' the organisation. As the conflict drags on the humanitarian costs, which are rising daily, are likely to dictate the approach of the world as also India. While the two-state solution has not been officially denounced by any of the sides, it has gradually lost traction with the increasing influence of 'hawks' on both sides.

**India's Approach.** The condemnation of the Hamas attacks by PM Modi and the subsequent reiteration of India's advocacy of the two-state solution is in line with its principle of no tolerance for terrorism while maintaining a balanced approach to the Israel-Palestine problem. India abstained from the UN resolution on the conflict, citing the absence of issues like the immediate release of hostages taken by Hamas and the mounting casualties and humanitarian costs in Gaza in the resolution. This underlines India's approach. India's approach should continue to be guided by the credo of this not being an "era of war" and the need to "stop bloodshed and human suffering".

**Lessons.** Some important lessons from the current situation, especially the failure of intelligence and the fallacy of over-reliance on technology for

assessing military threats, have been brought to the forefront. The military ability of Hamas to marshal thousands of fighters for attacks on land and in the air, through para-gliders, without any warning, despite Israeli claims to state of the art surveillance technology clearly underlines the need to sustain human intelligence resources. The Hamas attacks have once again emphasised the need for more intense discussion on violence perpetuated by non-state actors and the resulting unchecked violent disproportional retributions by states. India also needs to be cognizant of the pressures on the Israeli defence industry, especially in the context of a prolonged conflict, and the consequent effect on projects being undertaken by the Indian armed forces with Israeli cooperation.

## **New Generation Trade Agreements: Promise, Potential & Perils**

*Prepared by Dr Arpita Anant*

The Vivekananda International Foundation organised a roundtable discussion on the topic “New Generation Trade Agreements: Promise, Potential and Perils”, on 9 November 2023. The discussion was moderated by Shri JS Deepak, India’s former Ambassador to the WTO. The main speakers at the event were Shri Dammu Ravi, Secretary (ER), Ministry of External Affairs, Government of India; Ambassador Dr. V S Seshadri, Senior Fellow for Economic Security, Delhi Policy Group; and Dr. Abhijit Das, Freelance Academic, formerly with Centre for WTO Studies, IIFT. In addition, the event was attended by scholars and faculty members from the Indian Institute of Foreign Trade and other think tanks engaged with issues of trade.

The discussion commenced with a recounting of developments on the trade front in recent years. It was underscored that there has been a proliferation of new generation trade agreements, which include new issues such as digital trade, labour and environment issues, anti-corruption, regulatory coherence (or good regulatory practices), gender and MSMEs. These non-traditional issues are included in recent FTAs of the developed countries. In parallel, attempts are being made by developed countries and some developing countries to negotiate binding rules on these issues among WTO members. India has not remained untouched by these developments. It is understood that many of these non-traditional issues figure prominently in the on-going FTA negotiations. Further, binding rules on the new issues

in FTAs could create a pathway for similar rules being negotiated at the WTO. In this context, the discussion focused on the following issues:

- What should be the Indian strategy related to negotiation of FTAs?
- How crucial would FTAs with new issues be in boosting India's export growth?
- Based on some of the recent FTAs of the developed countries, what could be the impact on India of agreeing to binding rules on new issues in FTAs, as well as at the WTO?
- How can India strike a balance between three objectives-using trade rules for geo-strategic purposes; enhancing exports and facilitating investment flows- and preserving the policy space for boosting domestic industry in new and emerging sector?

This discussion that took place can be divided into the following heads:

### **Imperatives for change**

First, it was emphasised that there was a need for India to change the manner in which it negotiates trade deals, whether bilateral or multilateral. Over the last twenty years, India's focus has been on goods trade, leaning strongly towards import defensive rather than export oriented strategies. As a result, India set low ambitions and favoured restrictive rule of origin to limit imports. This in turn resulted in marginal growth in trade, and no value addition in exports. The top ten export items remain elementary products with no value addition, rather than manufacturing items.

Second, India has a tendency to remain non-integrated. One example of this is the manner in which Indian economy's integration with other South Asian economies was stymied. As a result, intra-South Asian trade is only 5 per cent of the total regional trade. Moreover, China's trade with South Asia stands at 70 billion dollars while India's is merely 30 billion dollars.

A contrary example is of countries like Sri Lanka, Bangladesh, Maldives and Mauritius that have deep FTAs with China and are only gaining from them. Even in the strategically significant Indo-Pacific, the RCEP and the CPTPP will emerge as free-trade architectures. India has to understand that future FTAs are not only about goods, but also about services, investments, technology and commerce. They are about economic integration-bilateral as well as regional. And the benefits of FTAs will accrue in the long run, say after a decade. So India should reverse the tendency of staying out and understand the strategic importance of integration within and outside the region.

Third, India must also rescind its resistance to engage with non-trade issues which are moving from the multilateral realm of the WTO to bilateral/regional FTAs. It has to have clarity on the positions it need to take on such issues. In the case of negotiating the FTA with Europe for instance, India's concerns regarding gender, environment and child labour are amply understood by the Europeans. So, rather than stall negotiations due to these issues, India should take on commitments on a best endeavor basis and keep open the option of revisiting them periodically.

India must recognise that positions in the negotiations in the WTO need not be the same in FTAs. On many issues such as subsidies, agriculture and dispute resolutions, the WTO is in a rule-making role. Since many of India's interests coincide with that of LDCs- such as that of subsidies for small and marginal farmers- India took positions akin to the LDCs. However, rule-making is not at stake in FTAs. Here, at least theoretically, there is scope to have difference in policy from one country to another and get differential gains from different FTAs. So in its FTAs, India must negotiate from its position of strength in different sectors as a rising economy rather than as a conservative LDC. That said, the need to protect its vast and diverse industrial sector which is not very competitive must not be lost sight of.

## **Scope for Proactive Measures**

First, India should think and adapt nimbly to emerging trends. In the past, India had resisted the inclusion of data in trade negotiations. Today, India has emerged as the biggest advocate of data for development. Our position on data needs to be changed, and we need to get into the business of framing rules for data, lest others become rule-makers and we remain rule-takers. Similarly, the labour arbitration that India was benefiting from no longer holds due to AI and robotic engineering. We need therefore to quickly change our position of labour flows.

Second, India needs to stand by the requirements not only of its industry but also of its MSMEs and consumers in its negotiations in the WTO or in FTAs. Hitherto, the focus of our negotiating positions has been to preserve the policy space for Indian industry. As a result, we were restricting the flows of components and raw materials which are crucial for MSMEs to grow. Low level growth of MSMEs has resulted in low levels of manufacturing, leading further to lack of local jobs and migrations. Big industry and MSMEs often have contradictory requirements. However, since MSMEs are fragmented their voices are often not heard. Going forward, India's negotiators must be able to protect their interests as well. India's exports like gems and jewelry in which limited value is added or refined petroleum products or shrimp fisheries are industries that must be protected. Consultations with all stakeholders must be broad-based. Whether or not such changes should be brought about through FTAs is a matter of further discussion.

Third, to shore up investments, rather than relying on high tariffs to attract investment, India must create a positive investment climate and sign investment protection treaties. This is because it is the predictability, transparency and openness of the ecosystem that will attract investments. Similarly, in the trade arena, rather than setting trade rules to boost trade, the focus should be on overcoming infrastructure deficiencies and

reducing logistical and transportation costs that will enable our integration into global value chains.

Fourth, India must recognise the importance of economic issues for its foreign policy. Such a recognition must then translate into including subject experts into the negotiations of bilateral and multilateral trade deals. Bureaucrats from ministries must have experts with deep knowledge and reflection alongside them in the complex trade negotiations of today. Teams of experts must remain associated with relevant bureaucracies for a long term period. Well paid consultants must also be part of the negotiating teams. Back-stop capacities, such as that in the Centre for WTO Studies must be created and their advice heeded to.

Fifth, India must create its own rules of trade for every sector. Rules developed by western countries, even though they are projected as universal, are developed to cater to the needs and interests of their traders. So, rather than accept them as golden rules that cannot be abrogated, India must have its own rules that it must stand by in FTA negotiations. This is particularly needed in the areas of digital trade and cross-border data flows as well as that of green product and technologies. Present-day FTAs with developed countries can curtail India's policy space in these areas in the future, so they have to be negotiated carefully.

Sixth, India must be very creative in negotiating the present day FTAs. This is because to enforce different aspects of FTAs, domestic laws need to be amended or newly framed. Laws once framed can even apply to other FTAs. Such laws can contradict our long-held positions in multilateral conventions such as the principle of CBDR in the realm of climate change. They can also contradict our long-held reservations on issues of freedom of association and application of labour standards in SMEs and agriculture sector in multilateral labour conventions. So creativity must also be displayed in matters of market access, ratcheting clauses and scheduling

of tariff reduction. In the choice of FTA partners, we must privilege those with whom we have complementarity of economic structures and are resource/critical mineral rich.

## **Conclusion**

The main takeaways from the discussion were as follows:

- India needs new and deep FTAs as much as it needs to be part of global value chains. However, each FTA must be creatively negotiated to shield our vulnerable sectors.
- Non-trade issues must be kept out of FTAs or commitments related to these issues must be taken on only on best-endeavour basis so that they are not subject to dispute resolution.
- There is a need a need for developing an internal consensus on matters related to FTA due to their importance for national security.
- MEA must take economic issues more seriously since economic weakness will reduce of geostrategic importance.
- There is need for an assessment of gains and losses from past FTAs.
- Parliamentary assessment FTAs must be made mandatory to ensure accountability of FTA negotiators and reduce conflicts between the different ministries involved.
- Think tanks must remain engaged with FTA negotiations to highlight needs of continuity and indicate areas of compromises where required.
- India's trade and especially its imports must increase. For this there is need to increase facilitation, competitiveness and manufacturing.

## Current Status of Chinese Economy

*Prepared by Commodore Gopal Suri*

A meeting of the China Expert Group was held on 10 Nov 23 in the hybrid mode to discuss the ‘Current Status of the Chinese Economy’. The meeting was chaired by the Director VIF, Dr Arvind Gupta and was attended by Lt Gen RK Sawhney, Amb Ashok Kantha, Lt Gen Rakesh Sharma, Lt Gen YK Joshi, Amb DB Verma, V Adm Satish Soni, Lt Gen SL Narasimhan, Lt Gen Gautam Banerjee, Prof Sujit Dutta, Dr Sanjeev Kumar, Gp Capt Chandan Sharda and Cmde Gopal Suri as also the faculty of the VIF. Presentations were made by Ms Sarah Mujeeb on ‘Current Trends of the Chinese Economy & Perceived Infirmities’ and by Sh Santosh Pai on ‘Future Outlook of the Chinese Economy & Implications for India’. Discussions and deliberations on the various issues that emerged during the meeting are elaborated below.

The Chinese economy has been struck by strong headwinds in the wake of its opening up after the pandemic. The Communist Party of China is seized of these challenges which it has identified as the “triple pressure of demand contraction, supply shock, and weakening expectations”, and has emphasised same in many meetings since the Central Economic Work Conference held in December 2022. The expected recovery has not been forthcoming even though the Chinese themselves have forecast a moderate growth rate of GDP at about 5 percent. While the Plenum of November 2013 had pledged to comprehensively deepen reform, the implementation

of the decisions of the plenum has been tardy, especially in addressing structural problems related to the role of markets, reform of the labour and financial sectors and the reforms of state-owned enterprises (SOEs). Current day challenges to the Chinese economy are a result of the lack of progress on these structural reforms.

Much of this tardiness can be attributed to the ideological approach of the current Chinese leadership wherein the CPC continues to retain control for achievement of national objectives pertaining to the 'Chinese Dream'. Moreover, flagship initiatives like the 'Belt and Road' have necessarily been driven by SOEs precluding much needed reform. The current international climate, with the West gradually turning from partner to rival, has also led to reactionary Chinese industrial policy which has hindered the needed reform. Consequently, there has been a slowdown in Chinese economy from the volatile GDP growth of yesteryears which, while not cyclical, is structural in nature. The Chinese leadership appears to be reconciled to a period of slower growth and a changed 'social contract' based on the Chinese Dream and not high economic growth. The private sector also appears to be aligned with this direction of the Chinese economy. Nevertheless, the CPC is unlikely to allow unbridled growth of the private sector and will continue to 'manage' it while avoiding suppression of the sector.

Another dimension of the changed political direction is the shift in resources towards the 'real economy', especially in the technology sectors of AI, quantum computing, etc. As China aims to become a technological global power, self-reliance in critical areas like semi-conductors will be a major focus of the government and the CPC. However, the emphasis on innovation has not yielded the desired increase in productivity except in some areas like battery manufacturing. China will continue to diversify and re-shape its economic relations with the global south that is becoming a major focus of its efforts. Chinese initiatives like the Belt and Road Initiative (BRI), Global Development Initiative (GDI), Global Security

Initiative (GSI) and the Global Civilisation Initiative (GCI) will become an important part of its foreign policy toolkit.

A review of the Chinese economy reveals the down trend in manufacturing with the Purchasing Managers Index (PMI) contracting from April to August 2023 and is currently below 50 indicating low domestic demand. Data for retail sales for consumption also reflect this sentiment showing negative trend with growth reducing from 6.6% to 5.8%. in the period January – September. Fixed Asset Investments (FAI) is also not encouraging with just 3.3% y-o-y in the same period. The current weak global demand has also impacted China’s trade with exports slowing down. Apprehensions about Chinese policies, especially with respect to foreign investors, has also impeded foreign direct investment (FDI). Long term infirmities like weak demand, a weakened real estate sector, burgeoning local debt and an ageing population will continue to hobble the Chinese economy.

The current economic outlook for China does not portend well for its ambitions of overtaking the American economy, which now appears unlikely till even the mid-20240s. China is therefore, looking to consolidate its strength in select industries like EVs, where it has control over the materials supply chain. Consequently, other sectors like renewables, petrochemicals and pharma, where China has similar control over the supply chain, have potential for replication of the success witnessed in EVs, for China to dominate the global market. Even as the ‘Made in China 2025’ programme has faltered, because of denial of technology from the West, China continues to consolidate in other sectors like white goods. The BRI is also witnessing a changing trend wherein SOEs are leading projects in regions of strategic importance to China like Africa, Latin America, Middle East and various parts of Asia while private enterprises have taken the baton in the West. Another discernible trend is that of re-location of Chinese private wealth to places like Singapore and Dubai. Consequently, the possibility of family offices and private equity funds becoming the new conduits rather than SOEs and listed companies is on the rise.

In the post-COVID scenario, India has judiciously reduced trade dependency on China where domestic capacity exists. While the Production Linked Incentive (PLI) scheme has been created to stimulate industry, it may run out of steam without proper support and FTAs. Another impediment could be the China-Taiwan dilemma, insofar as the semiconductor industry is concerned. The ability to attract global value chains to India and away from China will remain a difficult proposition till the formulation of clear and transparent policies with regard to Chinese participation. Moreover, with the expansion of India's industry, the danger of creation of new dependencies on China will also have to be guarded against.

## **VIF-Prospect Foundation Webinar on Taiwan and India's View on the Current International Dynamics**

*Prepared by Dr Sweta Kumari*

The Vivekananda International Foundation and the Prospect Foundation (Taiwan) organised a joint webinar on “Taiwan and India’s View on the Current International Dynamics” on November 16th, 2023. Lt. Gen. R.K. Sawhney (Retd.) and Dr. I-Chung Lai, President (PF) gave the opening remarks. Dr. Arthur S. Ding, Professor Emeritus, Graduate Institute of East Asian Studies, National Cheng-Chi University and Dr. Alan H. Yang, Executive Director, Taiwan-Asia Exchange Foundation, Dr. Sweta Kumari, Associate Fellow, VIF and Ms. Prerna Gandhi, Associate Fellow, VIF made presentations on relevant themes in the webinar. Brig. Vinod Anand (Retd.), Cmdr. Gopal Suri (Retd.), Dr. Cchavi Vasisht, Dr. Anchita Borthakur and Dr. Angana Kothokey also attended the event. The discussion highlighted some of the critical geopolitical developments taking place in the Indo-Pacific region. Various facets of relevant areas such as Cross-Strait relations, China-Russia relations, India’s vision of the Indo-Pacific region and the Global South were deliberated.

### **Tensions Across Taiwan Strait**

It was discussed that reunification has been one of the main objectives of President Xi Jinping’s plan for the rejuvenation of the Chinese dream. He wants to be remembered as a great leader in history. The Chinese economy is undergoing a severe economic crisis. Since the 1996 Taiwan Strait crisis, the Chinese government has made huge investments in the growth

of the People's Republic Army. Taiwanese President Tsai Ing-wen does not honour the 1992 consensus. This has led to an increase in Chinese assertive activities around Taiwan. The US continues its sale of arms to Taiwan. It, however, is concerned about the new tensions across the straits as Chinese activities are unlikely to stop. The PLA does realise that invasion will be costly for China, hence it is opting for grey-zone tactics. Even if the upcoming election results in the opposition- Kuomintang Party to come into power, the Chinese activities will continue as coercion gives leverage to China to enhance its influence in the region.

### **Taiwan's New Southbound Policy**

Taiwan, through its New Southbound Policy (NSP), is trying to diversify its supply chains and enhance ties with ASEAN, India and other countries in the Indo-Pacific region.

### **Chinese Engagement in Global South**

China is expanding its Belt and Road Initiative (BRI) to expand its influence in the region and also counter Taiwan's outreach. Chinese infrastructure projects and other investments in the Global South including the Pacific Island countries are becoming increasingly influential. China is dealing with the US very carefully. It is partnering with Russia and North Korea. It is influencing the leadership of developing countries and countering the US-led rules based order. It is forming more China-led groupings. The Taiwan issue is very critical for China.

### **Russia-China Relations**

China and Russia have come closer than ever before, with Russia selling China its most advanced weapons and helping to develop an early warning system to spot ballistic missiles, in addition to cooperation on military

satellites. This has specifically developed against the backdrop of NATO increasingly stating China as a challenge and participation from leaders of non-NATO members in NATO Summits. The importance of trade and investment was emphasised, noting the significance of China as an investor in Russia and the burgeoning trade between the two countries. The recent China-Russia Comprehensive Strategic Partnership of Coordination for a New Era is one of the highest of all Chinese diplomatic relationships. Overall, the areas of cooperation and divergence between China and Russia, as well as potential implications for other countries such as India were outlined. The importance of India as an alternative to Russia, as a way to maintain equilibrium and strategic partnerships in the region was also highlighted.

### **India and the Indo-Pacific**

India has historical, civilizational, and economic ties to the region, as well as geopolitical realities that motivate its interest, including China's assertive rise and non-traditional security threats. Greater focus is placed on the region's economic significance, with more than half of India's trade flowing to the Pacific Region. Furthermore, India's policy of supporting a free, open, and inclusive region, ensuring maritime security, and upholding a rule-based international order is primarily guided by the SAGAR Doctrine (2015), Act East Policy (2015), Shangri La Dialogue (2018), and Indo Pacific Ocean Initiative (IPOI). The importance of existing regional cooperation architecture and dialogue mechanisms was highlighted, especially convergence on blue economy.

### **Conclusion**

India's concerns regarding China's actions in the Indo-Pacific region were emphasised in the discussion. The meeting focused on the potential for cooperation between India and Taiwan including domains such as

semiconductors, and critical and emerging technologies. The discussion underscored major developments in the Indo-Pacific region from Indian and Taiwanese viewpoints. The upcoming elections in India, Taiwan and the US were also deliberated.

## **Recent Developments in Pakistan and Other Regional Developments**

*Prepared by Dr Angana Kotokey*

A meeting of the Pakistan Study Group (PSG) was held in hybrid mode on 22 November 2023. The main items on the agenda were- Nawaz Sharif's return to Pakistan, the probable electoral alliances in the upcoming elections, the position of the Pakistan Tehreek-e-Insaf (PTI), Afghanistan-Pakistan relations and the issue of Refugee repatriation, Pakistan's ammunition supply to Israel and Pakistan and the IMF agreement. The meeting was attended by Lt Gen RK Sawhney (Retd), Mr Tilak Devasher, Mr Rana Banerji, Shalini Chawla, Amb Satish Chandra, Amb DB Venkatesh Varma, Amb G Parthasarathy, CD Sahay, Gen NC Vij, Sushant Sareen and Amb PS Raghavan.

### **Nawaz Sharif's return to Pakistan**

As Pakistan prepares for the upcoming general elections on 8 February 2024, probable assumptions and interpretations pour in from policy circles regarding the position of Nawaz Sharif and his party Pakistan Muslim League (PML N). Pakistan's former three-time Prime Minister Nawaz Sharif returned to Pakistan on 21 October 2023, after four years of voluntary exile in London. The former PM was accused and charged with corruption cases after he lost support from Pakistan's military establishment, which ultimately led to his removal from power in 2017, bringing the army's then favorite Imran Khan to power. However, after the military's conflict with Imran Khan which led to a no-confidence motion against him on 10

April 2022; the Pakistan military now facilitates Nawaz Sharif's return to Pakistan and lauds his political participation where their only interest is to see him as the much-needed alternative to Imran Khan and the PTI. There is a growing perception within the establishment that Nawaz Sharif who still remains popular in the country can take Pakistan out of the crisis as he has the support of the Gulf countries. Hence, he is expected to draw more assistance from the Gulf on the economic front. However, Nawaz Sharif's economic agenda lacks a clear road-map to rejuvenate the country's crisis ridden economy.

With temporary relief from legal troubles including bail in the Toshakhana case and the Islamabad High Court's granting him protective bail in the Avenfield and Al-Azizia cases; Nawaz Sharif is going to face a tough challenge from the popular support that Imran Khan receives on the streets despite the military's backing. Amidst all the uncertainties, he returns to unite a fractured party with the hope of bringing it back to power in the forthcoming election. Moreover, hurdles remain in his path to contest the upcoming general elections in 2024 and the biggest one arguably is the infamous Panama Papers case, in which he was disqualified from holding any public office for life in July 2017. If he does not get respite from his legal troubles and is unable to contest elections, his brother Shehbaz Sharif could be a strong contender for the prime minister's post. Nawaz Sharif, who was unable to complete his previous tenures as prime minister, after losing crucial support from the Pakistan's military establishment, is hoping to come back to power this time, partly due to the latter's desire to strike a workable political settlement with him to thwart Imran Khan and his party from coming back to power.

Meanwhile, the Election Commission of Pakistan (ECP), in its recent notification of the final list of constituencies, has revised the number of National Assembly (NA) general seats to 336, indicating a decrease of six seats from the previous count of 342. The constituency list released by the ECP signifies a decline in the general seats of the National Assembly

(NA) from 272 to 266. The breakup will now be of the general elected seats of 266 in place of 272, with Punjab having 141, Sindh having 61, KP with 45, Baluchistan having 16 and Islamabad capital area with 3 seats respectively.

### **Probable Electoral Alliances in the Upcoming Elections**

The Military establishment's willingness to let Nawaz Sharif have another term comes with some difficult ground realities as well. Nawaz Sharif's poor handling of the economy is not a forgotten past that led to public dissatisfaction, and now the party suffers from internal fissures among some of the party's top leadership. Moreover, Imran Khan's PTI has made major inroads in the PML-N's bastion of Punjab province. With 141 seats, Pakistan's most populous province is crucial for any political party looking to win the elections and form the next federal government. Since 2018, PML (N) has faced competitors in Punjab including the rise of Tehreek-e Labaik Pakistan (TLP) who could play a significant role in the upcoming elections. However, Punjab by-polls in July 2022 put forth a different picture where the TLP did not have much success and the PTI swept the polls.

However, at the same time, the Pakistan People's Party (PPP) is also eyeing a major comeback, especially in southern Punjab. Under the changing political scenario, there is a probability that the PML (N) will look to forming new electoral alliances across Pakistan.

On November 07, 2023, the PML (N) and the Muttahida Qaumi Movement-Pakistan (MQM P) in a joint statement agreed to contest the upcoming elections together. Meanwhile, the MQM denies any alliance building and calls it a mere 'seat adjustments'. However, their electoral alliance can be understood as the first step towards countering the PPP in Sindh because MQM has a strong base in Karachi and Hyderabad districts

of the Sindh province. Moreover, in Sindh, Nawaz Sharif's party is likely to open a broad anti-PPP alliance and therefore has called on MQM to complete consultations with the Grand Democratic Alliance (GDA), a regionalist political alliance based in Sindh along with Jamiat Ulema-e-Islam-Fazalur Rehman (JUI-F), and Awami National Party (ANP), which has the potential to challenge the PPP.

Meanwhile, it has been reported in Pakistan's daily newspapers that to counter the PML (N), the PPP in Punjab is open to a deal with the PTI; despite both being opposed to each other. Bilawal Bhutto is of the opinion that his party is not getting a level playing field in the upcoming elections; therefore, might decide to enter into some form of alliance with the PTI, probably because with the help of the latter, PPP wishes to increase its support base in Punjab. Another party to play an important role in south Punjab is the Jahangir Tareen's Istehkam-i-Pakistan Party (IPP) with whom both the PPP and the PML (N) will try to strike a deal because of the former's strong hold in the province. Apart from Punjab and Sindh, a similar situation might come up in Balochistan where it is believed that PML (N) is trying to form an alliance with the Balochistan Awami Party (BAP). It has been part of several reports suggesting that the PML (N) is eyeing 25 electable in Balochistan.

With PML (N) making alliances with different political groups in the country; it is likely that the party will be at some advantage in the forthcoming electoral battle—showing itself as having support base throughout Pakistan.

### **The position of Pakistan Tehreek-e-Insaf (PTI)**

It is likely that it will be difficult for Imran Khan and his party PTI to play any major role in the upcoming elections. Despite his popularity in the streets, Imran Khan won't be able to mobilize and energize his support

base since the army will make sure that he remains in jail until the election is conducted. A pessimistic view regarding Imran Khan's role in the elections persists with many believing that he will be completely sidelined in 2024. With Khan in jail, the existence of the party is in question now as many party leaders are either in jail or have been forced by the military to switch parties or to leave politics altogether. The situation can go in favor of Imran Khan and the PTI if some compromise is made with the military establishment. This is unlikely given the personal differences between him and the current army chief and his predecessor even though he still enjoys some support within the lower and middle ranks of the military. Moreover, the PML (N) and the PPP in the present times are not as popular as the PTI; and despite the army's severe restrictions the party remains popular even after the 09 May 2023 events.

However, the scenario for the PTI might not be that positive concerning the splinter groups that came out of the PTI after May 9, 2023. The Pakistan Tehreek-i-Insaf Parliamentarians (PTI-P) led by former PTI leader Pervez Khattak is one such group that parted from the PTI citing discomfort with Imran Khan. IPP is another party that broke from the PTI in June 2023 and became a separate political party. IPP faces criticism for having the backing of the Pakistan military establishment. However, the PTI members remain positive about their role in the upcoming election despite Imran Khan's legal prohibitions and disqualification in the Toshakhana case. However, Imran Khan is likely to face more restrictions after the end of the election in Pakistan.

### **Afghanistan-Pakistan Relations and the Issue of Refugee Repatriation**

After the Taliban takeover of Kabul in August 2021, Afghanistan-Pakistan relations is facing mounting challenges, and strategic calculations in their relationship are changing since then. Pakistan's caretaker government on 3 October 2023 announced to carry out mass deportations of Afghan

refugees—under domestic law ‘Illegal Foreigners Repatriation Plan’ after asking the concerned to leave the country before 1 November 2023. The Pakistani state has been hosting an estimated four million Afghan refugees and migrants, including at least 600,000 who have crossed the border since the Taliban takeover in 2021. Of these numbers, 1.3 million are registered as legal refugees, holding Proof of Registration cards, while an additional 850,000 have received Afghan Citizen Cards from the Pakistani authorities, but not all of those afforded to be registered as refugees. Moreover, some 1.7 million Afghans are believed to be residing in the country without any documentation. However, on 10 November 2023, the government of Pakistan extended the validity of the Proof of Registration (PoR), cards issued to the registered Afghan refugees till 31 December 2023, allowing the extension of legal residence status for approximately 1.4 million Afghan refugees following a four-month delay.

On 8 November, the caretaker Prime Minister, Anwaar-ul-Haq Kakar said that over 250,000 Afghan individuals had voluntarily returned since the announcement of repatriation at the beginning of October 2023. It has been observed so far that the Afghans facing eviction include those who fled the Taliban’s takeover in Kabul two years ago, lacking legal documents or with expired visas. According to the Pakistan government officials, more than 170,000 Afghans, many of whom have lived in Pakistan for decades, had started to leave the country voluntarily since 17 September 2023, after which the government gave an ultimatum for all ‘unregistered foreign nationals’ to leave Pakistan immediately.

According to the Pakistan government, the deportation was aimed at tackling the issue of terrorism i.e. the increase in the number of attacks carried out by armed groups like the Tahreek-e Taliban Pakistan (TTP), also known as the Pakistani Taliban, in the country. After a meeting of the apex committee of the National Action Plan, chaired by the caretaker Prime Minister Anwaarul Haq Kakar, Pakistan’s caretaker Interior Minister Sarfraz Bugti, the government official supervising the expulsion

drive, claimed that 14 out of 24 suicide bombings in the country in 2023 were carried out by Afghan nationals leading to a total of 2,867 Pakistani fatalities since the Taliban's takeover of Afghanistan in August 2021. Since the Taliban takeover, TTP's resurgence has caused tension with Pakistan, since they were under the impression that the Afghan Taliban at the helm of power now would help them in containing the TTP, a section of whom are believed to be based in Afghanistan. But things did not fall the way Pakistan anticipated and the Afghan Taliban made several statements citing that the Emirate has not allowed anyone to use its territory against Pakistan and that the latter should solve its internal problems and not blame the Afghan Taliban for the rise in TTP attacks. However, Pakistan has been adopting several measures to pressurize the Taliban to take actions against the TTP. For instance, very recently several containers of imports were stranded at Karachi ports and not released including Pakistan imposing extra duties and taxes. Further, there is an imposition of a 10% fee on every critical import along with several tough conditions on the bank guarantees. Apart from these pressure points, Pakistan decided that it will not advocate Afghanistan's case at the international level. However, these coercive measures are not going to change TTP's relationship with the Afghan Taliban because of some form of ideological connections that exist between the two groups. In fact, this whole situation will help TTP in getting more recruits for the organization. Nevertheless, in these tumultuous times, the repatriation will put both Afghanistan and Pakistan in problems and the social and security dynamics will also change with these mass deportations. These repatriations will only add to the existing numbers of humanitarian crisis in Afghanistan.

### **Pakistan's Ammunition Supply to Israel**

Since the beginning of the Israel-Hamas conflict, there were reports claiming Pakistan supplying 155 mm shells to Israel. The reports claimed that the shells to Israel was supplied with the help of British Air Force planes, that travelled from Pakistan's Nur Khan Base in Rawalpindi and

then all the way going to a base in Cypress via Oman. However, soon after such reports came up, Tahir Mahmood Ashrafi, the Prime Minister's special envoy to the Middle East, reiterated saying that Pakistan can never have relations with Israel and very categorically made a statement that they extend no official support to Israel. Moreover, the current chief of Army Staff Syed Asim Munir made a very strong statement that Pakistan extends political and diplomatic support to Palestine. Moreover, as part of showing support to Palestine it was also observed that the Jamaat-e-Islami held pro-Palestine rallies in Islamabad, Lahore, and Karachi in large numbers against Israel's bombing in Gaza with anti-Israel and anti U. S. slogans. Despite this, doubts linger about the supply.

### **Pakistan and the IMF Agreement**

The International Monetary Fund (IMF) staff and the Pakistani authorities have reached a staff-level agreement on the first review under Pakistan's Stand-By Arrangement (SBA), subject to approval by the IMF's Executive Board. Upon approval, Pakistan will have access to around US\$700 million. The agreement supports the authorities' commitment to advance the planned fiscal consolidation and accelerate cost-reducing reforms in the energy sector. The agreement will help complete the return to a market-determined exchange rate and pursue state-owned enterprise and governance reforms in order to attract investment and support job creation; while also continuing to strengthen social assistance. This is the much-awaited preliminary agreement for the release of \$700 million from a \$3 billion bailout fund approved by the international lender in last July. The standby credit fund is meant to save cash-strapped Pakistan from default. The development comes at a time when Pakistan is facing economic crisis with worsening inflation that is driving up food prices including the Pakistani rupee losing more than 50% of the value against the dollar. The agreement comes ahead of parliamentary elections scheduled in February 2024. However, despite signing of the agreement, the caretaker foreign minister made a statement that the prices of the gas and fuel is likely to be

increased again in January. However, it has become immensely important to adhere to the conditionalities of the IMF and to prevent the accumulation of circular debt in both gas and power sectors. Upon approval of the agreement, the IMF in its statement said, “Inflation – which in May hit 38 percent, the highest in four decades, and is currently hovering at about 30 percent – is expected to decline over the coming months amid receding supply constraints and modest demand”.

## **Semiconductor Technology: A Perspective on the Future of Intelligent Systems**

*Prepared by Dr Saroj Bishoyi*

Under the Science and Technology (S&T) Series, the VIF organised a talk on “Semiconductor Technology: A Perspective on the Future of Intelligent Systems” by Prof Manan Suri, Department of Electrical Engineering, Indian Institute of Technology (IIT), Delhi on 23 November 2023. Prof Suri’s talk focused on the next generation of semiconductor memory technology while touching on some case studies from his research journey in this field. He provided his perspective on the present and future of semiconductor technology. The Research Group at IIT, Delhi has been actively working on exploiting the characteristics of emerging Non Von Neumann (NVM) semiconductor technology for a multitude of novel applications such as data storage, low-power bio-inspired computing and cyber-security. He emphasised that the nature of existing data intensive applications is such that, excellence in computational performance cannot be achieved based on raw transistor scaling or increasing the number of processing cores alone. He pointed out that a fundamental shift in the vastly successful Von Neumann computational paradigm is needed to overcome the bottlenecks associated with data-intensive real-time applications.

The talk was chaired by Lt General R K Sawhney (Retd.), Centre Head and Senior Fellow, National Security and Strategic Studies & Internal Security Studies, VIF, who in his remarks underlined the growing significance of the semiconductor technology in the civil and military field. He highlighted the geopolitics and geo-economics of semiconductor technology, and

emphasised the necessity to develop India's own capacities and capabilities in the field to meet its own requirements and also become an integral part of global semiconductor value chains.

Prof Suri highlighted four essential verticals closely linked to how the semiconductor technology is evolving i) Quest for a Digital Empire, ii) the Nature of Our World, the real world where we live in; iii) Quest for Intelligent Machines, and iv) the Nature of Technology itself.

### **Quest for a Digital Empire**

On the Quest for a Digital Empire, he said that everything that we look at such as internet of things (IoT), e-Governance, healthcare, defence, security, space, smart cities, social media, retail and finance, industry 4.0, etc., we are in a quest of creating digital empire in every field of our life. This leads to phenomenal amount of data creation. A few years ago, it was projected that the total amount of data to be generated by 2021 would be 62 thousand billion gigabytes. The New Data Economy is accelerating data creation. So when we think of keeping the data in a reliable way, the semiconductor industry has to decisively address semiconductor memory or storage technology. When we talk about semiconductors, unfortunately, more than 90 percent of it is about processing or computation. Very little discourse takes place about the storage part of it. This is a key area that the research group at IIT, Delhi also focuses on. He pointed out that in the coming years, all the efforts will be directed towards the creation of memory technology rather than computing or processing.

### **The Nature of Our World Driven by Data**

The nature of our world, everything including security, health, climate change, basic sciences, and weather modelling, etc. are driven by data. The nature of the problems are such that unless we generate a lot of data, they

cannot be dealt with. If we start with small volume of data, we cannot reach a meaningful solution. There is need for advanced processing techniques for such data storage. US Department of Defense's drones generate 430 PB (Petabytes) of data per day. Surveillance cameras in China generate 2.5 EB (Exabyte) per day. So security problem itself is essentially a massive data problem. Though we do not encounter with such humongous amount of data at the individual level in our daily life, but when dealing with the societal or national issues it assumes an urgency.

### **Quest for Intelligent Machines**

While the first stage is to store this huge data in real physical world, the next stage is to process it or to generate meaningful information from this data. Here we enter into the Quest for Intelligent Machines. The expectation of any common user is to interact with more and more intelligent machines in their daily lives whether we call it AI or GPT (Generative Pre-trained Transformer). The expectation is that the machines should have more and more capability to process data fast. Consequently, these machines have become more autonomous and project back a lot of raw information or data. But these generate a massive amount of data. For instance, a self-driving car generates 40 terabyte (TB) data with just 8 hours of drive. So if we calculate the total number of self-driving cars used in a specific area or state with how many hours these are driven, and multiply with how much data is generated, that would be humongous. Interestingly, 90 percent of energy is lost in data management with only 10 percent on computation. Hence, the focus would be more on storage or memory paradigm in times to come. And, not on the processing paradigm as has been for several decades, especially with strong emphasis on the Moore's law. This is an interesting inflection point.

## **The Nature of Technology Itself**

This is a positive feedback loop. According to the Moore's law, every year more and more semiconductors can be manufactured in the same amount of silicon and this leads to an economy of scale. So sensors, processors, etc. have become cheaper and easier. That itself leads to generation of more data and information. It is like feeding into itself.

## **Memory Centric Neuromorphic Systems**

The research group at the IIT Delhi works more on the neuromorphic system, which is a sub-field of AI. This is latest generation of AI algorithm or the AI computing techniques. It is a concept inspired from mammal brain. It brings together computer science, nanotechnology, and computational neuroscience. Neuroscientists look at the healthcare side of the functioning of the brain. Computational neuroscience basically is trying to see what the learning mechanisms, rules, etc. are and how processing happens in real organisms and then they try to abstract out to build artificial machines which can follow those paradigms. This is quite evident in our brain. It is a massively parallel system with (10<sup>11</sup> Neurons; 10<sup>15</sup> Synapses). It has scalability (~ 2 L Volume), needs low power (~ 20 W). It is immune to variability and noise, and doesn't connect to the cloud which means it is more secure. So what can be learned from this is that the storage and processing in natural systems are not two separate entities or two separate tasks. Whereas 99.9% of computing systems that exist, storage and computing are two separate tasks.

## **Power Consumption Landscape**

Explaining the power consumption landscape in the context of Conventional hardware and Neuromorphic hardware, Prof Suri said that the Hoover Dam uses up to 2 gigawatts. The present day supercomputer

chip cluster not analogous to neural function, needs its own energy source to power its own data center and runs slower than the biological neural. Coming down the order, the state of the art CPU has power rating of 300-400 watts, biological computing uses 20 watts. Furthermore, laser in CD/DVD player uses 5-10 milliwatts, IBM's True North uses tens of milliwatts (1 million artificial neurons, or 256 million synapses). He went on to state that one old device made by humans which is very low in spectrum is the hearing aid. It is not a new technology, which consumes about less than 1 milliwatt. The objective is to take both the storage and computing process to that sub-milliwatt stage and come down to the natural level of energy dissipation. Moreover, new intelligence systems like drones, autonomous underwater platforms, aerial platforms, space platforms, satellites, nano-satellites, etc. with storage system in them would run with low power, and will not create battery issues, thereby increasing system lifetime.

### **Non Von Neumann (NVN) Computing**

The leading tech industries around the world such as IBM, Intel, Google, NVidia and Cerebras are investing a lot in this new computing architecture especially chips. Their effort is to go in the direction of new form of bio inspired computing. This is definitely setting the tone in new fundamental ways of computing without ignoring storage or memory aspects. Importantly, Amazon, Google and Microsoft were never into hardware manufacturing, especially never into the chip design. But they are now giving good competition to the traditional chip design tech companies by having their own chip design team, and computing architecture team. They are fully aware about the implications of the security of storage as well.

### **Memory Technology**

The memory technology today appears as a science fiction, given that 1TB SSD can be stored in a size of stamp. But if one looks into the microscopic

level, it is actually a three dimensional chip or three dimensional structure. So memory technology has now reached a matured stage. This needs to be recognised if we want to get into the semiconductor industry. He also highlighted the importance of semiconductor materials. However, there are few countries who control major portions of the supply chain of semiconductor materials that has strong geopolitical ramifications. India has limited control over those materials. So access to semiconductor technology and materials is critically important to set up semiconductor fabs in India.

### **Economic Security**

Worldwide, semiconductor imports have crossed oil and related energy imports. Semiconductors are the building blocks of electronic devices and use of electronics such as tablets, cell-phones, set-top boxes, digital TVs, automotive, medical, gaming consoles, military, etc. have significantly increased in the last few years. On joint development and production of semiconductor technology, it was pointed out that unless there are compelling economic factors or incentive, no tech industry or country will agree to start new ventures. So joint production is purely economics. How much we can offer as a consumer will also play into this.

### **Geopolitical Aspects**

The semiconductor foundries are currently located in select countries and the global semiconductor supply chain is dominated by them. At present, the US has at least 13 foundries, Japan has 15 plus foundries, Taiwan has over 20 foundries, South Korea has 12 foundries, China has 10 foundries, and Europe has 8 foundries. Unfortunately, India has only 0.2 or 0.5 foundry that is Semi-Conductor Laboratory (SCL), Mohali which is already outdated. However, global semiconductor supply chains are a very complex issue. The typical semiconductor production process

spans multiple countries and goes through different stages of production processes: silicon ingots cut into wafers; bare wafer into fab water; fab wafer sorted, cut into die; die are assembled packaged, tested; final product shipped for inventory; chip integrated into consumer goods by end production manufacturer; and then customer buys end product.

It is important to note that 70 % of semiconductors pass through Taiwan/ China during production process, which raises concern in Washington, when it factors China's policy toward Taiwan. Thus, when we talk about zero trust in critical electronics, security will be ensured not only through software but also through hardware. So having some minimum end-to-end semiconductor capability locally or by authorized companies for at least strategic or security applications is absolutely essential.

### **Hardware Layer Threats to Zero Trust Model**

The hardware layer adds threats to the zero trust model in several ways: Trojan, backdoors and untrusted foundry, counterfeit ICs, physical attack, side-channel, fault injection, reverse engineering, and fake parts. The research group at IIT, Delhi thus, looks into some specific areas such as side-channel, fault injection, among others. Prof Suri pointed out that the factors like geo-economics, geopolitics, and security of supply chains should be inherent in policy frameworks for the sector.

### **India Context**

At present, bodies like SCL, SSPL, SITAR, IITs, and IISC have some competencies in the semiconductor sector. There is however, need to upscale their capacity not only in equipment, but also in capabilities. They need to come at par with 3D chips that we are currently aiming at. Then there are programmes like India Semiconductor Mission (ISM), which aims to build a semiconductor ecosystem in the country and the Chips to

Startup (C2S) programme further aims to train over 85,000 engineers. The Ministry of Electronics and Information (MeitY) has sought applications from academia, R&D organisations, start-ups and MSMEs under its C2S Programme. The government has also launched the production-linked incentive (PLI) scheme to encourage semiconductor manufacturing within India. Prof Suri noted however, that there is overemphasis on training and skilling; and we are providing semiconductor design services without having headquarters in India. By this service we are not gaining much. He emphasised on the need to build indigenous capabilities in the domestic set up even if this is costly.

Today almost all the leading academic institutions in India are doing research on semiconductor. However, the academics work extremely in silos that is a big problem. Though they do collaborate, the outcome of those collaborations are very peripheral, which are for showcasing, and difficult to translate into ground reality. If things have to translate, then an absolute chain of command and empowerment is necessary. The present committee culture within every academic institution having their own procedure do not add up to an urgency that is sorely needed. Thus, for translating projects, we need our own Manhattan projects.

Nevertheless, there are good things happening such as Micron's proposal to invest in India for building testing and packaging facilities. Tata has also announced its semiconductor plans. But these are small steps, and more need to be done. A lot of semiconductor design work is happening in India, but those are for foreign tech companies located outside India. Prof Suri pointed out that there is no shortage of vision and strategy on semiconductor technology in India. However, this needs to be implemented right way to realize its semiconductor mission.

## **VIF-Habibie Center Roundtable Discussion on Indo-Indonesian Geopolitics: Navigating Growth amidst Global Challenges**

*Prepared by Dr Cchavi Vasisht*

On 11 December 2023, the VIF in collaboration with Habibie Centre, Indonesia organised a Round Table Discussion (RTD) on “Indo-Indonesian Geopolitics: Navigating Growth Amidst Global Challenges”. Dr Arvind Gupta, Director VIF, welcomed the speakers and gave the introductory remarks followed by Dr Mohammad Hasan Ansori, Executive Director, The Habibie Center. H.E. Ina Krishnamurti, Ambassador of the Republic of Indonesia, New Delhi and H.E. Sandeep Chakravorty, Ambassador of the Republic of India, Jakarta gave special remarks on the Indonesia-India relations. The RTD involved presentations by Prof Dr Dewi Fortuna Anwar, Chairperson and Board of Directors, Habibie Center; Prof Sachin Chaturvedi, Director General, RIS; and Dr Udai Bhanu Singh, Former Senior Research Associate, IDSA. They were followed by inputs from Mr Satish Mishra, Former MD, Strategic Asia and Dr Gautam Jha, Asst Prof, Center for Chinese and SE Asian Studies, JNU.

India and Indonesia, being close neighbours, share deep historical and cultural ties. Though the relations faced some kind of hiatus in the past, the relations are now growing. In the 1990s India’s Look East Policy, and later the Act East Policy under PM Modi has strengthened the relations. In 2024, India and Indonesia will celebrate 75 years of establishment of diplomatic relations. During this journey, the partnership has evolved from being partners fighting colonial powers to being drivers of the Asian Century. In

2018, the bilateral relationship was elevated to a Comprehensive Strategic Partnership during the visit of the Indian Prime Minister Modi to Indonesia in 2018.

The discussion focused on how the two sides emphasized on building economic ties. India's AtmaNirbhar Bharat programme and Indonesia's policy of promoting Make in Indonesia will help improve the manufacturing sector and provide economic opportunities in both countries. The inauguration of the direct flight between New Delhi and Bali is a case in point. Indonesia wants to become middle income country by 2045 and India is pursuing its vision of Amrit Kaal by 2047, thereby sharing common economic postures. There is also a similarity between India and Indonesia's foreign policy postures of strategic autonomy. Therefore, the two countries are said to be balancing powers given their strategic location and positions. However, recently Indonesia declined to join the BRICS.

The two countries being strategic partners have many high-level exchanges along with institutionalized strategic dialogues. India took the G20 presidency after Indonesia in 2023, showing how the countries of the south are gaining importance. The solidarity and spirit of the 1950s which helped in leading the non-aligned movement is getting revived by both Indonesia and India. Indonesia through its outlook for ASEAN in the Indo-Pacific and India through its G20 theme on *Vasudhaiva Kutumbakam* showed the world about the solidarity of the global South.

At the same time through regional summits such as East Asia Forum and IORA, both countries discuss important issues which reflect the concerns of countries in Asia as well as global order whether it is climate change, disarmament, maritime security and security of the common-spaces. With the increasing geopolitical fragmentation and the rising dysfunctionality of multilateral organisations, the Asian countries are looking at a transition to the new world order but are not aware of the contours of the same.

Discussion also focused on how we tend to forget or not prioritize strengthening our close relationship with each other. Therefore, we must focus on future engagements and not just restrict ourselves to talking about the past and bridge the past, present and the future. Both countries have played important roles in global arena in 2023, with ASEAN's presidency being with Indonesia and G20's presidency being with India. India's growth is projected to be 7 percent and Indonesia is projected to be 5 percent; the global growth is projected at 2.8 per cent. Additionally, according to the IMF, in the next five years, India will be the third largest country in the world and Indonesia will be the sixth largest. Thus, if we combine the huge demographic dividend in both countries (60 percent of the population in Indonesia and 65 percent of population in India), we can collaborate in vast areas.

Trade between India and Indonesia surged eightfold since 2005, reaching a substantial USD 38 billion in the financial year (FY) 2023. Indonesia is the second largest trade partner for India in the ASEAN region. Earlier 80 percent of the trade consisted of crude oil, but now it constitutes only 50 percent. The key imports from Indonesia to India consists of coal, coke, and briquettes, vegetable oils, iron and steel, and bulk minerals and ores. India also exports a diverse range of commodities to Indonesia including petroleum products, motor vehicles and cars , sugar, ships, boats, and floating structures, and iron and steel. The focus is now on value addition and not just finished products. Both nations have set an ambitious goal of reaching USD 50 billion in bilateral trade by 2025, as part of their broader strategic partnership and their collective efforts to access the Comprehensive Economic Cooperation Agreement (CECA).

The discussion made various suggestions to further build economic relations between India and Indonesia. First, within the energy sector, where India has a growing EV market and expertise in renewable energy, Indonesia has abundant raw material to make batteries. Second, Indonesia holds 40 percent of ASEAN's digital economy and India could share its

digital payments mechanisms as well as give training and help in skill development of the local people. Cyber security could be a crucial area of collaboration between the two sides. Third, focus could be given on developing human resources and capabilities, for instance, building food security and sister hospitals. The two sides can also engage in coproduction of knowledge. In addition, the two sides could explore developing shared value systems, for example, focus on building biodiversity wellness index. Finally, there is an ongoing process to review the India-ASEAN trade agreement, which is expected to increase beneficial trade between both sides.

Apart from India-Indonesia relations, the discussion focused on the issues surrounding Indo-Pacific and geopolitical landscape. The first major challenge that the Indo-Pacific faces is the rise of China. China has used its economic power and statecraft i.e. BRI and AIIB to provide opportunities yet coupled it with an aggressive foreign policy and use of military force to assert its claims. Another issue in the Indo-Pacific is the unavoidable rivalry between the US and China. The consequences of this rivalry for other countries has resulted in in either bandwagoning, balancing, hedging or neutrally accepting both sides. And then there are the conventional and non-conventional military challenges that the Indo-Pacific region faces. The perceptions of emerging threats have led to an increase in military spending in most countries in the Indo-Pacific.

Finally, the major issue in the Indo-Pacific discourse is the contending visions for the region. The geographic boundaries of the Indo-Pacific are not clearly defined—a broad definition extends it from western coast of America to the eastern coast of Africa; but the major focus of the Indo-Pacific has been in essence Southeast Asia which is the geographic center of the Indo-Pacific. There has been a close association of the term “Indo-Pacific” with US’ Free and Open Indo-Pacific (FOIP) in China’s eye. Therefore, China has rejected the use of the term Indo-Pacific. The discussion enumerated the several Indo-Pacific strategies and initiatives by

various countries. The discussion also questioned ASEAN centrality given there are challenges imposed by the rise of China and what is happening in Myanmar.

The discussion concluded with a focus on strengthening the close strategic ties between India and Indonesia. The countries, as maritime neighbours and vibrant democracies, need to collaborate on various fronts. The Indian Ocean region should be a zone of cooperation, emphasising the importance of ensuring regional peace, stability, and prosperity. Collaboration in the blue economy and governance was underscored as crucial for mutual benefits. The event emphasised the need for sustained collaboration in navigating global challenges and fostering peace and prosperity in the region.

## **Bilateral Webinar between VIF and the Heritage Foundation on Future of India-US Relations**

*Prepared by Dr Sweta Kumari*

The Vivekananda International Foundation (VIF) organised a bilateral webinar with the Heritage Foundation, Washington DC on the topic “Future of India-US Relations” on December 14th, 2023. Lt Gen. R.K. Sawhney (Retd.) and Mr. Jeff Smith, Director, Asian Studies Center, Heritage Foundation gave the welcome and introductory remarks. The participants from the Heritage Foundation included Mr. Bryan Burack, Senior Policy Advisor, China and the Indo-Pacific, Asian Studies Center; Mr. Robert Greenway, Director, Center for National Defense; and Mr. Andrew Harding. The VIF was represented by Amb. Arun Kumar Singh, Amb. Ashok Kantha, Lt. Gen. Rakesh Sharma (Retd.), Lt. Gen. Anil Ahuja (Retd.), Vice-Adm. Satish Soni (Retd.), Ms. Prerna Gandhi and Dr. Sweta Kumari.

The event involved discussion on the significance of India-US relationship and its associated challenges and opportunities. The major milestones established in the relationship were highlighted along with the outcomes of the recently held 2+2 dialogue between the two countries. The Biden-Xi summit and the Israel-Hamas conflict and their impact on India and the United States were also deliberated. The Russia-Ukraine war, situation in the Middle-East, India-China relations, US-China relations and the security dynamics of the Indo-Pacific region were discussed at length among the participants.

## **India-US Relations**

*Significance:* India-US relationship is one of the most defining partnerships in the 21st Century. Since the pandemic, the US is making strong efforts to reduce its supply chain dependency from China. India has been a key potential ally or target for diversifying supply chains.

*High-Level Interactions:* A series of high level interactions took place in 2023. The two National Security Advisors met at the end of January to launch the India-US Initiative on Critical and Emerging Technologies (iCET). Prime Minister Narendra Modi was in the US in June on a state visit, while President Biden visited India in September for G20. Both these visits were followed by joint statements. There is identification of new areas of cooperation with technology emerging as a defining parameter in the India-US relationship. In the joint statements, there are recurring references to growing trust and confidence in the relationship. The India-US strategic partnership is being perceived as a force for global peace and stability. The US government is committing itself in helping India to develop indigenous defence capabilities.

*2+2 Dialogue:* The 2+2 dialogue between India and the US was significant as it took place on 10th November amidst the ongoing Israel- Hamas conflict, which was engaging a lot of attention of US Secretary of State Anthony Blinken and Secretary of Defense Lloyd Austin. In the joint statement, India and the US for the first time together took an official stance on standing with Israel against terrorism. It was quite evident in the joint statement after the 2+2 dialogue between the two countries that despite some of the turmoil, India-US relationship has made extensive progress and there is a continued momentum. A large number of cooperative projects are being carried forward. Along with them, some new and more potentially meaningful agreements such as the Security of Supply Arrangement to strengthen both countries' supply chain interdependence have also been reached.

2+2 also referred to India's full membership to the multinational combined military forces headquartered in Bahrain. This is again a very significant development as India has normally stayed out of non-UN multilateral forces. The visit of US Deputy NSA John Finan to India after 2+2 dialogue for an inter-sessional review meeting of the iCET further shows continued progress in the relationship.

*Recent Achievements:* Some of the recent initiatives undertaken by the two governments are mentioned below:

- INDUS-X: The defence acceleration ecosystem which aims to bring in industry and start up from both sides in defence to promote technology partnership, defence finance and cooperation.
- Workshops by the US Department of Commerce to educate startups in India about what would be the procedures for collaboration and the export control system to enable higher level technology flows to India
- Intense joint exercises between the two militaries and a high degree of interoperability are taking place. Interoperability, an outcome of logistics support agreement, is a great step forward in the defence relationship.
- Space: There is tremendous progress and cooperation. India has signed the Artemis Accord, which is unique, as it is a framework outside the United Nations. The NASA-ISRO Synthetic Aperture Satellite will be launched from India in 2024. Both countries are working towards a joint mission to the International Space Station in 2024 as well as towards India's human space flight mission.
- In military dialogues, aspects related to space and artificial intelligence are also being considered.
- The F414 deal between GE and HAL although involves a lot of regulatory and bureaucratic procedure, there is optimism for it to be a success.
- The iCET is focusing on broader areas such as biotechnology, critical minerals and rare earth processing technology, digital connectivity,

digital public infrastructure and advanced materials.

*Pro-Khalistan Elements & India's Sensitivities:* In the case of the arrest of an Indian national for allegedly plotting murder of a Khalistani supporter with dual US and Canadian citizenship, both the governments have handled it well by following the due process and providing each other with relevant information. Currently, the arrest of an Indian national is only at indictment level which may or may not lead to conviction if there is not enough evidence to substantiate the case. The US handled the matter with greater maturity in comparison to Canada and did not escalate it to political level as the latter. The Indian side during the discussion expressed concerns regarding the lack of attention by their Western partners including the UK and the US to the challenges posed to India's security through violence and terrorist activities by elements of the Indian origin diaspora based in these countries.

It was agreed from the American side that there is lack of awareness about this issue in the US and this incident could be a teaching moment where India could use it to educate its American counterparts about the sensitivities attached to these issues. The cancellation of President Biden's visit to India and postponing the Quad summit was also highlighted. However, it was agreed that India-US relationship is moving in a positive direction and these small issues should not be a problem in it.

### **Biden-Xi Summit**

The Biden-Xi meeting was held in Woodside, California on November 15, 2023. One of the major outcomes of the summit was the resumption of military communication between US and China that was stopped since Nancy Pelosi's visit to Taiwan in August 2022.

*Conservative Perspective:* The conservative analysts are critical of Biden's

China policy. For the first one and half years, the Biden administration inherited a new paradigm from the Trump administration's China policy that was primarily focused on competition, rather than cooperation. However, since around August 2022 it started to re-adopt some of the old elements of US' China policy.

- *Provocation Paradox*: The analysts have been using the term 'provocation paradox' which is the United States making concessions in light of aggression by the Chinese Communist Party, through which it creates more incentive for China to manufacture further aggression and further provocations.
- *Zombie Engagement*: Since Pelosi's visit to Taiwan, the Biden administration's China policy has taken some national security actions regarding China but there has also been a continuing tension that has led them to find ways to cooperate with the CCP where the interests align. The on and off events such the semiconductor export control action followed by Biden-Xi summit in Bali, then the spy-balloon incident has led to a situation known as 'zombie engagement' wherein the US is focused on process over substance, having meetings, rather than actually achieving tangible-specific outcomes. The United States wants to engage more than the PRC side and is in a posture of seeking to sway the PRC to return to the table. Such an engagement process disrupts United States national security action. Meetings and summits and conversations with the PRC side come at the cost of affecting the United States sanctions designations and delaying important steps such as capital controls into the PRC.

*Chinese Views about US*: The Chinese are deeply worried about the outcomes of the upcoming US presidential elections as also the Taiwanese elections. They are more unfavourable of Trump coming back to power that would result in stricter China policy.

As the geopolitical rivalry between US and China will continue, China with its carefully crafted strategy will aim to edge the US out of the Indo-Pacific region and then eventually have supremacy, globally.

*India-China Relations and India's Concern:* There has been some outreach by China at the track 2 level to India. But the position of Chinese Ambassador to India has been vacant for more than a year. They expect India to agree to the changes made in the border after Galwan in 2020 and consider it a new normal. Some of the concerns from Indian side are:

- China has begun to look at India from the prism of its strategic rivalry with the US and not on a bilateral level.
- There is more emphasis on how to respond and what to expect from each other in case of a crisis in Taiwan Strait or across India-China border rather than on enhancing deterrence to avoid such situations.
- There is a need for clarity on how we develop strategies to reduce dependencies on China.
- China is the primary challenge of the US, however, there are concerns not just in India but broadly in the region that the US is getting over extended with its engagement in the European theatre, and recently in the Middle East.
- There is a need to find ways to deal with China's salami slicing tactics through which it continues to make incremental gains in the South China Sea or in the Eastern Ladakh region.
- Overall, India does not want a conflict between the US and China, however, a collusion or G2 kind of situation in issues such as climate change where India's interests have been blind-sided by the two, will also not be desired.

## **Middle East Dynamics**

*US Perspective:* Stability of the global energy market in the Middle East has

been America's US vital national interest since the Carter administration. The global trade that transits the region is vital to the global economy and it cannot afford disruption. The conflict in the Middle East be it Hamas or Hezbollah or proxy groups in Iraq, Syria, or the Houthis in Yemen is sponsored by Iran. The US is concerned that it is very close to testing its nuclear weapons and has already acquired delivery systems capable of reaching Europe and Israel and needs to be prohibited at all costs. The escalation in the northern border of Lebanon is a greater risk than Gaza and could directly hinder the global energy and trade markets. There have been sharp escalations in attacks on US ships in the region including the attacks by Houthis in the Red Sea. The experts believed that the Biden administration policy has led to this situation.

*US Viewpoint on Israel-Hamas Conflict:* In response to the accusations of genocide against Israel, the some experts believed that it is the opposite case. Since Gaza is an urban settlement, it is very difficult for the Israeli forces to operate. They're exercising far more restraint than they're getting credit for. Hamas is good at winning narratives and is getting a tremendous amount of support in international and national media. Compelling Israel to exercise restraint against Hamas will exacerbate and extend the conflict even further. The neighbouring Arab countries including Jordan and Egypt are not willing to give shelter to Palestinian civilians temporarily.

*Chinese Engagement in the Middle East:* China requires external sources of energy. 43% of China's oil and gas requirements come from the Middle East. This number is increasing and its military is dependent on oil. China is aware of this situation and if the US and India neglect their partnerships in the Middle East, it will allow China unrestricted access to expand their influence.

## **Russia-Ukraine Conflict & US Response**

There is a disconnect between multiple elements of the defence establishment and president Zelensky and Ukraine. The Biden administration has been aiding Ukraine without any accountability and transparency on the Ukrainian side and the funds are being misused.

## **Conclusion**

The discussion covered a wide range of geopolitical issues that impact India-US relations. It was agreed that India-US relations are deepening and will continue to do so in future. VIF and the Heritage Foundation agreed to hold more such interactions on critical aspects of India-US relations.

## **Secure Communication in the Quantum World: Opportunities and Challenges**

*Prepared by Dr Saroj Bishoyi*

In the emerging quantum world, establishing quantum secure communication is quite a demanding and challenging affair. The quantum era is governed by rules of Quantum Physics, which has led to the development of quantum technologies aiming to harness applications in computing, communication, and precision sensing. Quantum Key Distribution (QKD) offers a means for information exchange, which is secure even in the presence of quantum computers. In this context, the VIF under its S&T Series organized a talk on “Secure Communication in the Quantum World: Opportunities and Challenges” by Dr Bhaskar Kanseri, Associate Professor, Department of Physics, Indian Institute of Technology (IIT), Delhi on 18 December 2023. Prof Kanseri provided a brief overview of the Quantum Technology (QT), the QKD, and why it is needed. He highlighted the state of the arts activities in quantum secure communication both globally as well as India’s standing in this field and what has been done in the country so far. Finally, he touched upon the opportunities and challenges as well as future prospects in the field of QTs.

### **Quantum Revolution**

We are now in the midst of the second quantum revolution or quantum 2.0, which refers to the development and use of quantum superposition and entanglement in large engineered systems. In the first quantum revolution,

we understood the physics and the existing phenomena happening. Now using those phenomena, we are developing something new that was not existing so far. During the second revolution, the short-term outcomes are quantum entanglement, quantum gates, and quantum communication where progress has been made in the areas of quantum cryptography, quantum teleportation and quantum hacking. The medium-term goals are quantum control, quantum simulation, quantum error correction and quantum meteorology which pertains to quantum imaging, quantum sensing, and quantum radar. These are expected to be achieved in the next five years. The longer-term goals are quantum foundations, quantum computation and implementation which include ion traps, photonics, superconducting. These are expected to be achieved in the next 20 years or so.

## **Motivation and Driving Force**

There are two key motivation and driving forces in QT. The first imperative is to miniaturize things. We had bigger computers, we tried to miniaturize them. Every time the innovation was to make things smaller and smaller as much possible. So, this technological innovation in miniaturization led to length scales approaching Planck's constant requiring the use of quantum principles. This means we cannot use classical physics to explain and understand those phenomena. We really need to invoke quantum mechanics to understand the length scale, which are approaching the Planck's length. The second imperative is to organize and control components of a complex system, governed by the laws of quantum physics. The examples of quantum enabled science and technologies that came as a breakthrough during the last decade or so are in the field of quantum computing, quantum sensing and metrology, and quantum key distribution (QKD). In quantum computing, tech companies such as IBM, Google, IonQ and Intel are demonstrating multi-qubit processors on every month. The goal is to understand quantum science and mechanics and do engineering in the quantum domain.

## **Quantum Computers**

If we look into quantum computers, the basic idea here is to start with qubits which are different than bits and use the principles of quantum superposition and quantum interference to come out with better computational capabilities than classical computers. In classical bits, we had two states that is 0 and 1. In case of quantum, where we use the qubits, there are infinite possibilities to make combinations of 0s and 1s. This makes a revolutionary change where classical computers would take a number of years to solve a problem, the quantum computer will take seconds to solve same problem. Therefore, applications of quantum computers have benefits in several areas such as artificial intelligence and machine learning, drug design and development, where we need very complex simulations to run. We need them in financial modelling, accurate prediction of weather, and also optimization of logistics. Other areas where quantum computers can be used are cybersecurity and cryptography. While there are benefits of quantum computing, there are big threats to existing security systems due to quantum computers where quantum communication comes into picture.

### **State of the Art Quantum Technologies and India's Status**

So far as the state-of-the-art quantum technologies are concerned, quantum computing, quantum enhanced metrology and quantum imaging come into the picture. The IBM recently launched a new quantum qubit processor chip i.e. IBM condor which has a more thousand qubit in it. This is the maximum quantum processor so far available. In India, we have a maximum of five qubit processor as of now, which is made by the Tata Institute of Fundamental Research (TIFR). The other area is quantum enhanced metrology where the goal is to use quantum principles to enhance sensing and metrology capabilities to increase the sensitivities. For instance, advanced Laser Interferometer Gravitational-Wave Observatory, which is called LIGO in the USA, uses quantum light and of space itself

to detect and understand the origins of gravitational waves. Similarly, in quantum imaging, two times improvement in imaging happens by just using quantum light in comparison to classical imaging. Here basically photonic technologies are used. In defence sector, there are many areas where photonic technology can play important role apart from the QKD; quantum imaging, quantum radar, quantum illumination are very much of strategic in nature. All these can be basically developed by using QTs.

### **Quantum Key Distribution (QKD)**

The QKD is a secure communication method where two people can produce secret keys by using quantum principles, which they can use to encrypt and decrypt messages. If any person tries to eavesdrop, it changes the system that can be noticed by the two parties. An important property of the QKD is that they will be able to know when somebody is tweaking or tracking the data. The QKD can be achieved two ways: satellite and optical fiber. In the satellite based QKD, China with more than 2000km has achieved more success. Many other countries are also trying to do satellite based QKD. They also use nano satellites and balloons to increase the secure communication distance. So far as India is concerned, ISRO has achieved a maximum of 300 meter free-space QKD in 2021. It was a line of communication basically between two buildings. As of now, there is no satellite based optical tracking technology developed to track from the ground. It would require significant time to catch up and develop these technologies.

The other way to communicate is through optical fibers which is less successful so far. In 2010, Japan developed a QKD network where they connected different nodes between different cities with varying distances of 1km to 30km. They tried to manage the keys in a way so that any user can get the key from the server. China, too, achieved success in fiber QKD network spanning 5000km through its quantum backbone network.

It achieved this distance by establishing many nodes with two nodes separated by about 50 to 60 km. In this way, the whole distance they could achieve was 5000 km. In fact, their fiber network is also connected with their satellite network so that they can increase the distance.

So far as India's status is concerned, it has achieved a maximum distance of 380km with a single hop in the lab by IIT Delhi. If we replicate it then we will get longer distance. In field, it has demonstrated 100km with DRDO. This is at par with the international standards. Moreover, different agencies and startups such as CDoT, a PSU, and QuNu lab have demonstrated 40-60km fiber-QKD with their own technologies. It is important to note that these have been achieved through the existing fiber network in the country.

## **Quantum Internet**

The quantum internet is going to be a game changer in terms of developing secure communication. The goal is to have quantum computers and then to connect them with a quantum channel and communicate through transmission of qubits. The quantum internet is a kind of parallel internet to the classical internet which would feed to quantum devices or quantum processors. It is important to note that it is not going to replace the classical internet. Quantum computers are for some specific tasks which are not achievable with the classical computers. So this quantum internet is going to supplement the classical internet with quantum communication rather than replace it.

## **Quantum Technology Supply Chains**

The quantum technologies are not individual technologies. They are several enabling technologies which are required for realizing quantum technologies. For instance, to make quantum communication system, we need quantum number generator which can be made by the some of

the industries. We need photon sources which are made by some other industries. Then we have photon detectors which is a different entity and require strong understanding of material science. Then we need technologies to cool our detectors. Cryogenic technologies come from somebody else. In nutshell, it is a complete ecosystem which requires all kinds of enabling technologies along with hardcore quantum technologies to get the success. These are the areas where we actually have a plenty of avenues. If one looks into the QKD market, there will be an exponential growth in this market in coming years. The markets for QKD systems by end users include mobile and payment systems where maximum secure communication is required for making mobile based transaction. There are also big uses in government, financial, healthcare, military, transport, telecom, utilities or other infrastructure providers, data centers, etc. So there is huge market for the QKD and the QKD market is expected to reach \$20 billion by 2030 with CAGR of 22%.

### **Quantum Effort Worldwide**

The quantum technologies have national importance. The countries that have developed QTs are not going to provide quantum solutions to others, given its strategic significance. That's why there is quantum effort worldwide and the leading countries have initiated their own quantum missions and funding their own organisations in order to develop their own indigenous quantum devices. According to an estimate, worldwide investment in quantum R&D was \$22 billion in 2020. China is the leading investor in this field where it has invested over \$10 billion. Other major investors are Germany \$3.1 billion, France \$1.6 billion, UK \$1.3 billion. US has also launched its national quantum initiative with investment of \$1.2 billion, European Union also launched its quantum flagship program with an investment of \$1.1 billion. India launched its national quantum mission with investment of over Rs 6,000 crores. These technologies have tremendous avenues for the new comers in coming years.

## **National Quantum Mission**

India launched its National Quantum Mission (NQM) with investment of over Rs 6000 crores from 2023-24 to 2030-31. It focuses on Research, Development and Innovation and aims to put India among the top six leading countries involved in the R&D in quantum technologies. It prioritizes four main areas: Quantum Computing; Quantum Communication; Quantum Sensing and Metrology; and, Quantum Materials. In this regard, it would set up four thematic hubs in different domain across the country. These have wide scale applications ranging from healthcare and diagnostic, military, energy and data security. It aims to strengthen indigenous building of quantum based computers. It would help develop magnetometers with high sensitivity in atomic systems and Atomic Clocks for precision timing, communications and navigation. It would support design and synthesis of quantum material. All the stakeholders including the government, industry, startups and academia are going to play important role in this endeavour. This is a huge boost to national priorities like digital India, make in India, skill India, stand-up India, start-up India, self-reliant India and SDGs.

## **Quantum Encryption**

Quantum encryption is important for the quantum secure communication. There are two ways quantum encryption is done: symmetric encryption and asymmetric encryption. In symmetric encryption, the two parties have the same key and they share the key via trusted courier to distribute the key for decryption of data. Here the length of the key is same as the length of message. In asymmetric encryption, we have two different keys. One is called public key and other is private key. For instance, all the internet comes from asymmetric encryption. This is an important area which is more secure than the symmetric encryption. It is noted that the longer the key, the more secure it is. It is also noted that once we will have quantum computers, all internet based communication will be gone. It is believed

that some countries have already developed quantum computers, but they are not disclosing them because they find more opportunity in this area and will be in a strategically advantageous position. So this remains a vulnerable area, and solution comes through the QKD. In this context, Prof Kanseri explained the single photon based QKD and entanglement photon based QKD.

### **Challenges in Quantum Communication**

Looking at the security-closeness of real systems with theory, there could be attacks on the QKD systems which is now known as quantum hacking. The idea here is to hack a quantum communication system. This is a race between code makers and code breakers. Importantly, those who are making the QKD systems are trying to make countermeasures by which they could avoid those attacks. In this regard, Prof Kanseri referred to ethical quantum hacking where the code makers try to hack systems by which they could propose what kind of countermeasures be taken so that the system is not hacked when it is in the field. The other problem is trusted nodes. The last mile connectivity is also another problem. The idea is to use the QKD with quantum cryptography.

### **Future Prospects**

It was observed that the US and China began their dedicated research work on quantum technologies at least two decades back. India started only about five years back. Since then it has made notable progress, especially in quantum communication, though there exists some gaps between India and China or the US. However, it was pointed out that knowing quantum is not enough. There is need of understanding electronics and physics associated science to develop quantum technologies. In addition, developing trust and technology absorption is also very important. It was observed that scientists are doing research in silos across India and

there could be overlapping of research works. So it was suggested that registration and streamlining of these projects into a single list would be useful and help avoid duplication and resources wastage. It was noted that timely funding of research projects is key to achieving success. Importantly, India's private sectors have to play big role in quantum research, development and innovation and also on other new technologies. There is need of industry wide commitment and effort to upscale research in these cutting-edge technologies in the country.

## About the VIVEKANANDA INTERNATIONAL FOUNDATION

The Vivekananda International Foundation is an independent non-partisan institution that conducts research and analysis on domestic and international issues, and offers a platform for dialogue and conflict resolution. Some of India's leading practitioners from the fields of security, military, diplomacy, government, academia and media have come together to generate ideas and stimulate action on national security issues.

The defining feature of VIF lies in its provision of core institutional support which enables the organisation to be flexible in its approach and proactive in changing circumstances, with a long-term focus on India's strategic, developmental and civilisational interests. The VIF aims to channelise fresh insights and decades of experience harnessed from its faculty into fostering actionable ideas for the nation's stakeholders.

Since its inception, VIF has pursued quality research and scholarship and made efforts to highlight issues in governance, and strengthen national security. This is being actualised through numerous activities like seminars, round tables, interactive dialogues, Vimarsh (public discourse), conferences and briefings. The publications of VIF form lasting deliverables of VIF's aspiration to impact on the prevailing discourse on issues concerning India's national interest.



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