



KASHMIR POLICY

PROBLEMS OF INDIAN DIASPORA

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U.S SECURITY STRATEGY

INCOME INEQUALITY

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US's National Security Strategy

GS 2

- **Effect of policies and politics of developed and developing countries on India's interests**

Intro

- The new National Security Strategy (NSS) document unveiled by US President Donald Trump **showcases a world locked in unceasing economic competition.**
- In this world, Washington is **not preoccupied with promoting democracy abroad and will focus instead on great power competition, economic rivalry and homeland security.**

Rethinking Liberal Politics

- History, as they say, finally and **formally ended for the liberal fallacies which had come to dominate the US foreign policy discourse and practice since the end of the Cold War.**
- The Trump administration has **defined the new strategy as one based on "principled realism" in an "ever-competitive world".**

Threats from China and Russia Emphasised

- Focusing frontally on great power politics, the new document **calls Russia and China "revisionist powers" seeking to change the global status quo, and paints a stark picture of the world, rejecting cooperation in favour of competition.**
- The US, therefore, **has to "rethink the policies of the past two decades—policies based on the assumption that engagement with rivals and their inclusion in international institutions and global commerce would turn them into benign actors and trustworthy partners",** the document says.
- It is an extraordinarily blunt attack on the two powers as Trump underlined that **Russia and China "are determined to make economies less free and less fair, to grow their militaries, and to control information and data to repress their societies and expand their influence".**
- The US president also claimed **China and Russia are developing "advanced weapons and capabilities"** which could threaten the US' **"critical infrastructure and our command and control architecture".**

- In Trump's own words: **"We will stand up ... like we have never stood up before."**

Reimagine Economic Relationships

- The idea of democracy promotion, traditionally a cornerstone of US foreign policy, is now being given a go-by. As per Trump's **'America First'** approach, the **US is more likely to "demand fair and reciprocal economic relationships around the world"**.
- Tough action against China is expected, with suggestions that the Trump administration could apply **new punitive tariffs on goods from the country, even as an investigation into China's intellectual property theft and forced technology transfer policies** is nearing completion.
- There is a new-found emphasis on the importance of US intellectual property and the NSS **introduces the idea of a "national security innovation base" comprising everything from academia to tech companies.**
- Where cooperation with allies and economic partners was a key element of the Obama or Bush-era NSS, Trump insists that this must happen in a framework advantageous to the US.

Climate Change

- It does not seek to build democracy elsewhere or champion issues like multipolarity or climate change which were an important part of the NSS of the Bush and Obama administrations.
- Climate change too has been **jettisoned as a national security priority**, something which was expected after Trump pulled the US out of the Paris climate accord in June.
- This despite the fact that Trump has signed off on the 2018 defence spending Bill that states, **"Climate change is a direct threat to the national security of the United States."**

Multilateral institutions role recognised

- Yet, the global multilateral order has not been completely ignored as the **"economic system continues to serve our interests"**, according to the NSS, though **"it must be reformed to help American workers prosper, protect our innovation, and reflect the principles upon which that system was founded"**.
- There is still an **expectation that "trading partners and international institutions can do more to address trade imbalances and adhere to and enforce the rules of the order"**.

- The need for **greater cooperation with allies and partners in tackling China on the economic front** has been articulated.
- The isolationist sentiment engendered by the campaign rhetoric of Trump has given way to a more nuanced understanding of the reality confronting a major power in the 21st century.

India's Role

- Seeking to **support “India’s emergence as a leading global power”**, the NSS calls for **increasing “quadrilateral cooperation with Japan, Australia, and India”**.
- India has unequivocally welcomed U.S. President Donald Trump’s announcement of the National Security Strategy (NSS) for his country during his tenure.

Positives

1. Acknowledgement of India's emergence

- It acknowledges **“India’s emergence as a leading global power”**.

2. India's role in Indian Ocean

- It mentions plans to **“encourage Indian economic assistance in the region”**, and outlines U.S. support to India’s **“leadership role in Indian Ocean security and throughout the broader region”** as a priority.

3. Critical of China's sovereignty violations

- Mr. Trump’s views of **China’s assault on the “sovereignty” of South Asian nations and of Pakistan’s continued support to terror groups** are closely aligned with India’s concerns in the neighbourhood.

4. Encourage Central Asia and South Asia economic linkage

- NSS **seeks to promote South Asian and Central Asian economic linkages, connectivity and trade**. But it remains to be seen if the US can persuade Islamabad to lift its blockade of India.

5. Critical of Pakistan terrorism

- US says it is seeking a Pakistan that “is not engaged in destabilising behaviour” and defines the principal US goal as the need to prevent terrorist threats that impact the security of the US homeland and of its allies.
- It also seeks to prevent “cross border terrorism that raises the prospect of military and nuclear tensions” and in line with this, it declares that “an Indo-Pakistan military conflict that could lead to nuclear exchange remains a key concern requiring consistent diplomatic attention.”

Negatives - Manoj Joshi

1. Indian Ocean contours not very specific

- **India is a priority area which deserves support for “its leadership role in Indian Ocean security and throughout the broader region.”**
- **The document notes that the Indo-Pacific “stretches from the west coast of India to the western shores of the US.”**

2. India's role limited to South East Asia and Western Pacific

- **India is seen primarily in terms of the balance of power in relation to South East Asia and the Western Pacific Ocean.**

3. India not given role in Persian Gulf and North Arabian Sea

- But neither in the document, nor otherwise, does the most important external area of Indian concern – the Persian Gulf and the North Arabian Sea – fit into the Indo-US conversation.
- In fact, when it comes to the Middle East, **besides not figuring in US calculations, India may find itself on the wrong side since the NSS goal is to “neutralise Iran’s malign activities in the region.”**

Way forward

- India must be mindful, therefore, that in welcoming the U.S.’s categorisations of its security threats, it **doesn’t unthinkingly get swept into an American clinch.**
- While the **U.S. has talked of countering China’s influence in South Asia, it has not backed this with actual financial assistance for infrastructure** critical to the region.

- Equally, while Mr. Trump’s words on Pakistan and terrorism are sharp, the **U.S. has yet to show its hand, either in terms of military action or withholding of coalition support funds.**

Connecting the Dots

- **US National Security Strategy reinvigorates the world order different from what US has seen it in the past. Examine its consequences on the world at large and India in particular.**
- **India has been a significant partner of USA in the recent times even in the realm of security. In this respect, explain the impact USA National Security Strategy will have on Indian interests.**

Income Inequality

GS 1

- **Poverty and development issues**

GS 3

- **Inclusive growth**

Context

- ***World Inequality Report 2018*** asserts that there has been continuous growth in inequality here since the **mid-1980s**.
- However, inequality in India declined for three and a half decades since 1950 even as the economy grew steadily, though maybe not spectacularly.
- ***Capital in the Twenty-first Century*** by **Thomas Piketty, and his colleague Lucas Chancel** at the World Inequality Lab, Paris School of Economics, have provided the numbers, at least as far as incomes are concerned.
- Their **working paper “Indian Income Inequality, 1922–2014”** is provocatively subtitled **“From British Raj to Billionaire Raj?”**—arousing Indian academic economists from their stupor on such matters, and goading journalists to think aloud.

- **World Bank estimates (2015)**, there has been a **decline in India's poverty rate** but this is cold comfort — **172 million citizens still live below the poverty line and constitute 24.5 per cent of the world's poor.**
- **India's richest one per cent now hold 58 per cent of the nation's wealth**
- **Oxfam report** released this year revealed that **57 billionaires in India own as much as the bottom 70% of the population.**
- Comparison of **inequality in terms of Lorenz ratios at State level based on NSSO 68th round (2011-12) data and 66th round (2009-10) data** indicates that **inequality in rural sector increased in all States/ UTs except for Sikkim, Bihar, Jharkhand, Odisha, Andhra Pradesh, Uttarakhand, Chhattisgarh, Haryana, Madhya Pradesh and Punjab.**
- During this period, in respect of the **urban sector, inequality increased in Manipur, Mizoram, Jammu and Kashmir, Rajasthan, Tamil Nadu, Delhi, Odisha, Chhattisgarh, Arunachal Pradesh, Uttarakhand, Karnataka, Haryana and Kerala**

Inequality in the 21st century

Against democracy

- If a wealthy person does have a particularly strong work ethic, it is likely attributable not just to their genetic predisposition, but also to their upbringing, including whatever privileges, values and opportunities their background may have afforded them.
- So there is no real moral argument for outsize wealth amid widespread poverty.

Against social cohesion

- There is **another dimension to profit-sharing** that has received little attention, related to **monopolies and competition.**
- **With modern digital technology, the returns to scale are so large that it no longer makes sense to demand that, say, 1,000 firms produce versions of the same good, each meeting one-thousandth of total demand.**
- A more efficient approach would have **1,000 firms each creating one part of that good.**
- But a **monopoly of production need not mean a monopoly of income, as long as the shares in each company are widely held.** It is thus time for a radical change, one that **replaces traditional anti-monopoly laws with legislation mandating a wider dispersal of shareholding within each company.**

Arguments by Piketty

Wealth of top 1%

- India has emerged as the country that has recorded the highest increase in the share of the top 1% in national income over the past three decades, from 6.2% in 1982–83 to 21.7% in 2013–14.
- Indeed, the latter figure is the highest level recorded since the establishment of income tax in 1922, overtaking the British Raj's record of the share of the top 1% in national income, which was 20.7% in 1939–40.

Income Growth of Different Groups

- While incomes of the bottom 50% of the adult population (above 20 years) over the period 1980–2014 grew at 89%, and that of the middle 40% (individuals above the median income and below the top 10% earners) by 93%, those of the top 10%, the top 1%, the top 0.1%, the top 0.01%, and the top 0.001% grew at 394%, 750%, 1,138%, 1,834% and 2,726%, respectively.
- Indeed, India has recorded what could be the highest gap between the growth of incomes of the top 1% (a growth rate of 750%) and the growth rate of incomes of the full adult population (187%).

Comparison with China

- And, while the incomes of the bottom 50% grew in China over the period 1980–2014 by 312%, those of the bottom 50% in India grew by only 89%.
- Further, while the growth rate of incomes of the middle 40% over the same period in China was 615%, the corresponding figure for India was just 93%.
- Indeed, the growth of incomes at the very top of the income distribution in India (that of the top 0.001%) was 2,726%; the corresponding figure for China was lower, 2,546%.
- Both China and India have recorded appallingly unequal growth over the last three decades, but in China, even though it is not a democracy in the sense of permitting free expression of public opinion, its growth process over the period 1980–2014 has been relatively much less unequal than India's.
- The bottom 90% of Chinese population captured 56% of the national income growth compared to what India's bottom 90% did, a mere 34%.

India's Middle Class

- Indeed, in India, the middle 40% seems to have benefited the least (as compared to China, France, and the United States) from the total national income growth over this period.
- It is **not India's middle class (the middle 40%), but merely the top 10% of the population (80 million adult individuals in 2014)—“Shining India”—that has inordinately benefited from the growth of national income over the last three decades** (it captured 66% of that growth).

Income from property than work

- As regards the **top 10%, and especially the top 1%**, much of their **income comes from profits from business, dividends and interest from stocks and bonds, rent from land and buildings, and salaries and bonuses deriving from management control in business enterprises**, the latter more like property income rather than income from work.
- Moreover, over the last three decades, it is likely that **real wages have been lowered relative to labour productivity, thus increasing the share of property incomes over incomes from work in value added.**
- And, even within property incomes, the eschewing of antitrust action to reduce monopoly power has concentrated profits in the hands of the big oligopolies to the relative detriment of small businesses.

Monopoly of natural resources

- The **access of big business to undervalued assets of the public sector, of mineral and forest resources, of land, and of the allocation of the spectrum for telecom** should not be forgotten. The larger picture over here is of a **financial aristocracy** lording over a process of corporate-led jobless growth.

Reservations against the paper

Data inappropriate

- The **data is largely derived from tax declarations, which, as one suspects, are often falsified.**

1% income anomaly

- And in the case of the **very rich who control corporations, the distinction between their income as individuals and the income of the enterprises they control is, at least in part, artificial.**
- For instance, **much of their consumption expenses, and the personal ones at that, are passed off as company expenses.**
- What the eminent economist **D R Gadgil wrote in 1949**, that **“tax evasion by the rich may ... have to be taken as a chronic feature of the Indian economic situation”**, is applicable to the whole period, 1922–2014, under consideration.

Counter arguments by Simon Kuznets

Income mobility

- US economists **Simon Kuznets**, when economic growth takes place, at the **disaggregated micro-level, individual economic agents move along the real income scale — a process which he termed as “income mobility”.**
- Now, **income mobility can either be upward or downward** but it is **observed that during phases of rapid economic growth, opportunities for upward mobility far outweigh those for unchanged or downward mobility.**
- Also, **in the presence of income mobility, the identity of individuals at different levels of the income scale changes rapidly over time.**
- In such a scenario, **average inequality indicators cannot reflect the true picture on the ground** and can, therefore, prove to be misleading predictors of the adverse social outcomes of growing inequality.
- The **tolerance level of inequality for the society in times of rapid economic growth may be much higher than what is reflected in inequality statistics as it fails to take income mobility into account.**

Focus needed on the incomes at the bottom than one-on-one comparison

- Another problem with only looking at inequality statistics is the perception of a simplistic one-to-one correspondence between movements in income inequality and equity.
- Rising inequality cannot be equated to a one-on-one fall in equity. Therefore, more focus should be kept on the wealth accruing to the people at the bottom of the ladder to understand the real implications of rising inequality

Rapid growth fuels positive sum game

- A stagnant economy leads to a zero-sum game where economic advancement of others provokes a negative signalling effect of a possible deterioration of one's own economic position. However, in times of rapid economic growth, there arises a positive-sum game where economic improvement of others signals an environment where there is hope for a rise in one's own prosperity in the future.
- contrary to the common perception among individuals and policymakers, rising inequality is not necessarily inequitable, if and when it arises out of rapid economic growth

Countering growing inequality

Case of China

- **World Development Indicators** data released by the **World Bank** show that per capita income in China was five times that of India in 2016 while the percentage of the population living on less than \$1.90 a day was about 10 times less at the beginning of this decade. India has a forbidding gap to traverse in all directions, but for now let us focus on inequality.
- Since 1980, while the Chinese economy has grown 800% and India's a far lower 200%, inequality in China today is considerably lower than in India. The share of the top 1% of the Chinese population is 14% as opposed to the 22% reported for India.
- Inequality actually declined in China from the early 21st century.

Investment in Human Capital

- If there is to be a meta narrative for China's economic development, it is that its leadership combined the drive for growth with the **spreading of human capital**. Human capital is a person's endowment derived from education and robust health.
- The spread of health and education in China enabled the Chinese economy to grow faster than India by exporting manufactures to the rest of the world.
- As the human capital endowment was relatively equal, most people could share in this growth, which accounts for the relative equality of outcomes in China when compared to India.
- An ingredient of this is also the greater participation of women in the workforce of China, an outcome that eludes India.

Way forward for India

- India's full panoply of interventions, invariably justified as being pro-poor, have not only not spread human capital, but they have also not been able to prevent a growing income inequality.
- The focus must be on expanding profit-sharing arrangements, without stifling or centralizing market incentives that are crucial to drive growth.
- A first step would be to **give all of a country's residents the right to a certain share of the economy's profits**
- There is need to spread health and education far more widely amidst the population.

Conclusion

- **Differential rewards do indeed create incentives for people to learn, work and innovate, activities that promote overall growth** and advance poverty reduction.
- It is recognized how unacceptable **severe inequality is, both morally and economically.**
- **The focus must be on expanding profit-sharing arrangements, without stifling or centralizing market incentives that are crucial to drive growth.**
- A first step would be to **give all of a country's residents the right to a certain share of the economy's profits.** But it is particularly vital **today**, as the **share of wages in national income declines, and the share of profits and rents rises**—a trend that technological progress is accelerating.
- Unless we **confront the inequality challenge head on, social cohesion and democracy itself will come under growing threat.**

Connecting the Dots

- **Why has income inequality increased in India in the liberalisation period? Is income inequality a very serious problem?**
- **India has seen more inequality as compared to China since 2000. Analyse why this trend is emerging and the lessons India can learn from China.**

Kashmir Policy

GS 3

- Challenges to internal security due to communication networks
- Border Security

Intro

- India has off-late witnessed a surge in insurgency related incidents in the Kashmir Valley. The military response has been swift and the counter-insurgency campaign has gone full throttle.
- The magnitude of local support for the insurgency has increased tremendously in the last couple of years. Though the authorities have been providing the youth with skill training and vocational opportunities, and engaging the populace through various welfare programs, they view the functional state apparatus only in the gun-toting uniformed men.
- However in September 2017, Home Minister Rajnath Singh spelt out the contours of a plan of engagement in Jammu and Kashmir.
- He said that a permanent solution to the Kashmir problem was based on **five Cs**, which he would define as “**compassion, communication, coexistence, confidence building and consistency**”.
- Also Dineshwar Sharma has been appointed “as the Representative of the Government of India to initiate and carry forward a dialogue with the elected representatives, various organisations and concerned individuals in the State of Jammu and Kashmir”

Lack of Political Outreach

- In Kashmir, the **conflict cycle operates like a sine or cosine wave**; there is always limited time for a congenial environment under which reconciliation efforts can take place.
- The lack of a political initiative that complements the tactical military effort is a consistent feature in India’s handling of the conflict.

1. Compassion

- On the political front as had been indicated at the height of the 2016 summer uprising when he tried to reach out to the separatist camp.

- However, the hard-line approach that advocated and pursued a **security-oriented approach**.

2. Communication

- Communication has been missing.
- The line of communication has been not kept open for all
- By not engaging in a political dialogue with forces such as the All Parties Hurriyat Conference, the Government of India is also giving them an excuse to not do anything.
- Having a line of communication and putting their ability to test would have helped people think about the capacities of the leadership, but that perhaps cannot come without communication that has no precondition.

3. Coexistence

- There is no coexistence on the ground. Particularly in the past few years, the effort has been to isolate the community.
- New Delhi has defeated the idea of Jammu and Kashmir being an “integral part of India” on the ground by not showing any respect for coexistence.
- Use of military power, that too, indiscriminately against the civilian population, putting them under curfew for 54 days at a stretch, and protecting those who commit human rights violations are some of the hard facts that talk about a different existence.

4. Confidence building

- Confidence-building measures have been another casualty. Confidence has been shaken for a long time now.
- **Deploying more and more forces does not help to build confidence**; it dents the very essence of it.
- Confidence comes from measures that are aimed at addressing the concerns that are directly linked to people’s existence, their daily life, and their rights.
- When institutions fail to deliver justice, there can be no hope of confidence building. By treating the people as the “other”, confidence-building measures can become far-fetched and that is how it has played on the ground.
- The finest example of confidence building *vis-a-vis* Kashmir was when former Prime Minister **A.B. Vajpayee** took a giant step by extending a hand of friendship to Pakistan from Srinagar on April 18, 2003. This gesture was followed by opening the roads between the divided Jammu and Kashmir, starting trade exchanges across the Line of Control (LoC) and allowing people on the borders to live peacefully.

5. Consistency

- Consistency is the only requirement in dealing with an issue like Kashmir.
- No matter what happens, **foreign policy has to be consistent.**

Need for Military

- The **security environment within Jammu and Kashmir has largely improved** on account of India's information asymmetry with respect to the militants. Security forces are successfully locating and initiating encounters against militants.

Strategical advantage for Pakistan due to Kashmir

- It is a **reasonable expectation that J&K could turn restive at the onset of war. Pakistan has not sustained the insurgency in Kashmir out of a sense of affinity with Kashmiris alone.** Its military overlords have national security and the military's institutional interests at heart.
- **Operationally, they wish to undercut India's conventional military advantage prior to its application on the western front.**
- **Keeping rear areas insecure helps in interdicting and disrupting the Indian forces en route to the frontline.**
- An example is Pakistan's choice **in the late 1990s of the Hill Kaka area in Surankote tehsil as a base for terrorism.**
- Not only would the terrorist base **prove useful for disrupting India's defences in Poonch sector from the rear, but would also help sustain the insurgency across the Pir Panjal range in the Kashmir Valley.** The base was finally evicted in a division-level operation, **Operation Sarp Vinash (2003),** on the heels of **Operation Parakram (2001–02).**

Afghanistan Factor

- This makes clear the background to the appointment as not rooted so much in a conflict resolution initiative regarding India's leading internal security challenge, as much as in the regional security situation, energised by US President Donald **Trump's Afghanistan policy** speech of 21 August 2017.
- Keeping its interests at heart in Afghanistan, the **US has expressed its keenness on occasion to intervene in the India–Pakistan stand-off that Pakistan, leveraging its strategic location,** regularly urged.

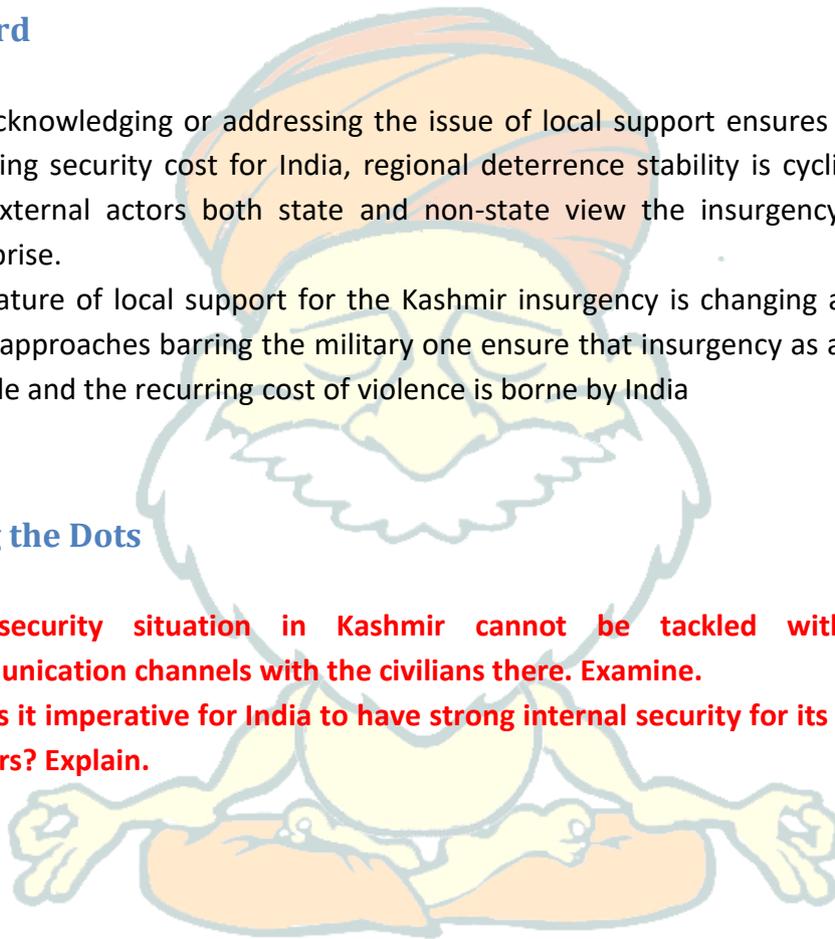
- While **India had in 2009 decisively rebuffed Richard Holbrooke, US Special Representative to Afghanistan and Pakistan (Af-Pak)**, the new US administration in its settling-down stage had revisited the notion.
- The Pakistanis, being past masters at manipulating the US, will, to their advantage, allow transit of US and North Atlantic Treaty Organization (NATO) logistic lines through Pakistan, demanding that the US lean on India over the Kashmir issue in return.
- Apprehending this, India appears to have scrambled to put together a dialogue process of sorts in Kashmir.

Way forward

- Not acknowledging or addressing the issue of local support ensures that there is a recurring security cost for India, regional deterrence stability is cyclically impacted and external actors both state and non-state view the insurgency as a feasible enterprise.
- The nature of local support for the Kashmir insurgency is changing and the lack of other approaches barring the military one ensure that insurgency as an enterprise is feasible and the recurring cost of violence is borne by India

Connecting the Dots

- **The security situation in Kashmir cannot be tackled without opening communication channels with the civilians there. Examine.**
- **Why is it imperative for India to have strong internal security for its security of the borders? Explain.**



Problems of Indian Diaspora

GS 2

- Indian Diaspora

Intro

- In 2016, 5.07 lakh workers landed in countries in West Asia; in 2015 the number was almost **7.6 lakh** took the **emigration clearance required (ECR) route**.
- The ECR stamp means that the labourer is legal, but **thousands more end up on tourist visas and work in the 18 West Asian countries**.

Problems

Poor working conditions

- Most labourers end up in harsh work environments, many land in jails, some die and others are tortured. Despite these distressing stories, many still flock to West Asia in search of a better future.

Insensitive legal structure

- In the last three years, the Government of India filed 182 mercy petitions across the world. The fact that just two countries—the United Arab Emirates (74) and Oman (57)—accounted for the lion's share of these petitions tells a story that is unmistakable: one of intolerant regimes and barely human legal processes.
- Legal structures are weak for domestic workers, construction labour and fishermen in the GCC countries. As a result, it is common to come across instances of passports of workers being impounded and kept with the licence holder or contractor, poor pay for long hours of work, and near-zero access to legal services.
- Besides, the conduct of court proceedings is in Arabic, a language alien to most workers from outside the region.

International Efforts

- Although the **Abu Dhabi dialogue** was the first multilateral forum to broach the subject, this positive factor was largely undone by the mechanism it put in place: it

decided to have country-specific negotiations instead of specific and clear-cut goals for each of the worker-recipient countries to work towards.

Steps Taken by Indian Government

MoUs with countries

- India has memoranda of understanding (**MoUs**) in place on workers with many of **these countries** but none of these addresses the burning issues that are constantly highlighted by the continuing abuse and exploitation of Indian migrant workers.

e-migrate

- The government endeavour is to see that all persons who are going abroad—broadly **in the ECR category**—come through **e-Migrate**
- There is a need to do more **to regulate the unscrupulous travel agents** who take people for a ride

Other measures by the Indian Mission

- The Mission provides **free legal counselling** at the **Indian Workers Resource Centre** to Indians in need. It also gets consular access from the local authorities to meet Indian inmates in Abu Dhabi jails.
- It has a provision for legal assistance **through the Indian Community Welfare Fund** to Indians in most deserving cases.

Connecting the Dots

- **Explain the nature of problems faced by Indian diaspora in the Gulf countries. What steps should be taken to tackle them?**

'Editing' out Faulty Gene Responsible for Hearing Loss

GS 3

- **Biotechnology**

In news

- Researchers have, for the first time, found a way to “edit” out the faulty gene that causes progressive hearing loss, using a promising gene-editing technology called CRISPR-Cas9.
- It is also called molecular scissors because the enzyme Cas9 has the ability to snip strands of the DNA double helix, which can ultimately disable a gene.
- The findings are clinically significant as genetic factors are responsible for nearly half of all deafness cases. The scientists are not sure whether it would work in humans.

Mechanism of Editing Gene

- Scientists designed a lipid-encapsulated Cas9–guide RNA complex that can specifically target a deafness-causing genetic mutation in a mouse model of human deafness.
- Molecular scissors can disrupt the mutant version of a gene called Tmc1, which is important for the growth of inner ear’s hair cells, which help detect sound. A single spelling error in this gene can trigger progressive hearing loss in humans as well as in mice.
- A single treatment involving injection of the genome-editing complex can prevent hearing loss in young animals.
- One of the challenges encountered by the scientists was directing Cas9 to target only the bad copy of Tmc1, and not the good one. This can be tricky because the two copies differ by just one DNA letter. But the scientists managed to do so by using an RNA guide to lead Cas9 to the mutant copy of the gene.

Next-gen Displays

GS 3

- **Nanotechnology**

- Researchers at the Indian Institute of Science (IISc) in Bengaluru have created a **novel hybrid of two remarkable materials called graphene and quantum dots** in a breakthrough that **may inspire highly efficient and controllable next-generation displays and LEDs.**

Quantum Dots

- Quantum dots are **semiconductor nanocrystals** with the potential to revolutionise diverse technologies, from photovoltaics and medical imaging to quantum computing.
- They can **absorb ultraviolet (UV) light and produce sharp, bright colours, making them especially attractive for TVs, smartphones and LEDs.** They are **extremely tiny particles with properties vastly superior to conventional semiconductors.**
- When activated by UV light, they can produce visible light in different colours depending on their size. Small dots produce blue light, for example, while large ones radiate red.
- Quantum dots **absorb light very well, but they are poor electrical conductors;** quantum dot-based devices that convert light to electricity are, therefore, not very efficient.

Graphene

- Graphene, on the other hand, is **almost transparent to light, but it is an excellent electrical conductor.**

Hybrid of Quantum dots and Graphene

- When the two are combined, graphene could, **in principle, quickly pull the absorbed energy away from quantum dots—cutting down energy loss—and convert it to an electrical signal.**
- This makes it possible to **create devices such as photodetectors with extremely high efficiency.**

- Adding graphene would also confer the ability to tinker with the output even after fabrication, or turn the device on and off at will.
- **Although the combination works well for photodetectors and sensors, it is practically useless for displays and LEDs because quantum dots lose their ability to emit light when fused with graphene.**
- By modifying some experimental conditions, the IISc scientists have found a way to eliminate this effect and create a highly efficient and tunable hybrid material.

Turning Plants into Lamps

GS 3

- **Nanotechnology**
- **Biotechnology**

- After designing plants that can detect explosives and give out an early warning of an impending water shortage, a research team at Massachusetts Institute of Technology (MIT) in the United States has found a way to **create plants that glow.**
- Scientists **embedded nanoparticles into the leaves of an edible aquatic watercress plant to make them glow**, just enough to give off dim light for four hours.
- Their goal is to make a plant that will function as a desk lamp—a lamp that does not need to be plugged in. The light is ultimately powered by the energy metabolism of the plant itself.
- The technology could be harnessed to **provide low-intensity indoor lighting or transform trees into self-powered street lights.**

How plants will emit light?

- To create their glowing plants, the team turned to **luciferase, the enzyme that gives fireflies their glow.**
- **Luciferase acts on a molecule called luciferin, causing it to emit light.**
- **Another molecule called “co-enzyme A” helps the process along by removing a reaction byproduct that can inhibit luciferase activity.**
- The scientists **packaged each of these three components into a different type of nanoparticle carrier.** The nanoparticles would help each component get to the right part of the plant.
- They also prevent the components from reaching concentrations that could be toxic to the plants.

Other Studies from the same Team

- The same laboratory has been doing some pioneering work in the area known as plant **Nano bionics**.
- Last year, they turned spinach plants into detectors that can detect landmines and other explosives.
- Last month, another study from them reported how ultra tiny sensors can be printed onto leaves so that they can warn of a water shortage, helping farmers find a way to ensure judicious use of water in farming.

Best Wishes!

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