**1. Examine the distorting impact of agricultural subsidies. What reforms are needed to streamline the subsidy regime in India? Discuss.**

**Approach:**

Question is straight forward in its approach students are expected to explain the distorting impact if agricultural subsidies in India with proper examples also explain how to streamline the subsidy regime to lower the burden on exchequer and then arrive at a well balanced, logical and forward looking conclusion.

**Introduction:**

Agriculture in India is the most important segment of the economy. Growth of Agricultural sector is crucial for Indian economy as it employs two-third of its population and contributes nearly one-third of national income. However its importance in the economic, social and political fabric of India goes well beyond what is indicated by its contribution to the economy. The large number of poor agricultural households and their income vulnerability are major concern among policy makers. These concerns have driven both agricultural policies and public expenditures in agriculture in India as well as in other part of the globe. Agriculture is also one of the major sources of export earnings of our country and is crucial for improving the balance of payments. In recent years, the export of agricultural and allied products accounted for about one-fifth of total export earnings of India. India's share of agricultural export has remained very low in many commodities despite inherent strength of Indian agriculture with the exception of few commodities.

**Body:**

Introduction of the High Yielding Varieties (HYV) seeds programme in the 1960s demanded a high priority to supplying irrigation water and fertilisers to the farmers, the government tried to ensure that they were accessible and affordable. Subsidy on fertilisers is provided by the Central government whereas subsidy on water is provided by the State governments. Government gives different types of subsidies to farmers like, fertilizer, irrigation, equipment, credit subsidy, seed subsidy, export subsidy etc.

**Distorting impact-**

- Subsidies directed by the United States government, particularly to corn farmers, can have a spill over affect in developing countries like India. Subsidies granted to the farmers of developed countries are way higher than that given to Indian farmers, thus it can cause distortion to the domestic market of domestic markets as well.
- Fertilizers subsidy, as an input for agriculture production, is responsible for rampant use of fertilizers, commonly the triad NPK, in India. This acts as a barrier for entry to the developed market like European Union who held that India’s agricultural products are not up to the mark of WTO’s phytosanitary measures.

- While the developing countries like India and China are not in an affordable position to breach the de-minimus level of Aggregate measures of support(AMS), developed countries like US provides subsidies exceeding 50% in some products such as Canola, cotton, sugar and more than 200% for wool.
- Most benefits of subsidies are allotted to big farmers while In India, 2/3 rd farmers are marginal farmers which can't utilize the benefit of subsidy properly. Thus the value of produce of such farmers decrease.
- It leads to overproduction of one crop(grains) over other(like fruit, pulses). Thus sometimes grains are piled up for rotting in warehouse. Also in market, the trade of such cereals take place on the expanse of other non- subsidised products.
- Groundwater is the dominant source of irrigation and it has expanded rapidly since the 1970s. Since electricity is used to pump water from underground aquifers, electricity use in agriculture and the number of electrified pumpsets have also increased rapidly. In 1979/80, the number of electrified pumpsets was a little less than 4 million. By 2017/18, the number had jumped to more than 21 million. The share of agriculture in electricity supply was negligible in the early 1970s. The low and flat tariff structure of agricultural electricity supply is a plausible reason for excessive groundwater extraction although it is not probably the only or even the major factor. Other reasons such as price support policies that make water-intensive crops attractive.
- Agricultural Finance: Farmers are entitled to pre- harvest loan at 7% interest rate.They are allowed further 3% subvention in case of timely payment. Farmers can also take loan for post-harvest time against negotiable warehouse receipt. Economic survey notes three discrepancies in this subsidy. One, trend indicates that amount for a single loan is increasing for most of these subsidized loans. This means that more subsidies is going in favor of rich farmers. Two, extension of subsidized credit is concentrated in last three months of the financial year, which indicates that reluctant banks otherwise unable to meet priority sector lending targets, desperately disburse loans to reach target at the end only. It is unlikely that this way credit will reach to desirable party. Third, agriculture credit is getting concentrated on peripheries of urban areas, which means that money is being diverted to nonagricultural use.

**Reforms to streamline subsidy regime in India-**

- Pursuing Cooperative Federalism: Agriculture is a State subject in the Constitution, listed as Entry 14 in the State List (List II). Apart from this, entry 26 in List II refers to "trade and commerce within the State"; entry 27 refers to "production, supply and distribution of goods"; and entry 28 refers to "markets and fairs" For these reasons, intra-State marketing in agriculture was always considered a legislative prerogative of States. Therefore, any reform pertaining to agriculture and farmer's income must come up after consultation with the states.
- Changing the Pricing Mix: Government must come up with a suitable transition to agricultural pricing policy, whereby partial agricultural pricing

should be state-supported and partially market-driven. One way to do this, could be a deficiency payments scheme along the lines of the Bhavantar Bhugtan Yojana (BBY) initiated by Madhya Pradesh. In this scheme, the government rather than procuring from farmers, compensates farmers with cash transfers when the market price falls below MSP.

- Strengthening FPO: With the changes brought the recent farm legislation, it is expected that many companies will be encouraged to build efficient supply lines somewhat on the lines of milk. However, there is a genuine demand for protection of farmers from ruthless market orientation for Profit. Thus, there is a need for strengthening of Farmers Producer Organisations (FPOs), this will increase bargaining power of farmers on one hand and provide a suitable investment climate on the other.
- Direct Benefit Transfer (DBT) in Fertilizers: DBT scheme can bring benefits to the farmer on various fronts; choice of improved products at competitive rates, gain from enhanced extension services from the industry on best practices leading to "sustainable and responsible" agriculture production, and better earnings for such produce.
- Enabling Last-Mile Connectivity: Affordable and workable" last mile" technologies can enable the Government to set up the required framework for disbursal, which in turn will allow for focused targeting of subsidy based on land, crop, soil health and other geographical factors. In order to address the imbalance in the fertilizer use, urea has to come under NBS.

**Conclusion:**

Agriculture lies at the backbone of Indian economy. Therefore, more sustainable solutions lie in augmenting productivity, diversifying to high-value crops, and shifting people out of agriculture to the high productivity sector. Subsidies are meant for poor people and they shall ensure equitable redistribution of resource. Subsidies extended to rich are regressive. They help in keeping poverty intact and create inefficiencies in economy which culminates in inflation and corruption. In such case economy is retarded as we have seen in India's case. When India grew in first decade of millennium at average rate of 7.5% it was found that this growth was jobless and unsustainable. India's economy faced supply side constraints, which didn't increase productivity as compared to GDP. RBI had to then control spiraling inflation by steep hikes in interest rates. Rationalization of subsidy regime will improve markets in India which will then attract more investment. This in short, can turn the wheel of a virtuous economy which creates more employment and attacks poverty at its roots.

**2. What role does IT play in agricultural growth? Discuss with the help of suitable examples. What can be the next possible frontiers for IT in the field of agriculture? Examine.**

**Approach**

Candidates are expected to write about Information technology as potential tool for agriculture and how application of IT will play a role in agriculture growth with suitable examples. Also highlight on few next possible IT enabled technology which can enhance the field of agronomy and increase the productivity of agriculture.

**Introduction**

Information technology and agriculture, both were considered incongruous to each other a decade ago, but now the scenario has changed. Today, information system is being widely incorporated with agriculture. Information technology always had the potential to increase the quality of farming and farming products. The WTO has recently made a laudable effort in promoting the information technology as an integral part of farming sector around the world.

**Body**

Role of IT in agriculture growth:

- E-Agriculture is a new area of knowledge emerging out of convergence of IT and farming techniques. It enhances the agricultural value chain through the application of Internet and related technologies. Basically IT helps farmers to have better access to information which increases the productivity. It also enables get better prices through information of change in price in different markets.
- Soil Management, Water Management, Seed Management, Fertiliser Management, Pest Management, Harvest Management and Post-Harvest Management are the important components of e-Agriculture where information technology aids farmers with better information and alternatives.
- The E-Agriculture is part of Mission Mode Project, which has been included in NeGP (under National E-governance Plan) in an effort to consolidate the various learnings from the past, integrate all the diverse and disparate efforts currently underway, and upscale them to cover the entire country.
- For example it uses a host of technologies like Remote Sensing, Computer Simulation, Assessment of speed and direction of Wind, Soil quality assays, Crop Yield predictions and Marketing using IT.
- Mobile is playing a big role in monitoring and controlling crop irrigation systems. With the right equipment a farmer can control his irrigation systems from a phone or computer instead of driving to each field.
- Moisture sensors in the ground are able to communicate information about the level of the moisture present at the certain depth of the soil. GPS enabled

services are helping in field documentation about yield, moisture, maps for field drainage, etc.

- Site specific crop management (SSCM) i.e precision agriculture is a farming management concept. This technique focuses on utilising resources optimally to improve the quality and quantity of crops while lowering the cost of production.
- For example Uzhavan app, Ag mobile, CCMobile app, IFFCO Kisan are some of the applications developed keeping in mind the need of the hour requirements in farming. Several notable initiatives like e-choupal, Agri market, Kisan Suvidha and the more recent e-NAM had long been trying to place agriculture as the forerunner.

IT has the potential to transform agriculture into a better prospect in the wake of climate change and decrease in the cultivable land let us examine next possible frontiers for IT in the field of agriculture:

- Computer-controlled devices or automated systems. For example, automated milking systems that milk the dairy cattle without human labor. This way, farmers can save time for supervisory duties.
- RFID (Radio-frequency identification) allows easier identification and provides to data, such as bearer's location, name of breeder, origin of livestock, sex, and dates of movement. Also, RFID technology will provide improvements in controlling disease outbreaks in livestock.
- Digital Mandi App helps to check the latest Indian agricultural commodities mandi price from different states and districts. It simplify for farmers, traders and for every Indian citizen to know the mandi and trade.
- IMD and ICAR in collaboration with the different institutions like agricultural universities, there inter-institutional collaboration could be further strengthened in the field of agro-meteorological activities.
- National Mission on Agricultural Extension and Technology (NMAET) aims to plan interactive methods, using information and communication technology (ICT), which includes messaging services, web-based applications, capacity building, institutional strengthening, encouragement of public-private partnership and training services to guide farmers.
- With the new extension of ITC initiatives like Krishivihar, i-Kisan,e-kutir, e-Sagoo, ICT models- AGROWEB, Agropedia, AgrInnovate, etc. Indian agriculture has come to a long way and established several records in terms of production and productivity.

Challenges in India for adopting IT initiatives:

- In rural areas, insufficient connectivity, along with lack of basic computer knowledge, high costs for services and literacy hinder rapid development of electronic-agriculture.
- Despite the visible benefits of the new agricultural technologies, farmers either do not adopt them or it takes a long time for them to begin the adoption process and scaling up.
- Rich farmers are adopting the technology and utilizing their services but the small and marginal farmers are unable to afford the new technologies and they remain left out.

**Conclusion**

ICTs are changing all the spheres of human lives and agriculture cannot be an exception. It may act as an agent for changing agrarian and farmer's life by improving access of information, linking farmer with big markets, consumers and sharing knowledge. However, these technologies are pretty expensive, thus, government should strive to make it affordable and accessible with targeting digital divide so that farmers feel empowered and can adopt for substantial upliftment and sustainable development.

**3. What do you understand by buffer stock? What are the policies related to the maintenance of buffer stocks in India? Discuss.**

**Approach**

The candidate needs to address the question in two parts where the first part explains the concept of buffer stock and the second part discusses the policies related to the maintenance of buffer stocks in India.

**Introduction**

Buffer stock refers to a reserve of a commodity that is used to offset price fluctuations and unforeseen emergencies. Buffer stock is generally maintained for essential commodities and necessities like food grains, pulses etc. In context of Indian agriculture, it is the minimum food grains the Centre should have in the Central pool at the beginning of each quarter to meet requirement of public distribution system and other government schemes related to food grains.

**Body**

- State-run Food Corporation of India (FCI) is the responsible agency to maintain buffer stock limits in India. As per recent reports, FCI held food grain stock that is 2.7 times more than the required norms as on January 1 2021.
- The concept of buffer stock was first introduced during the 4$^{th}$ Five Year Plan (1969-74). Buffer stock of food grains in the Central Pool is maintained by the Government of India (GOI) / Central Government for –

1) Meeting the prescribed minimum buffer stock norms for food security,
2) Monthly release of food grains for supply through Targeted Public Distribution System (TPDS) and Other Welfare Schemes (OWS),
3) Meeting emergency situations arising out of unexpected crop failure, natural disasters, etc., and
4) Price stabilisation or market intervention to augment supply so as to help moderate the open market prices.

- The Cabinet Committee on Economic Affairs fixes the minimum buffer norms on quarterly basis: i.e. as on 1st April, 1st July, 1st October and 1st January of every financial year.
- At present, GoI prefers to use the term - Food grain stocking norms - which refers to the level of stock in the Central Pool that is sufficient to meet the operational requirement of food grains and exigencies at any point of time. Earlier this concept was termed as Buffer Norms and Strategic Reserve.
- The current buffer norms were reviewed in January 2015. According to the new norms, the central pool should have 41.1 million tonnes of rice and wheat on July 1 and 30.7 million tonnes on October 1 every year. These limits were 32 million tonnes and 21 million tonnes earlier.

- Main drivers for increased buffer stocks were increased off take from the targeted public distribution system and also enactment of National Food Security Act. But then it also needs to maintain an excessive, incontrollable and monetarily troublesome food inventory.
- Previously, once the buffer norms were met, cabinet approval was needed to sell any part of it in the open market. But in January 2015, it is revised. The current policy is that Food Ministry is authorized to dispose the surplus stock into open market without seeking cabinet approval.
- This was a major policy decision and it was needed to resolve the problem of burdensome inventories at Food Corporation of India and misrepresentation created in market.
- The maintenance of a buffer stock is also important to ensure national food security. Stocks mainly of rice and wheat are commonly maintained from year to year at a substantial cost in order to effectively take care of variations in domestic food grain production.
- The buffer stock policy helped India in COVID times where the government had decided to give three months' ration in advance free, plus one kg of pulses per family. This helped in combating the menace of hunger during the pandemic induced lockdown.

**Way Forward –**

- Incorporating the recommendation of Shanta Kumar High Level committee to improve the operational efficiency and financial management of FCI.
- The coronavirus crisis has shown how digital technologies can make supply chains functional and resilient. New technologies could facilitate the supply-demand interface, which would greatly help perishable goods.
- Supportive actions for e-commerce and delivery companies will strengthen agro-supply chains. Governments can also initiate mobile procurement of crops with the help of the National Agricultural Cooperative Marketing Federation of India (NAFED).
- Access to farm machinery can be improved by making the inventory available at block or sub-district levels. The launch of Kisan Rath app is proving to be a boon; 1.5 lakh farmers and traders have already registered to avail the app's services.
- Further, Ashok Gulati suggests that a cash pay-out would still be been a better option than a grain pay-out, which is also seconded by NITI Aayog.

## Conclusion

There is a need for evaluation and rationalisation of buffer stock management policy so as to reduce the burden on the central and state exchequers and to promote efficiency in the system. Involving private players in the same will create greater competition, promote the desired efficiency and growth in the ecosystem, which is the ideal also sought through the recent farm acts.

**4. What are the factors responsible for regional variations in food and nutritional security in India? Examine.**

**Approach**

Candidates are expected to write about what is food and nutritional security in introduction and then in body part shortly address the current situation in India and examine the factors responsible for regional variation in the food and nutritional security in India.

**Introduction**

Food and nutrition security exists when all people at all times have physical, social and economic access to food, which is consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life.

**Body**

Food and nutritional security in India:

- Despite historically high levels of food production in India, undernutrition and micronutrient deficiencies persist. At present, 22.5 percent of adults are underweight, and 38 percent are still stunted.
- While undernutrition persists, based on the latest data from the National Family Health Survey-4, more than 20 percent of Indians are overweight or obese. India joins many other countries in grappling with the double burden of malnutrition. Overweight and obesity rates have doubled over the past decade in all Indian states, registering rapid growth in both rural and urban areas.
- India ranked 94 among 107 countries in the Global Hunger Index 2020 and is in the 'serious' hunger category with a score of 27.2, India's rank was 102 out of 117 countries last year.
- The economic disruption caused by pandemic & the lockdown is still unfolding. Supply chains are disrupted especially the ones related to food for example children out of school who were previously benefited from mid day meal scheme.

Factors responsible for regional variations in food and nutritional security in India:

- India exhibits considerable heterogeneity in geography, climate, infrastructure, production structure and socio-cultural development; and inter-state variation in income growth due to significant differences in such structural characteristics across states intensify the regional differences in food and nutritional security.
- Despite its success, the Green Revolution is often criticised for being focused on two cereals, wheat and rice which impacts nutritional diversity being

confined to a few resource abundant regions in the northwestern and southern parts of the country.

- The Green Revolution was followed by the White Revolution, which was initiated by Operation Flood during the 1970s and 1980s was mainly revolutionised in western part of few Indian states.
- Lack of coherent food and nutrition policies in few states. Deserving beneficiaries of the subsidy are excluded on the basis of non-ownership of below poverty line (BPL) status, as the criterion for identifying a household as BPL is arbitrary and varies from state to state. Besides this, low quality of grains and the poor service at PDS shops has further added to the problem.
- Food security adversely affected with availability and expansion of irrigation facilities, improvement in agricultural technology and overall food grain output.
- Climate change too, has an impact on the agricultural productivity, which affects the availability of food items and thus, food security. Major impact of climate change is on rain fed crops growing region other than wheat and rice growing region.
- Agro-climatic diversity with rain shadow region and influence of climate variability on yields at regional scales affects the food and nutritional security. And a complex interplay among rainfall, temperature and cropping choices, with a drought-prone region in India impacts vastly on food security.
- Tribal communities in tribal part of India due to there habitation in remote difficult terrains and practice of subsistence farming has caused significant economic backwardness and food insecurity that led to malnutrition among the tribals children.
- The emergence of rural origin pockets in the urban region has resulted in a number of slum settlements characterised by inadequate water and sanitation facilities, insufficient housing and increased food insecurity.
- Ironically, around 50 % of the urban slums are not notified and thus are deprived of the government schemes. People from these un-notified slums have to buy their food from the common market at the competitive price and are devoid of the subsidised food made available through Public Distribution System (PDS).

Measures to be Taken to Ensure Food and nutritional security:

- Improved inputs like irrigation facilities, availability of better quality seeds, fertilisers and credits at lower interest rates. Also focus mainly on rationale distribution of cultivable land, improving the size of the farms.
- Higher profitability and stability in production highlight the importance of crop diversification, e.g. legumes alternative with rice and wheat. Growing of non-cereal crops such as oilseeds, fruits and vegetables etc need to be encouraged.
- Working towards Blue Revolution Sea, lakes and rivers can be used to provide food and nutrition. Fish are a very good source of protein and do not require good soil.
- Existing direct nutrition programmes should be revamped to enable management by women's Self Help Groups (SHGs) and /or local bodies along

with orientation and training of community health workers, Panchayati Raj Institution (PRI) members, other opinion leaders, caregivers and other stakeholders can be another area.

## Conclusion

The right to food is a well established principle of international human rights law. It has evolved to include an obligation for state parties to respect, protect, and fulfil their citizens' right to food security. India needs to adopt a policy that brings together diverse issues such as inequality, food diversity, indigenous rights and environmental justice to ensure sustainable food and nutritional security.

**5. How do cycles of inflation affect the common farmers in India? Illustrate. What strategies would you suggest to protect farmers from price fluctuations?**

**Approach-** Candidate is required to outline the factors responsible for inflation and its subsequent effects on farmers. In the second part, strategies can be given for balancing price volatility.

**Introduction**

India is experiencing high rate of economic growth in the last two decades but the growth has been coupled with high rate of food price inflation. The growth has been very uneven across sectors with agriculture remaining very sluggish.

**Body**

How inflation hits income of farmers?

- Inflation raises prices for farm inputs as well as farm products, resulting in uncertain effects on the current net incomes of farmers. Inflation may benefit people with flexible money incomes but not those whose money incomes are fixed.
- Farmers have flexible money incomes. Therefore, theoretically at least, they should benefit from an unanticipated increase in the rate of inflation. Empirical studies however, have not found this connection, the NCAER study said.
- As inflation increases, prices paid by farmers for various inputs increase faster than the prices they receive for their products, thereby the terms of trade for farmers deteriorate as the rate of inflation rises.
- On the other hand, higher marketing margins due to imperfections in the agricultural markets, stirred up by higher wages and various other marketing costs, reduce the demand for farm output at the farm level.
- These opposing forces suggest that the net impact of inflation in the national economy on prices received by farmers is small in comparison to the impact on prices paid.
- Also the inflation targeting in India has adverse effect on food prices. Since food items have a large weight in the consumer price index, any effective strategy of inflation containment seeks to keep food prices low. This is sought to be achieved through measures that keep farm-gate prices low.
- The fear of inflation rising to an arbitrarily set number is used as a justification to implement austerity.
- These penalize the agricultural sector by leading to a reduction in subsidies and a decline in investment, both of which contribute to raising input costs. The real cost of inflation-targeting is therefore borne by farmers, who are deprived of remunerative prices.
- The low current income from farming motivates farmers to seek higher support prices and to extend price support policies to more commodities. Such policies result in further higher prices and higher rates of inflation.

- The high input prices lead farmers to take recourse to more credit, especially non-institutional credit for their farm operations which ultimately leads farmers into a debt-trap, the study said.

What can be done?

- India could wipe out $49 billion from its GDP if global food prices double, says new research by the United Nations Environment Programme (UNEP) and the Global Footprint Network.
- The next global food shock will be created by the lethal combination of rising consumer demand and fluctuating supply, thanks to climate change, water scarcity and environmental degradation. And it will likely result in India's GDP dropping 2.4%, the consumer price index (CPI) rising 13.8% and the sovereign credit rating plummeting by three notches.
- There is need to ensure that the government lets farmers benefit from the free play of markets. In other words, when prices rise, let farmers benefit from it instead of, say, arbitrarily imposing an export ban or allowing cheaper imports to cushion the blow on consumers.
- the need to create supporting infrastructure that allows farmers to avoid making distress sales. Adequate and efficient warehousing can be a game-changer.
- By not letting greater free play of the market degenerate into an unregulated and exploitative regime. Let there be structures that provide timely regulation of trade outside mandis and allow for effective grievance redressal mechanisms will benefit farmers.
- More needs to be done with regard to contain impact of climate change on agriculture. With more investments and robust infrastructure this can be achieved to gain most of the benefits for farmers.

## Conclusion

The new farm reform laws and optimum inflation targeting will be in favour of farmers and will act against the price volatility. India is one of the worst performer on global hunger index, so we need to feed billion mouths and at the same time, we have to ensure that the annadata gets maximum benefits and not adversely affected.

**6. Examine the ways through which food is made accessible and affordable to the masses in India? What are the challenges in this regard? Discuss.**

**Approach**

As the derivative is discuss so it necessitates a debate where reasoning is backed up with evidence to make a case for and against an argument and finally arriving at a conclusion.

**Introduction**

India has been ranked 94th in a list of 107 countries on the Global Hunger Index, released a fortnight ago. It's behind Nepal (73rd), Bangladesh (75th) and Pakistan(88th). But food production has not been a problem in India. The problem is economic access (whether people can afford food) and physical access (whether it is reaching them).

**Body**

**THE WAYS THROUGH WHICH FOOD IS MADE ACCESSIBLE AND AFFORDABLE TO THE MASSES IN INDIA**

- In India, food and nutrition security for the poor deserves special attention, particularly amidst the COVID-19 pandemic.
- Companies in India play an important role in ensuring the accessibility and affordability of healthy products; for example, by not increasing the price of healthier products despite the economic shocks of COVID-19.
- Most people in India depend on markets for food acquisition, especially among the poorest wealth quintiles, for whom landlessness is common and farm sizes are small, making these households 'net consumers' of food.
- A wide range of policies – including input subsidies, public food distribution and price controls have increasingly tried to address food and nutrition insecurity through reforms to food and nutrition assistance programs and social protection schemes - such as the Midday Meals Scheme in government and government-aided schools and the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) that guarantees 100 days of employment per year to every rural household.
- However, whether India's food system is delivering adequate affordable and nutritious foods has remained understudied.

**THE CHALLENGES IN THIS REGARD**

- Supply chain disruptions can cause food price rises, increasing the overall cost of nutritious foods, making a healthy and diverse diet less affordable.

- Without policies that promote access to and availability of nutrient-rich foods, much of the country is left with diets high in either nutrient-poor grains or fattening processed foods.
- In India, for decades, the Minimum Support Price and public procurement policies have ignored the diversity of crops and skewed in favour of staples such as rice and wheat. The enhanced production of these food crops might have taken care of the calorie requirements, but the double burden of under-nutrition and micro-nutrient deficiency has risen further.
- Diets are highly inaccessible and unaffordable, especially for women hence greater focus is needed on enhancing inaccessibility and affordability of nutritious food groups.

**Conclusion**

Achieving nutritional security in India requires a much more holistic focus on improving the affordability of the full range of nutritious food groups (not just cereals), a reappraisal of social protection schemes in light of the cost of more complete nutrition, ensuring that economic growth results in sustained income growth for the poor, and more timely and transparent monitoring of food prices, incomes and dietary costs. Post-COVID-19 pandemic is the right time to seize the opportunity and push policies that promote nutritious and sustainable food systems and value chains and create adequate demand for healthy, nutritious, qualitative and safe food, through consumer behaviour change.

**7. How is rural society integrated with the livestock economy in India? Explain with the help of suitable examples.**

**Approach:**

Question is straight forward in its approach students are expected to explain the above question with the use of examples to explain the points properly.

**Introduction:**

Livestock sector contributes around 28% to agriculture GDP of the country which is more than food grains and 5% to overall GDP. India has world's largest no of buffalo and second largest no of cattle and goats. About 20.5 million people depend upon livestock for their livelihood. It also provides employment to about 8.8 % of the population in India. Livestock plays an important role in Indian economy. India has vast livestock resources. Livestock sector contributes 4.11% GDP and 25.6% of total Agriculture GDP.

**Body:**

**HOW IS RURAL SOCIETY INTEGRATED WITH THE LIVESTOCK ECONOMY IN INDIA**

- Livestock contributing 16% to the income of small farm households as against an average of 14% for all rural households, livestock provides livelihood to two-third of rural community. It plays crucial role in rural development as gives additional income, living banks for rural families and is also crucial in benefitting the women, illiterate and unskilled people of rural society.
- The rural women play a significant role in the rearing of livestock and are responsible for most of the operations relating to feeding, breeding, management and health care of the livestock. The rapidly increasing demand for livestock products creates opportunities for the empowerment of women.
- when 90% farmers are small and marginal, livestock as an allied activity assumes important role to provide livelihood in rural areas and drive Indian economy towards development.
- Livestock improves food and nutritional security by providing nutrient rich food products, generate income and employment and act as a cushion against crop failure, provide draught power and manure inputs to the crop subsector and contribute to foreign exchange through exports
- Diversification of income and employment portfolio is crucial for sustainable rural livelihoods. Livestock sector can play an important role in poverty alleviation, income enhancement and risk reduction for poor rural households.
- Livestock is one of the fastest-growing subsectors of agriculture and allied activities.

- Dalit or Scheduled Caste (SC) households, being at the lowest rung of social strata, is one of the most socially marginalised, resource-poor and economically vulnerable groups in India.
- Rural Poverty is largely concentrated among the landless and the marginal households comprising about 70 percent of rural population. livestock rearing has significant positive impact on equity in terms of income and employment and poverty reduction in rural areas. Livestock generates a continuous stream of income and reduces seasonality in livelihood patterns particularly of the rural poor.
- A large number of people in India being less literate and unskilled depend upon agriculture for their livelihoods but agriculture being seasonal in nature could provide employment for a maximum of 180 days in a year. The landless and small farmers having less land holdings depend upon livestock sector during lean agricultural season. Around 70 percent of the population living in rural areas depend on agriculture and allied activities for livelihood hence, there is a need for a subsidiary occupation like poultry, sheep and goat farming.

**Conclusion:**

Livestock helps in women empowerment and provides livelihood to many marginal farmers. Both the national economy as well as the socio-economic growth of rural India is backed by the livestock sector. So, in general we can clearly mention that the role of livestock is immortal and immense in today's scenario and in the coming future. It is going to pump up the socio- economic status of the rural families and hence secure the national food and economic security. Livestock is already catering the various employment opportunities and the day is not far when livestock will be an essential asset for every agricultural farmer.

**8. Integration of food processing into the agricultural production cycle will help achieve the target of doubling farmers' income. Do you agree? Substantiate.**

**Approach:**

Students are expected to write about how integration of food processing into agricultural production cycle will help in doubling famers income and substantiating the same with proper examples and it is also important to mention the issues in the process of integration as well.

**Introduction:**

Food Processing includes process under which any raw product of agriculture, dairy, animal husbandry, meat, poultry or fishing is transformed through a process (involving employees, power, machines or money) in such a way that its original physical properties undergo a change and the transformed product has commercial value and is suitable for human and animal consumption. It also includes the process of value addition to produce products through methods such as preservation, addition of food additives, drying etc. with a view to preserve food substances in an effective manner, enhance their shelf life and quality. The Indian food and grocery market is the world's sixth largest, with retail contributing 70 per cent of the sales. The Indian food processing industry accounts for 32 per cent of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. It contributes around 8.80 and 8.39 per cent of Gross Value Added (GVA) in Manufacturing and Agriculture respectively, 13 per cent of India's exports and six per cent of total industrial investment. The Indian gourmet food market is currently valued at US$ 1.3 billion and is growing at a Compound Annual Growth Rate (CAGR) of 20 per cent. India's organic food market is expected to increase by four times by 2022.

**Body:**

**Current status of food processing industry in India-**

- India is the world's second largest producer of fruits & vegetables after China but hardly 2% of the produce is processed. In spite of a large production base, the level of processing is low (less than 10%). Approximately 2% of fruits and vegetables, 8% marine, 35% milk, 6% poultry are processed. Lack of adequate processable varieties continues to pose a significant challenge to this sector.
- India's livestock population is largest in the world with 50% of the world's buffaloes and 20% of cattle, but only about 1% of total meat production is converted to value added products.
- Agricultural produce is an important factor for sustaining food processing activities. Due to seasonal availability of certain crops, the sector faces delays in production resulting in low supply.

- For oil production, the majority of oilseed producers are small and marginal farmers with poor access to resource bases such as fertilizers, manure, etc. Hence, oilseeds grown by such farmers have low yield.
- Rabi crops like wheat, barley and mustard are sown around mid-November and harvested in April or May. These food grains are dependent on forces of nature, which are rather unpredictable.
- Seasonal scarcity and high cost of raw materials constitutes one of the major constraints affecting the growth of small-scale food processing enterprises. This scenario results in scarcity and higher pricing of raw materials.

**How will integration help in doubling farmers income-**

- Since doubling of income will warrant high growth rate of production year after year, there would a need for robust post-production activities and hence' investment in storage and transportation' inducing cold chain logistics and food processing. This will reduce post-harvest losses in high value crops such as fruits, vegetables, fish, etc. How to reduce post-harvest losses in high value crops is an important issue. Wastages in fruits, vegetables, fish, etc.need to be reduced by creating storage, cold chain, and market infrastructure.
- Farmers' inclusive growth would require a shift fromproduction-based agriculture to profit based farming. Small and marginal farmers, who constitute around 85 per cent of total farming population are last to reap the benefits of agro-based enterprises; as they end up fighting distress sale and post-harvest losses. The farm harvest price i.e. average wholesale price at which the commodity is disposed off by the producer to the trader at the village site during the specified harvest period provides us a clear picture of farmers' condition.
- Agro processing generates employment opportunities within sector and more opportunities in service sector. Agro processing centre (APC) in the production catchment has twin obvious advantages of enhanced income through value addition to the farm produce and reduction in post-harvest losses as a means to provide gainful rural employment. These APCs consist of two or more machines for processing at farm/village level. However, the requirement of machinery depends upon the crops to be processed, level of processing and scale of processing.
- Small farmers will be associated and incentivised to form commodity groups/processor companies for better earning profits. Women can be given training in the area of processing and can go for value addition through mango pulp processing, guava products processing such as guava leather, guava nectar and various carbonated and fresh fruits beverages.
- Integration of agricultural cycle with food processing industry will increase demands of agri produce thus ensure the enhanced income to farmers.
- It will also enable farmers to go for contract farming which will ensure continuous and non disrupted supply throughout the year thus will save them from fluctuating market prices.

- It will incentivise farmers to go for integrated and mixed farming approach as well because of demand for diverse agri produce thus will help in stabilizing skewed cropping pattern already existing because of implementation of MSP.
- Integration will also help in bringing end to black marketeering and hoarding of agri produce which were affecting the income of farmers very badly through lack of demand on seasonal basis examples include onion and tomato prices.

**Conclusion:**

Food processing has numerous advantages which are specific to Indian context. It has capacity to lift millions out of poverty and malnutrition. Government should develop industry in a way keeping in mind the interests of small scale industry along with attracting big ticket domestic and foreign investments. The entire food value chain in India is controlled by multiple ministries, departments and laws. A comprehensive policy will ensure that various initiatives across the departments are aligned to the overall goal of ensuring availability, awareness, affordability, access, quality and safety of food. The target of ensuring food security for more than a billion people requires a concerted effort by all stakeholders including government and the food processing industry. In addition to private players and government, industry bodies and academia will also have a crucial role in the success of these initiatives.

**9. What role does the corporate sector play in the development of the agricultural sector? Is it possible to envisage a prosperous agrarian economy without the participation of the corporate sector? Critically comment.**

**Approach**

The candidate needs to address the question two parts where the first part highlights the role of corporate sector could play in the development of the agricultural sector while in the second part you need to critically comment on the aspect of whether it is possible to envisage a prosperous agrarian economy without the participation of the corporate sector.

**Introduction**

Agriculture is the primary source of livelihood for about 58% of India's population. Gross Value Added (GVA) by agriculture, forestry and fishing was estimated at Rs. 19.48 lakh crore in FY20. The current private corporate investment in agriculture as a percentage of the total annual investment in agriculture is about 2%, which is very less and thus showing agriculture's high reliance on the Government.

**Body**

Recently, Prime Minister Narendra Modi called for increased participation of the private sector in agriculture, especially in research and development. In this background, the role of corporate sector in development of the agricultural sector can be seen from the following points –

- The concept of a free market in agriculture will pave the way for corporate sector and make it more efficient. The emergence of private investment is expected to revamp the sector by driving productivity, adopting new technology, and integrating supply chain "from farm to fork".
- There is a need to improve the existing underdeveloped marketing system for better access. The Dalwai committee report (2017) estimates that the country requires 10,130 agriculture markets based on population, production, and geographical area. Currently, there are 6,676 markets in the country and thereby have a space for additional 3,568 markets.
- The recent farm acts create an opportunity for the private sector to intervene and invest in separate modernised trading platforms. Further, electronic trading platforms are also as crucial as physical trading platforms.
- The private sector can also help in developing post-harvest facilities like warehouses and cold storages. Given that production cycle is limited to few months, ensuring round-the-clock supply requires sufficient inventories the whole year in cold storages and warehouses.
- In this regard, earlier, private players were reluctant to invest in post-harvest facilities due to abrupt stock limits imposed through Essential Commodities

Act. The new bill on "Essential Commodities (Amendment)" will now envisage investment in storage and warehouses by the corporate sector.

- A well-developed process of marketing along with informed cropping decisions by farmers can go a long way in reducing the price volatility and will enable transparent price discovery.
- With the entrance of private players, it is plausible that existing mandis will reinvent themselves by reducing the prevalence of licence raj, loosen the entry barriers for the traders, lowering the market fees, and investing in modern facilities.

At the same time, there are many voices for ensuring prosperity in agrarian economy without the participation of corporate sector where –

- Agriculture being the dominant sector, bringing it into the profit oriented world of corporates can prove harmful. For example, many farmers in the USA suffered after unhinged corporatisation of farm sector.
- Corporate sector involvement many a times leads to monopoly, which could be economically disastrous for the farm sector. This monopolistic tendencies are evident from the example of telecom sector.
- Further, India has millions of small farmers, who cannot be left at the mercy of corporates, who are driven by profit. This will aggravate the already grim agrarian crisis in the country.

But the experience of past several decades in the form of socialism has led to the realisation that involvement of corporate sector can have immense significance to make agriculture sustainable and profitable and making it a tool to overcome poverty. Following points can be considered in this regard –

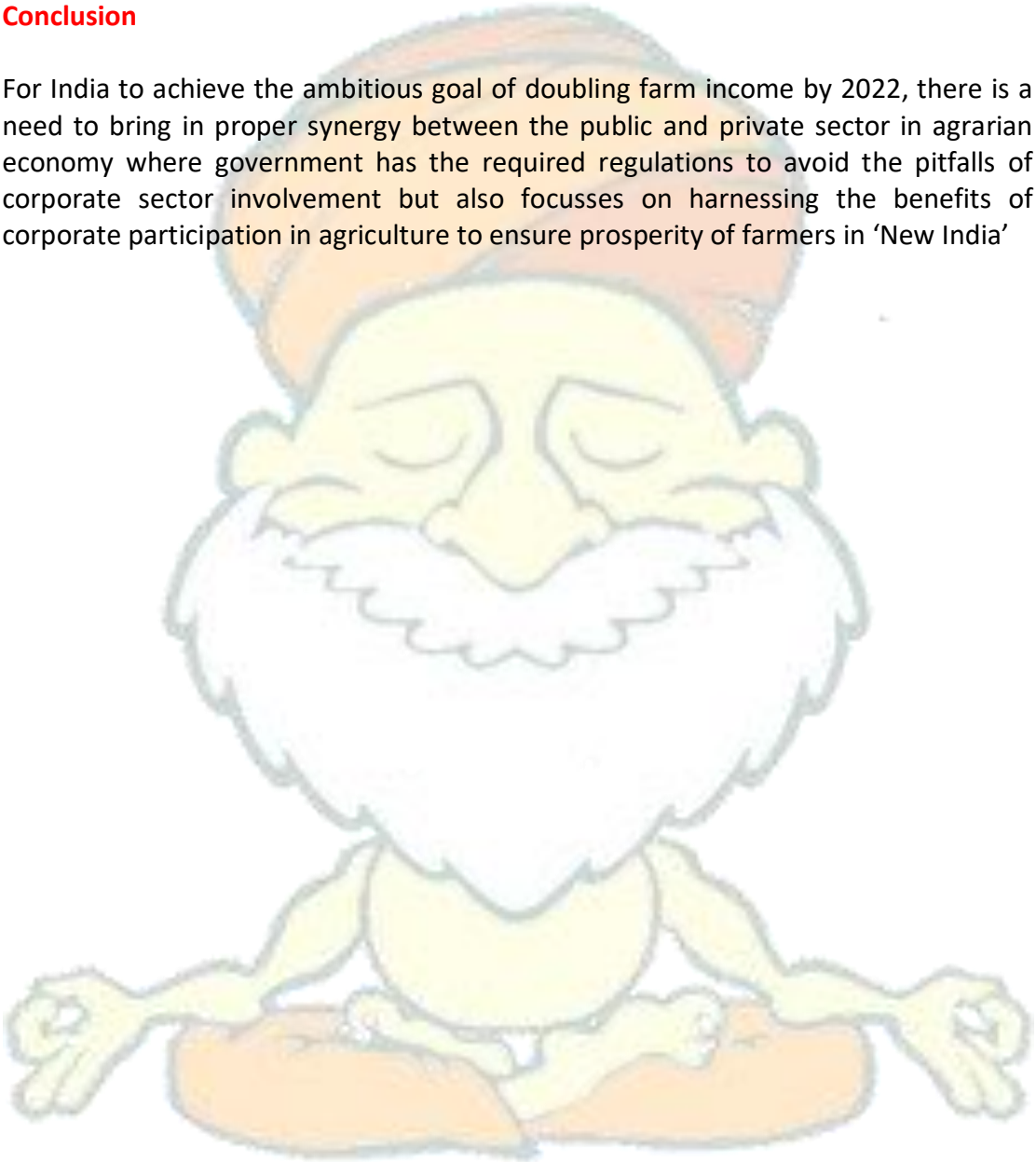
- According to an ADB report, "growth in agriculture supports the subsequent growth of industry", not the other way round that India pursued. This clearly necessitates the need for corporate sector involvement in agrarian economy.
- India invests very little in agriculture research and education (R&E), which Prof. Gulati claimed to have the "highest impact" on agri-GDP growth and poverty alleviation. Further, India's investment in agriculture has seen a fall. Agriculture's share of gross capital formation (GCF) fell from 8.5% of the total GCF of economy in FY12 to 6.5% in FY19, mainly due to a fall in private investment - according to the Agricultural Statistics at a Glance, 2019.
- These statistics point to the limited governmental capacity in ensuring proper development of agrarian economy and need for private sector involvement.
- Also, the example of dairy and milk sector in India is a proof to the benefits of private sector involvement where farmers involved in dairy sector have seen substantial growth in income as well as made India, the largest milk producer in the world.
- The three agriculture laws brought by the government seek to create the architecture for such investment and make agriculture a success story like the

milk sector where government agencies compete with the private sector, farmers get good price and consumer also gains in the process.

- Contract farming under India's new agri laws would lead to the establishment of large farms and the development of state-of-the-art infrastructure by clubbing landholdings of small, marginal and poor farmers, who have less than five acres and constitute 86 per cent of the farmers.

**Conclusion**

For India to achieve the ambitious goal of doubling farm income by 2022, there is a need to bring in proper synergy between the public and private sector in agrarian economy where government has the required regulations to avoid the pitfalls of corporate sector involvement but also focusses on harnessing the benefits of corporate participation in agriculture to ensure prosperity of farmers in 'New India'



**10. What are the key factors that reduce the competitiveness of India's farm produce in the global export market? Discuss. What immediate measures can be taken to address the same? Suggest.**

**Approach**

Candidates are expected first to write about Indian agri exports and factors responsible for reducing India's competitiveness it's farm produce at global platforms. And then in second part suggest the measures that can enhance India's farm produce competitiveness.

**Introduction**

Agricultural export constitutes 10% of the country's exports and is the fourth-largest exported principal commodity. However in the global trade, the share of India is only close to 2%. To achieve the true potential and export a greater share of what is being produced in India, there is an immediate need to address the export challenges.

**Body**

Indian agri export:

- During April-August 2017, exports of agricultural and processed food products summed up to US$ 7.26 billion.
- During the period, export of cereals and animal products accounted for 45.62 per cent of the total exports, followed by livestock products (23.78 per cent), other processed foods (17.92 per cent), fresh fruits and vegetables (7.45 per cent), processed fruits and vegetables (6.25 per cent) and floriculture and seeds (1.15 per cent).
- Export surplus from the country's agricultural trade is higher than the corresponding figure achieved by the manufacturing sector.

Factors responsible that reduce India's farm produce competitiveness in global market:

- Sanitary and Phytosanitary Measures: In the year 2016, the India's share in EU's imports of fresh and processed food products was 2.9 per cent, which was lower than that of other developing countries including Brazil (7.8 per cent), China (4.9 per cent), Turkey17 (4.5 per cent) and Vietnam (3.4 per cent). Border rejections as a percentage of total notifications raised are the highest for India, when compared to other developing countries.
- Lack of synergy between the state and central government as agriculture is a state subject, while the state's role for exports is undefined.
- Low Automation and processing of food: only ~ 10% of the food is processed. This leads to lots of wastage and reduces export capacity.
- The long-distance affects the viability of export shipments due to high transport costs and quality losses. Hence, this time efforts were made for reducing the transit time by using refrigerated rail containers (freight

transport that is refrigerated for the transportation of temperature-sensitive cargo).

- High Tariffs and Protectionist Policies: India has the highest average applied tariff of any G20 country and among the highest bound tariff rates in the WTO.
- The problem is that Indian industries do not invest time and money in innovation and research. There is a serious knowledge gap between Indian industries and the international market.
- The government pro-consumer bias in India's farm policy is unfair in putting export restrictions on important food items to prevent inflationary pressures in the domestic economy.
- The policy deprives farmers of higher prices in the international market and also adds an element of income uncertainty. If the government is going to impose export restrictions when international prices peak, farmers would lose part of the incentive to cultivate exportable crops.

Increasing agri – exports will help increase India's export basket and would also expand farmers' incomes and amend farm distress. Measures to make Indian farm produce globally competitive:

- This objective is achievable, provided there is a paradigm shift in policy-making from being obsessively consumer-oriented to according greater priority to farmers' interests.
- Recently, the APEDA along with Government of Andhra Pradesh has dispatched the first shipment of high-quality bananas from Anantpur to JNPT in Mumbai for exports to international markets. India government should take such case studies as reference to formulate policies.
- To boost agriculture exports, the government and business promoting agencies should focus on the use of technology and innovation, he said, adding, the government should support only those who are willing to invest in research.
- If India has to promote agri-exports, the country's policymakers must build global value-chains for some important agri-commodities in which the country has a comparative advantage.
- Stimulating agri – exports would require infrastructure and institutional support — connecting export houses directly to farmer producer organizations (FPOs), sidestepping the APMC-regulated mandis, removing stocking limits and trading restrictions.
- The country has a great potential to export fish and seafood, bovine meat, and fruits, nuts and vegetables. These are the commodities to focus on in order to stimulate agri-exports.
- On lines of the 'Make In India' campaign, the report urged the government to launch 'Grow In India' campaign aiming for substantial gains in agri-exports with a single authority to monitor India's international agricultural trade-both exports and imports.

**Conclusion**

A “farm-to-foreign” strategy, improving agri-trade surpluses by promoting agri-exports, and most importantly create more jobs and bring prosperity to rural areas can sure be a go ahead.

**11. What are the factors responsible for food inflation in India? How does food inflation impact the farmers? Examine.**

**Approach-** Question is straight forward. Candidate can define inflation and reasons of food inflation in first part and then discuss impact of food inflation on farmers with the way ahead.

**Introduction**

Food inflation is volatile. Agricultural prices tend to fluctuate because demand and supply are both inelastic and supply can vary due to the weather. However, despite the usual volatility, food prices seem to be showing a strong upward movement, reaching record highs in recent years.

**Body**

In India, a booming economy has GDP expanding at 9% a year. Official inflation is around 7%, but, headline food inflation is more than double at 17.8%.

**Some key reasons for Inflation:**

- High demand and low production or supply of multiple commodities create a demand-supply gap, which leads to a hike in prices.
- Excess circulation of money leads to inflation as money loses its purchasing power.
- With people having more money, they also tend to spend more, which causes increased demand.
- Spurt in production prices of certain commodities also causes inflation as the price of the final product increases. This is called cost-push inflation.
- Increase in the prices of goods and services is also a factor to consider as the involved labour also expects and demands more costs/wages to maintain their cost of living. This spirals to further increase in the prices of goods.

**Food Inflation is a major cause of inflation in India today, reasons for inflation**

- Untimely rains, drought in some regions and crop losses due to local factors did contribute to supply shocks.
- Transmission of global food prices, which have shown a rising trend in the last half-year, also is the reason for food inflation.
- The government policy of untimely imports in pulses flooded the markets and contributed to lower price realization last year. This led to lower production of pulses this year.
- The government had procured 34 million tonnes of wheat in 2019, on top of the 36 million tonnes procured in 2018. These are the highest procurement levels since 2012-13. However, it failed to distribute the wheat through the public distribution system. This has created an artificial scarcity that has led to Inflation.

**How does food inflation impact farmers?**

- Increasing food demand and price could be the best opportunity to lure farmers back to farms. But today there is a pressing concern, particularly for a country like India, which has the world's largest number of poor.
- Going by recent studies and anecdotal field reports, food inflation has impacted the health of the poor the most. It is an irony that while globally the fight against malnutrition is intensifying, food inflation may be impeding it within the country.
- Given that an average household in India spends nearly 50 per cent of its earning on food—the poor spend more than 60 per cent—price rise will precipitate a crisis. Going by the survey findings, the impacts will be severe in India.
- As inflation increases, prices paid by farmers for various inputs increase faster than the prices they receive for their products, thereby the terms of trade for farmers deteriorate as the rate of inflation rises.
- Farmers have flexible money incomes. Therefore, theoretically at least, they should benefit from an unanticipated increase in the rate of inflation. Empirical studies however, have not found this connection.
- On the other hand, higher marketing margins due to imperfections in the agricultural markets, stirred up by higher wages and various other marketing costs, reduce the demand for farm output at the farm level.
- Also the inflation targeting in India has adverse effect on food prices. Since food items have a large weight in the consumer price index, any effective strategy of inflation containment seeks to keep food prices low. This is sought to be achieved through measures that keep farm-gate prices low.
- These penalize the agricultural sector by leading to a reduction in subsidies and a decline in investment, both of which contribute to raising input costs. The real cost of inflation-targeting is therefore borne by farmers, who are deprived of remunerative prices.
- Though the inflation takes more out of the pocket from the common man, it does not benefit farmers much. The middlemen are the real beneficiaries.

## Conclusion

With food accounting for two-thirds of household budgets, higher prices will worsen demand for non-food goods. At a time when consumption expenditure data shows rising poverty along with declining wages, climbing inflation will only lead to increased vulnerability, while making an economic recovery harder and the situation worsening for farmers.

**12. What do you understand by the terms 'forward' and 'backward' integration in food processing industries? Illustrate with the help of suitable examples.**

**Approach:**

Question is asking you to illustrate such an answer will generally involve the use of many examples, such as tables, figures, graphs, or concrete research statistics and evidence.

**Introduction:**

Food processing is the transformation of raw ingredients into food, or of food into other forms (i.e. food processing may denote direct manufacturing of food or value addition on existing food). Food processing typically takes harvested crops or butchered animal products and uses these to produce long shelf-life food products. It also includes the process of value addition to produce products through methods such as preservation, addition of food additives, drying etc. with a view to preserve food substances in an effective manner, enhance their shelf life and quality.

**Body:**

**Forward Linkage:** Forward linkage integration refers to consolidating the chain from processing industries to market. It is when, the establishment of a processing industry can lead to the development and establishment of the number of advanced stage industries.

**There are many examples such as:**

- In context with Food Processing Industry, a Food Processing Unit needs to have strong backward linkages with the farmers, farmer producer organizations, self-help groups, farmer's groups etc.
- Further, to be able to sell its processed food, it needs to develop strong forward linkages with wholesalers, retailers, exporters etc.
- Forward Integration refers to that integration where Company expands its activities to downstream areas. Company aims to get more control over sales, consumer-contact and eliminate any middlemen, wholesaler, retailer. e.g. Amul has its own pizza outlets and ice cream parlours.
- products such as vegetable oils and rubber are used in a wide variety of manufacturing industries; based on the preparation of hides and skins, tanning operations can be started, as can the manufacture of footwear and other leather goods.

**Backward Linkage:** backward market integration refers to consolidating chains from farm to processing centres and to integration with ancillary industries. The feedback effects generated by a base industry on the development of the base sector is called backward linkage. The development of the food processing industry has many feedback effects on the agriculture sector itself.

**There are many examples such as:**

- Once a food processing industry is established, it results in increasing the demand of raw materials provided by the agriculture sector.
- The establishment of processing facilities is itself an essential first step towards stimulating both consumer demand for the processed product and an adequate supply of the raw material.
- Backward integration refers to that integration where company expands its activities to upstream areas. Company aims to get raw material at cheap rates, uniform quality, steady supply and eliminate any middlemen. E.g., Starbucks (chain of coffee bars) buys coffee plantations in central America.
- The provision of transport, power and other infra-structural facilities required for agro-industries also benefits agricultural production.
- The development of these and other industries provides a more favourable atmosphere for technical progress and the acceptance of new ideas in farming itself.

**Conclusion:**

For an industry, backward linkages are directed towards suppliers; while the forward linkages are directed towards consumers. Rising per-capita income, changing life style and food habits provide significant opportunities for the growth of Food processing industry. ordinances and the schemes like SAMPADA, etc. are likely to strengthen backward and forward linkages in turn help the Food processing industries to grow from present 2% of GDP to optimise high output of farming sector.

**13. Do an evaluation of the potential of food processing industries in the economically underdeveloped regions of the country.**

**Approach:**

Question is straight forward in its approach, students need to evaluate the potential of food processing industries in the economically underdeveloped regions of the country, also they are expected to mention the issues the industry is facing in such areas of the country and how those issues can be addressed.

**Introduction:**

India Food Processing Industry is estimated at $135 billion industry which is growing at about 8% annually. This growth rate is significantly more than agricultural growth rate which remains around 4%. These signals indicate toward phenomenal shift toward food processing from traditional ways. GDP by processing constitute about 10% that of agriculture. But given potential of India, this is an underachievement. With India moving from a position of scarcity to surplus in terms of food production, the opportunities for increasing food processing levels are innumerable. India's food processing sector, in recent years, has been known for its high-growth and high-profits, thus, increasing its contribution to the world food trade every year.

**Body:**

Currently, Indias food processing industries are localized mostly in urban areas most of the processing takes place in limited crops only, the reasons for the same are as follows-

- Lack of efficient supply chain infrastructure and inadequate expansion of processing and storage capacity commensurate with agriculture production have been identified as the main reasons for higher wastages, higher cost of production, lower value addition in food processing sector.
- Processors face difficulty in availing benefits under schemes being implemented by different agencies of central and state governments in the absence of exclusive supportive forum at the state level. Lack of awareness and absence of appropriate knowledge sharing & guidance forum adds to their problem.
- Multiple clearances are required for setting up of food processing units. The small processors are also required to go through the same processes as is applicable to larger units. Availing permission for Change in Land Use (CLU), environmental clearance, water and power connections are not only time consuming but also costly.
- Food processing units are required to comply with labour laws in relation to lay-off, retrenchment and closure even though these units run seasonally. Further, payment of minimum charges for electricity even though units run for few months in a year, adversely affects the commercial viability of the processing units.

- India is processing less than 10% of its agricultural output, thus, presenting immense opportunities for increasing these processing levels and leading to investments in this sector. With agriculture and its allied sectors being the largest source of livelihoods in India, 70% of its rural households still depend primarily on agriculture for their livelihood. Thus, this sector provides a huge employment generation potential as well. The food processing sector has been acknowledged as a high priority industry by the government of India and is currently being promoted with various fiscal reliefs and incentives.

**Potential of food processing in economically underdeveloped regions of the country-**

- Agriculture and allied sectors and rural India have enormous employment opportunities and affect the country most, so the government reinforced stress on the supply chain and agriculture and rural sectors and related industry, including domestic trade and export, food processing, fisheries, animal husbandry, cold storage, etc.
- With an increase in urban working culture and fast-paced lifestyles, there is limited time available for cooking and meal preparation. Thus, processed foods such as ready-to-eat products and snacks have become quite popular, particularly in urban areas. By 2030, Indian annual household consumption is set to treble, making India an opportune market for consumption of processed foods.
- India boasts of the world's largest population of livestock and is currently the third largest egg producer in the world, as per FAO (Food and Agriculture Organisation) in 2016. Additionally, India is also the fifth largest producer in broiler production. However, India currently processes only 6 % of poultry and 21 % of meat.
- India has a rich and diverse fisheries resources such as deep seas, lakes, ponds and rivers. They account for more than 10 % of the global biodiversity in terms of fish and shellfish species. India's vast potential in the sector can be seen in its long coastline spanning 8,118 kilometers apart from the inland waterways.
- Within India, Uttar Pradesh is the largest dairy and milk-producing state because it is home to the highest buffalo population and the second-highest cattle population in the country. Most of the rural population in this state is engaged in livestock rearing and dairying. Gujarat has numerous cooperative dairy milk unions, private dairy plants, and primary milk cooperative societies, which play crucial roles in the production of milk in the state. Being one of the primary dairy consumables, the increase in demand for milk in the country can be linked to an increasing population. Investment in the infrastructure required to change this ecosystem to an organized and hygienic one would be tapping into unrealised potential for supply and distribution logistics as well as a huge customer base.
- Malnutrition and dietary risks associated with diseases remain prevalent globally, including in India. In addition to this, rapid urbanization, changing lifestyles and lack of awareness with respect to the required nutrition intake have led to a greater need for health supplements and nutraceuticals in the

Indian market. Ensuring safe and nutritious food for over 1.3 Bn Indian citizens on pan-India basis calls for massive outreach efforts. India represents a vast market for nutraceuticals as almost every segment has a need for some form of nutraceuticals.

**Government initiatives in this direction-**

- PRADHAN MANTRI KISAN SAMPADA YOJNA (PMKSY)- Mega Food Parks are based on 'cluster' approach and focus on creation of state-of-the-art support infrastructure in a well-defined agri/horticultural zone for setting up of modern food processing units in the industrial plots provided in the park with well-established supply chain.
- Scheme for Cold Chain and Value Addition Infrastructure-It covers creation of infrastructure facilities along the entire supply chain viz. pre-cooling, weighing, sorting, grading, waxing facilities at farm level, multi product/ multi temperature cold storage, CA storage, packing facility, IQF, blast freezing in the distribution hub and reefer vans, mobile cooling units for facilitating distribution of horticulture, organic produce, marine, dairy, meat and poultry.
- Scheme for creation of backward and forward linkages-Provide effective and seamless backward and forward integration for processed food industry by plugging the gaps in supply chain in terms of availability of raw material and linkages with the market, financial assistance provided for setting up of primary processing centers/ collection centers at farm gate and modern retail outlets at the front end along with connectivity through insulated/ refrigerated transport.
- PM Formalisation of Micro Food Processing Enterprises' (PM FME)- The Scheme adopts One District One Product (ODOP) approach to reap benefit of scale in terms of procurement of inputs, availing common services and marketing of products. The states would identify food product for a district keeping in view the existing clusters and availability of raw material. The ODOP product could be a perishable produce based product or cereal based products or a food product widely produced in a district and their allied sectors.

**Conclusion:**

Food processing seems to have promising future, provided adequate government support is there. Food is the biggest expense for an urban Indian household. About 38 % of the total consumption expenditure of households is generally spent on food. This share is declining consistently. As mentioned, food processing has numerous advantages which are specific to Indian context. It has capacity to lift millions out of undernutrition. Government has challenge to develop industry in a way which takes care of small scale industry along with attracting big ticket domestic and foreign investments.

**14. What are the main constraints in the management of supply chain of food and agri products in India? What reforms would you suggest to address these challenges?**

**Approach**

A straightforward question where in the candidate needs to address the question in two parts, with the first part addressing the main constraints in the management of supply chain of food and agri products in India while in the second part, the candidate needs to suggest some reforms that would address the challenges mentioned above.

**Introduction**

Food supply chain management refers to the process whereby the movement of agro based product(s) from the initial supplier to the ultimate user occurs with all non-value adding expenses. In this regard, the Indian agriculture supply chain is far more complex and difficult to manage, as compared to developed countries because of its unorganized nature and a large number of intermediaries.

**Body**

Agriculture is inherently a fragmented and unorganized sector involving a diverse range of distinct stakeholders such as inputs supplier, farmers, traders, commission agents, processors and distributors. Here, the main constraints in the management of supply chain of food and agri products in India include –

1. **Fragmented supply chain**: The long and fragmented supply chain results in the wastages and price escalations due to the large share of unorganised players in the supply chain and operating commercial viability challenges.
2. **Inadequate cold storage and warehousing facilities**: Warehousing is a key requirement in the overall supply chain it is mostly dominated by unorganized players. 20% of warehousing is organized currently with 70% of the organized market controlled by the Government.
3. **Logistical challenges related to quality and connectivity**: Indian national highways account for only 2% of the total road network but carry 40% of all cargo. Port capacity may be increasing but lack of connectivity to these ports leads to cost escalations and delays in the goods transferred.
4. **Lack of demand estimation**: Demand forecasting is totally absent and the farmers try to push whatever they produce into the market.
5. **Lack of system integration**: The supply chain needs to be designed and built as a whole in an integrated manner. The process of new product development, procurement and order to delivery processes should be well designed and well supported with the help of IT tools and software.
6. **Lack of technology applications**: Cold chain logistic supply chains should take advantage of technology improvements in data capture and processing,

product tracking and tracing, synchronized freight transport transmit times for time compression along the supply chain and supply-demand matching.

7. **Presence of large number of unorganized retailers**: At present the unorganized retailers are linked with farmers through wholesalers or commission agents. The commission agent's and wholesaler's redundant supply chain practices make unorganized further inefficient.
8. **Lack of proper Sorting and grading technology**: Farmers lack the knowledge about the process as the entire ecosystem with regards to quality control is missing on a wider scale in India.

In order to shore up the emergence of professionally managed agri-supply management of different agricultural produce, the Government should play its facilitating role to its hilt while also considering the following reforms to address multiple challenges involved –

- Focus should be laid on free play of demand and supply forces in the market. This has to be enabled by removing different entry barriers, having a proper market information system, promoting grading and standardization, taking care of quality and safety issues, etc.
- Vertical coordination of farmers through cooperatives, contract farming and retail chains would facilitate better delivery of output, reduce market risks, provide better infrastructure and create awareness regarding the prevailing and new technologies.
- More focus on Mega food parks – where Mega Food Park consists of supply chain infrastructure including collection centres, primary processing centres, central processing centres, and food processing units.
- Customized logistics is another important immediate requirement to make logistic effective. This reduces the cost, facilitates the maintenance of quality of the produce and fulfils the requirements of targeted customers.
- Public private partnership is another strategic solution. Supply chain like washing, waxing, grading, sorting, packing, pre-cooling, handling facilities, insurance, finance, transport and processing facilities would add value to supply chain functioning.
- It is time a proper marketing system is in place for disseminating information on what to produce, when to sale and where to sell etc. and on packaging, transportation, grading, and standardization.
- Different legal restrictions inhibiting growth of competitive environment should be dismantled and replaced by a facilitating legal environment.

## Conclusion

The supply chain management has to be improved in all the stages of the supply by adopting global best practices in storage, packaging, handling, transportation, value added service etc. And also by disintermediation and participation of organized players i.e., modern supply chain with a view to benefit both farmers as well as ultimate consumers.

**15. How can digital technology help in undertaking second-generation land reforms? Discuss.**

**Approach**

Candidates are expected first to write about second generation land reform and then address the main demand of question how use of digital technology will help in undertaking second generation land reforms.

**Introduction**

Second generation land reforms are aimed at reorganising state and collective farms into family-size units and introducing market-oriented land systems. It is broadly about leaving resource allocation and production decisions to market forces rather than to the government institutions.

**Body**

Issues in undertaking land reforms for economic development:

- Benami Transfers: Excess lands were transferred to ghost beneficiaries.
- Unproductive lands: The excess lands transferred were fallow or infertile lands which was of less use for cultivators.
- Fragmentation: It led to fragmentation of land holdings, there by increasing small and marginal farmers.
- Mechanization: With small and marginal land holdings, investment on machine and return on their investment was poor.

Digital technology a useful tool in undertaking second generation land reforms:

- For a majority of Indian households' wealth invested in real estate, accessing land records and other details of encumbrances including mortgage, liability or claim against a property, is often difficult. Investors too face the drudgery of visiting public land record departments and Registrar's office to verify land records and register land agreements.
- A centralized land records system and reforms in land laws are thus the need of the hour to ward off internal constraints, local agitations, and speculative increase in land prices. The GIS land bank system launched by the government recently is a potent step towards actualizing this clamour for change by addressing issues like transparency and credibility directly.
- The GIS land bank system will serve as an information window for investors providing access to an array of details on various industrial belts, eliminating the need to visit various offices and platforms for land information and obtain clearances.
- The land bank system will also push the approach of "One District One Product", in line with the AtmaNirbhar Bharat vision, boost employment opportunities and attract investments from abroad by showcasing the improving ease-of-doing-business.

- With the arrival of GIS-enabled one-stop digital land bank platform, land records would be just a click away and can be accessed from anywhere around the world, enabling seamless and credible property registrations online, doing away with the need of any authorised intermediary.
- The Blockchain in the land registry is used for secure transfer of land property. The transparent nature of Blockchain enables to track the changes made in land documents. Advent of Blockchain technology in the land registry is playing a very beneficial role in this developing era. It is helping in uplifting the poor, and marginalized section of the society in fighting illegal authorization of land.
- The digitization of land records will mark an epoch in the history of real estate and amplify the potential of the country's real estate. The property sector which had for long been plagued by land issues that snowballed into complex litigations and disputes, will breathe a sigh of relief at this renaissance.
- With 24/7 availability of data online, it will become easily for buyers and sellers to scrutinize property data online and check the authenticity of a land or property.
- Digital enabled land records system, a full spectrum rollout in the near future will help organizations and decision makers to gain a deeper understanding of property economics, make faster decisions and take advantages of property developments in future essentially, what we often call a 'game changer'.

## Conclusion

With the digitization of land records, a clear picture of land data, starting from the first owner of the land to its present status, including image of property and landowner will be available. This will eradicate confusion between government land and private land, usher transparency, and speed up land acquisition; the use of reliable digital land records will add considerable impetus for India's rapid economic growth through better functioning of land markets and boost investment too.

**16. How do fragmented and small land holdings affect agricultural productivity? How severe is this problem in India. Discuss.**

**Approach-** Candidate can outline the problems faced by agriculture sector because of the small land holdings. With the help of some data and facts, can suggest a way forward in the conclusion.

**Introduction**

From farm subsidies to farm loan waivers, the Indian government spends crores on farmer welfare, but these efforts will be inadequate unless they can tackle an increasingly daunting barrier: lack of land. The provisional figures from the latest agriculture census reveals how land—the most critical input for agriculture is getting more fragmented.

**Body**

How serious is the problem?

- Since the first agriculture census over 45 years ago, the number of farms in India has more than doubled from 71 million in 1970-71 to 145 million in 2015-16, while the average farm size more than halved from 2.28 hectares (ha) to 1.08ha
- The more numerous farms have been driven by rural population growth. Between 1970-71 and 2010-11, the number of farms increased by 194%, almost exactly in line with rural population, which increased by 189%. As Ramesh Chand and others pointed out in a 2011 Economic and Political Weekly research paper, this relationship is a reflection of India's inheritance pattern, which leads to farms divided between multiple heirs.
- The majority of India's farms (86%) are less than 2ha. The bulk of which are located in the poorer states such as Uttar Pradesh and Bihar.

- The Indian experience shows that small farmers are more productive than large farmers. Ramesh Chand and others show that small farmers use more inputs (such as fertilizers), use their land more intensely (planting more crops) and adopt more technology. Yet, despite this efficiency, farm incomes remain poor. It is the poor returns to farming—despite intensive efforts put in by farmers—that lie at the root of India's farm crisis, and the recent farm angst.
- Given household sizes in rural India, small farms struggle to generate enough income for everyone in a household and often lack alternative sources of income.
- National Sample Survey Office's (NSSO) 2003 and 2013 surveys of farmers to show how farm size is an important determinant of income and, consequently, income inequality. They find that in 2013, for marginal farmers(less than a hectare of land), household consumption exceeded net monthly income of less than ₹ 5,500 from both farming and non-farming activities.

Way ahead

- One obvious solution to small farm sizes will be consolidating land into larger farms by enabling land leasing. However, this can be a complex and costly process, made more difficult by the lack of accurate land records.
- PRS survey pointed out that, despite most states computerizing and digitizing land records, as of 2017, spatial data had only been verified in 39% of villages. This is particularly problematic for small farmers who, without accurate land records, cannot access credit or secure insurance.
- India's farmers are not alone in these struggles. A 2016 study estimated that around 84% of the world's farms are less than 2ha. While many of these small farms face the same challenges, some small farmers, such as those in China, have been more successful in securing sustainable livelihoods.
- Economists agree that improving land records, investing in research and development, providing local rural non-farm employment opportunities and building better rural infrastructure are policies that can help small farmers.

**Conclusion**

More resources should be allocated to agriculture to increase irrigated area, improve soil health, promote agri -processing, and cover production risk, among many others. Despite various schemes already existing in the agriculture sector, it continues to remain a laggard, in order to ensure flourishing and vibrant agriculture improvement of land record and experiment of land consolidation on the basis of China's experience can be become effective alternative.

**17. What are rare earth metals? What are their applications? What are the issues with its extractions? Discuss**

**Approach**

A simple and straightforward question where in the candidate needs to explain what are rare earth metals along with their applications in the first part of the answer while discussing the issues with the extractions of these metals in the second part of the answer.

**Introduction**

Rare earth metals are metals obtained from a group of 15 elements referred to as the lanthanide series in the periodic table of elements. Scandium and yttrium, while not true rare earth elements, are also included. REEs are key components in many electronic devices that we use in our daily lives, as well as in a variety of industrial application.

**Body**

Rare earth metals comprise seventeen chemical elements — anthanum, cerium, praseodymium, neodymium, promethium, etc. Despite their classification, most of these elements are not really “rare”. One of the Rare Earths, promethium, is radioactive. As essential and functional materials, rare earth elements have been named "**The Vitamins of Modern Industry**". In this regard, their applications can be seen from the following points –

1. The manufacturing of permanent magnets represents the single largest and most important end use for REMs, accounting for 38% of total forecasted demand.
2. Permanent magnets are an essential component of modern electronics used in cell phones, televisions, computers, automobiles, wind turbines, jet aircraft and many other products.
3. They are used as phosphors in many consumer displays and lighting systems, and are also used in fluid cracking catalysts and catalytic converters in the oil and automotive industries and medical industry.
4. Rare Earth metals are used in space shuttle components, jet engine turbines, and drones. Cerium, the most abundant Rare Earth element, is essential to NASA’s Space Shuttle Programme.
5. REE are also vital for many defence technologies, including precision guided munitions, targeting lasers, communications systems, airframes and aerospace engines, radar systems, optical equipment, sonar, and electronic counter measures.
6. Scandium is used in televisions and fluorescent lamps, and yttrium is used in drugs to treat rheumatoid arthritis and cancer.

According to the Rare Earth Technology Alliance (RETA), the estimated size of the Rare Earth sector is between $10 billion and $15 billion. In this regard, some issues with regards to its extraction can be seen from the following points –

- **Low Concentration:** Global rare-earth reserves are at more than 130 million metric tons. However, most of those reserves either are too low in concentration to be extracted economically, or they are not readily accessible, such as metals locked away in deep-sea manganese-based nodules or hydrothermal deposits.
- **Extraction Costs:** REMs are found in a variety of minerals, but not all are equally suitable for economic development. REMs are generally found in concentrations below what is economically viable for extraction at current prices using available technology.
- **Environmental factors:** Extraction and mining of rare earth metals involves similar land-use exploitation, environmental damage and ecological burden as any other mining operation. They are mined using extremely energy-intensive processes, spewing carbon emissions into the atmosphere and toxins into the ground.
- **Geopolitical Issues:** China is the world's largest producer of REEs, accounting for over 60% of global annual production, estimated at 132,000 tonnes for 2019. It withheld the supply of Rare Earths to Japan after their dispute over Senakaku Islands, which alerted the world to use of rare earths for geopolitical purposes.
- **Supply Monopoly:** China remains virtually the only producer of the valued heavy REMs. China imposed export restrictions on REE between 2010 and 2014, resulting in dramatic increases in REE prices during those years. This leads to uneconomical trends in other countries for rare earth extraction.
- China's intents of hegemony, non-solidarity with other nations does not augur well for the environment in general, as well as for geo-politics and global renewable energy usage and scenarios. Its intents on doing the same with its vast rare earth reserves will be detrimental.

**Way Forward –**

- Recycling of these rare earth metals for continuous usage for various technologies is a good option that can be considered.
- Diversifying the supply chain of Rare Earth Metals around the world, especially focusing on the same in India.

## Conclusion

Rare earths have become indispensable and, in many cases, irreplaceable components of materials that are essential in modern life. Thus the usage of these metals, which form a critical part of the renewable energy revolution should be handled with careful, sincere and cleaner measures if the way forward has to be greener and environment-friendly.

**18. With the help of suitable examples, discuss the applications of robotics in agriculture.**

**Approach**

Candidates are expected to write about use of robotics in agriculture and then with the suitable examples discuss the application of robotics in agriculture.

**Introduction**

Agriculture is quickly becoming an exciting high-tech industry technology it is developing rapidly, not only advancing the production capabilities of farmers but also advancing robotics and automation technology as we know it.

**Body**

Robotics in agriculture:

- An agricultural robot is a robot deployed for agricultural purposes. Agricultural robots automate slow, repetitive and dull tasks for farmers, allowing them to focus more on improving overall production yields.
- Harvesting and picking is one of the most popular robotic applications in agriculture due to the accuracy and speed that robots can achieve to improve the size of yields and reduce waste from crops being left in the field.
- Many agricultural robotic advancements use machine vision technology to avoid hazards, identify crops, and even determine if they are ready to be harvested.

Applications of the robotics in the agriculture:

- Weeding: Combatting weeds and making sure crops have room to grow is a constant struggle for farmers. For example Using computer vision and a variety of mechanical tools, the robot plucks out individual weeds instead of using chemicals.
- Spraying: Similar to manual weeding robots, smart sprayers are typically paired with computer vision cameras to identify weeds for targeted herbicide applications. For example Sophisticated systems can even identify specific plants and activate only the relevant application nozzles. This means less waste, reduced herbicide resistance, and more efficient application across fields.
- Picking: Strawberries, like many berries and tender fruits/veggies, demand a very intensive harvesting program. Harvesting these crops require a lot of labour and time, both of which are often in short supply. The harvest process is quite intense, and farmers often run short of workers due to the backbreaking nature of the harvest.
- Seeding: Automated drone seeders are mostly used in forestry industries right now, but the potential for more widespread use is on the horizon. They are also able to plant much more efficiently with a team of two operators and ten drones capable of planting 400,000 trees a day.

- Robotic Harvesting: The robotic system utilizes soft-touch robotics and a lidar sensing system to detect ripe apples, leaving out unripe fruits during the picking process. For example AI-enabled robots are being widely deployed on tomato farms in Japan, and have reduced the on-field labour time by 20%.
- Other applications: Nursery planting, crop analysis, animal husbandry, dairy farming, drone service, harsh terrain resilient farming etc.
- PAAMA Agrico under Made-in-India Agri-Equipments has designed the world-class soil titling blades used in rotovators and cultivators. It enables a Robot to weld blades enabling the precision function ensuring uniformity in production while facilitating repeatability function each time.
- GRoboMac indigenously developed Robot has been designed in such a way that the computerised vision detects and locates the precise 3D coordinates of the bloomed cotton from the images of the cotton plant. A robotic arm uses these coordinates to pick the cotton and the arm, then uses a vacuum for precision picking of cotton and avoids picking any other contaminant.

Shortcomings of such applications in India:

- It will also reshape the definition of farmworkers Substitution of technology may put farmers out of their jobs and render difficulties to the already suffering state of unemployment.
- The capital-intensive nature of Robotics. And high cost of procuring imported hardware components as well as training personnel.
- It runs on increasing further Inequality among small and large landowners.
- Loss of various traditional, yet effectively resilient methods suitable for Indian agriculture.

**Conclusion**

Embracing new technologies like robotic will be a key factor in the changing face of Indian agriculture. Therefore, any policy measure on this front needs to be carefully designed and implemented. It is important to consider all stakeholders and have collaborated measures in making robotics and other technologies in agriculture affordable sustainable and properly understood by the end users and the farmer.

**19. What are the potential applications of artificial intelligence in the field of medicine? Discuss.**

**Approach-** Question is straight forward. Candidate is required to give application of AI in medicine with the help of suitable examples and answer can be concluded with predicting use of AI in various fields.

**Introduction**

A broad spectrum of intelligent technologies like Artificial Intelligence has managed to penetrate into different industries in this information and technology-oriented era. Healthcare is no exception. It is witnessing the rapid integration of AI over a couple of years. According to a CB Insights Report, 86% of the life science companies, healthcare providers, and technology vendors are relying on Artificial Intelligence technologies. The healthcare systems will be spending $54 million on an average, on different AI projects.

**Body**

Potential applications of AI in medicine

1. Diagnose diseases
    - Machine Learning particularly Deep Learning algorithms– have recently made huge advances in automatically diagnosing diseases, making diagnostics cheaper and more accessible.
    - Machine Learning algorithms can learn to see patterns similarly to the way doctors see them. A key difference is that algorithms need a lot of concrete examples – many thousands – in order to learn.
    - So Machine Learning is particularly helpful in areas where the diagnostic information a doctor examines is already digitized. Detecting lung cancer or strokes based on CT scans.
    - Assessing the risk of sudden cardiac death or other heart diseases based on electrocardiograms and cardiac MRI images. Classifying skin lesions in skin images, Finding indicators of diabetic retinopathy in eye images.

2. Develop drugs faster
    - Developing drugs is a notoriously expensive process. Many of the analytical processes involved in drug development can be made more efficient with Machine Learning. This has the potential to shave off years of work and hundreds of millions in investments.
    - AI has already been used successfully in all of the 4 main stages in drug development-Identifying targets for intervention, Discovering drug candidates, Speeding up clinical trials, Finding Biomarkers for diagnosing the disease.
    - Machine Learning can speed up the design of clinical trials by automatically identifying suitable candidates as well as ensuring the

correct distribution for groups of trial participants. Algorithms can help identify patterns that separate good candidates from bad.

3. Personalize treatment
    - Different patients respond to drugs and treatment schedules differently. So personalized treatment has enormous potential to increase patients' lifespans. But it's very hard to identify which factors should affect the choice of treatment.
    - Machine Learning can automate this complicated statistical work – and help discover which characteristics indicate that a patient will have a particular response to a particular treatment. So the algorithm can predict a patient's probable response to a particular treatment.
    - The system learns this by cross-referencing similar patients and comparing their treatments and outcomes. The resulting outcome predictions make it much easier for doctors to design the right treatment plan.

4. Improve gene editing
    - Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR), specifically the CRISPR-Cas9 system for gene editing, is a big leap forward in our ability to edit DNA cost effectively – and precisely, like a surgeon.
    - Machine Learning models have been proven to produce the best results when it comes to predicting the degree of both guide-target interactions and off-target effects for a given sgRNA. This can significantly speed up the development of guide RNA for every region of human DNA.

**Conclusion**

AI is already helping us more efficiently diagnose diseases, develop drugs, personalize treatments, and even edit genes. But this is just the beginning. The more we digitize and unify our medical data, the more we can use AI to help us find valuable patterns – patterns we can use to make accurate, cost-effective decisions in complex analytical processes.

**20. How do cryptocurrencies work? What are the issues with their regulation? Comment.**

**Approach**

Explain the working of cryptocurrencies. Also mention issues with their regulations. Comment means you have to give your views and support them with evidence.

**Introduction**:

Cryptocurrency is a kind of digital money that is designed to be secure and, in many cases, anonymous. It is a currency associated with the internet that uses cryptography, the process of converting legible information into an almost uncrackable code, to track purchases and transfers.

**Body:**

**How do cryptocurrencies work?**

- Cryptocurrencies use decentralized technology to let users make secure payments and store money without the need to use their name or go through a bank.
- They run on a distributed public ledger called block chain, which is a record of all transactions updated and held by currency holders.
- Units of cryptocurrency are created through a process called mining, which involves using computer power to solve complicated math's problems that generate coins.
- Users can also buy the currencies from brokers, then store and spend them using cryptographic wallets.

**Issues with their regulations:**

- There are big concerns about digital coins as a source of fraud. They are also entirely unregulated and some are open to market manipulation.
- Speculators who buy digital coins should be aware they could lose all their money.
- While Bitcoin is decentralized, it is highly volatile at the same time.
- One of the most common practical uses of cryptocurrency is to finance illegal activities, such as buying illegal goods on the dark web.
- Many black market internet stores accept payments in cryptocurrency because they can be highly anonymous and do not require cash to change hands.
- Hackers have taken advantage of digital coins and can target exchanges and accounts, in one case crashing one of the world's largest cryptocurrency exchanges.

**Conclusion:**

Cryptocurrencies are known for being secure and providing a level of anonymity. Transactions in them cannot be faked or reversed and there tend to be low fees. Their decentralized nature means they are available to everyone, although they can be complicated to set up and few stores accept them for spending.

**21. What are sounding rockets? How do they function? Discuss their applications.**

**Approach:**

Question is very simple and straight forward in its approach students are expected to write about sounding rockets their functioning and applications with proper explanation.

**Introduction:**

Sounding rockets take their name from the nautical term "to sound," which means to take measurements. Since 1959, NASA-sponsored space and earth science research has used sounding rockets to test instruments used on satellites and spacecraft and to provide information about the Sun, stars, galaxies and Earth's atmosphere and radiation.

**Body:**

These rockets are basically divided into two parts: a solid-fuel rocket motor and a payload. Many of the motors used in sounding-rocket programs are surplus military motors, which keep down the cost of the rocket. The payload is the section that carries the instruments to conduct the experiment and sends the data back to Earth. These rockets produce higher-quality microgravity conditions for longer periods than airplanes, or drop towers, and tubes. An experiment is placed on the rocket, which is launched and then allowed to free-fall back to Earth.

**Functioning and applications-**

- A sounding rocket follows a parabolic arc, like the aircraft, but goes above the Earth's atmosphere, where air drag does not disturb microgravity conditions. The typical flight profile of a sounding rocket is the following: subsequent to a launch and as the rocket motor uses up its propellants it separates from the vehicle; the payload continues into space after separation from the motor and begins conducting the experiments; when the experiments are completed, the payload re-enters the atmosphere and a parachute is deployed, bringing the payload gently back to Earth; the payload is then retrieved (by retrieving the payload a considerable saving can be achieved because the payload or parts of the payload and experiments can be refurbished and flown again).
- The main difference between a sounding rocket and an orbital launch vehicle is the velocity reached. In fact, a sounding rocket does not reach the velocity (in terms of (km/s)) needed to go into orbit, and after achieving the maximum altitude comes back to Earth.
- The experiments experience several minutes of microgravity before the rocket re-enters the atmosphere. Acceleration levels are usually around 10−5 g.
- Therefore, sounding rockets provide a reasonably economical means of conducting engineering tests for instruments and devices used on satellites

and other spacecraft, prior to their use in more expensive activities. Also, because of their low cost and short mission lead time, they are valuable tools for undergraduate and graduate students conducting research in the microgravity environment.

- They also serve as easily affordable platforms to test or prove prototypes of new components or subsystems intended for use in launch vehicles and satellites. With the establishment of the Thumba Equatorial Rocket Launching Station (TERLS) in 1963 at Thumba, a location close to the magnetic equator, there was a quantum jump in the scope for aeronomy and atmospheric sciences in India.
- ISRO started launching indigenously made sounding rockets from 1965 and experience gained was of immense value in the mastering of solid propellant technology. In 1975, all sounding rocket activities were consolidated under the Rohini Sounding Rocket (RSR) Programme. RH-75, with a diameter of 75mm was the first truly Indian sounding rocket, which was followed by RH-100 and RH-125 rockets. The sounding rocket programme was the bedrock on which the edifice of launch vehicle technology in ISRO could be built. It is possible to conduct coordinated campaigns by simultaneously launching sounding rockets from different locations. It is also possible to launch several sounding rockets in a single day.

**Conclusion:**

Not only are sounding rocket missions carried out at very low cost, but also the payload can be developed in a very short time frame -- sometimes as quickly as 3 months. This rapid response enables scientists to react quickly to new phenomena (such as observing the Shoemaker-Levy comet impact to Jupiter) and to incorporate the latest, most up-to-date technology in their experiments.

**22. What are the factors that have contributed towards India's global leadership role as the vaccine capital? Discuss.**

**Approach-** Candidate is expected to highlight the role of India in vaccine supply to the world. With the help of data and examples, the future of India's vaccine market can be shown.

**Introduction**

The Indian vaccine market, which has carved out a place for itself at the global level, is expected to reach a valuation of Rs 252 billion by 2025. The Indian market size was Rs 94 billion in 2019. Two coronavirus vaccine candidates, out of a total 11 worldwide, are from India.

**Body**

What are the factors behind?

- India currently is one of the leading manufacturers and suppliers of vaccines in the world. It solely accounts for around 60% of the total vaccines supplied to the UNICEF.
- Over the years, India has emerged as one of the leading manufacturers of vaccines worldwide, and supplies large quantities of basic and advanced vaccines across the globe. Currently, more than two thirds of the total volume of the vaccines manufactured is exported while the rest is utilised domestically.
- One of the major drivers of the Indian vaccine market is the strong government support to the manufacturers. Steady government funding and successful initiatives have resulted in considerable market development over the years.
- One of the primary forces that is stimulating the market growth is the increasing investments in research and development (R&D) by government funding agencies like the Department of Biotechnology, the Indian Council of Medical Research, and the Ministry of Health and Family Welfare.
- Some of the other factors positively influencing the market growth are increasing population, elevating incomes, improving cold chain logistics and active NGO participation.
- The launch of the Universal Immunization Program (UIP) aimed at increased immunization coverage against vaccine preventable diseases in the country, has also significantly added to the market growth.
- With advancement in technology, the vaccine production capacity along with cold chain storage facilities have also been improved. Besides this, the advent of a number of privately owned firms in India have positively transformed the industry.
- These firms have been making efforts to bring low cost solutions and are increasingly shifting their focus on innovation so as to increase their

revenues. Owing to these factors, India has emerged as a global vaccine manufacturing hub.

- The cost of manufacturing and clinical trials in India is relatively lower than in developed countries.
- Indian vaccines have shown less side effects and are low cost and are easier to store and transport.
- Looking forward, the Indian vaccine market value is projected to reach INR 252 Billion by 2025, expanding at a CAGR of 17.8% during the forecast period (2020-2025).
- Some of the major vaccines being developed are Bacillus Calmette–Guérin (BCG), Haemophilus influenzae type b (Hib), Influenza, Varicella, Typhoid, Japanese Encephalitis, Measles, Tetanus Toxoid, Hepatitis A, Rubella, Diphtheria, Tetanus and Pertussis (DPT), Oral Polio Vaccine (OPV), Measles, Mumps and Rubella (MMR), Rotavirus, Hepatitis B, Pneumococcal, Meningococcal, Rabies, Human Papillomavirus (HPV), Hexavalent and Dengue.

**Conclusion**

India is a leading force in vaccine development. India has exported more vaccines than the total vaccination at home. With robust infrastructure and government support, India has become a vaccine capital of the world. India is competing with china but with the help of soft diplomacy, India can play a major role in streamlining the vaccine supply to the world.

## 23. What were the key objectives of the Chandrayaan mission? What were the key learnings from the project?

### Approach

Mention the objectives followed by the key learning of the mission.

### Introduction

Initial indications are that the premature end to India's Chandrayaan-1 lunar orbiter mission was the result of a miscalculation by scientists at the Indian Space Research Organisation (ISRO) of the thermal stresses the spacecraft would encounter in its operating environment.

### Body

**The key objectives of the Chandrayaan mission:**

- The Chandrayaan-1 mission performed high-resolution remote sensing of the moon in visible, near infrared (NIR), low energy X-rays and high-energy X-ray regions.
- One of the objectives was to prepare a three-dimensional atlas (with high spatial and altitude resolution) of both near and far side of the moon.
- It aimed at conducting chemical and mineralogical mapping of the entire lunar surface for distribution of mineral and chemical elements such as Magnesium, Aluminium, Silicon, Calcium, Iron and Titanium as well as high atomic number elements such as Radon, Uranium & Thorium with high spatial resolution.
- Various mission planning and management objectives were also met. The mission goal of harnessing the science payloads, lunar craft and the launch vehicle with suitable ground support systems including Deep Space Network (DSN) station were realised, which were helpful for future explorations like the MOM.
- Mission goals like spacecraft integration and testing, launching and achieving lunar polar orbit of about 100 km, in-orbit operation of experiments, communication/ telecommand, telemetry data reception, quick look data and archival for scientific utilisation by scientists were also met.

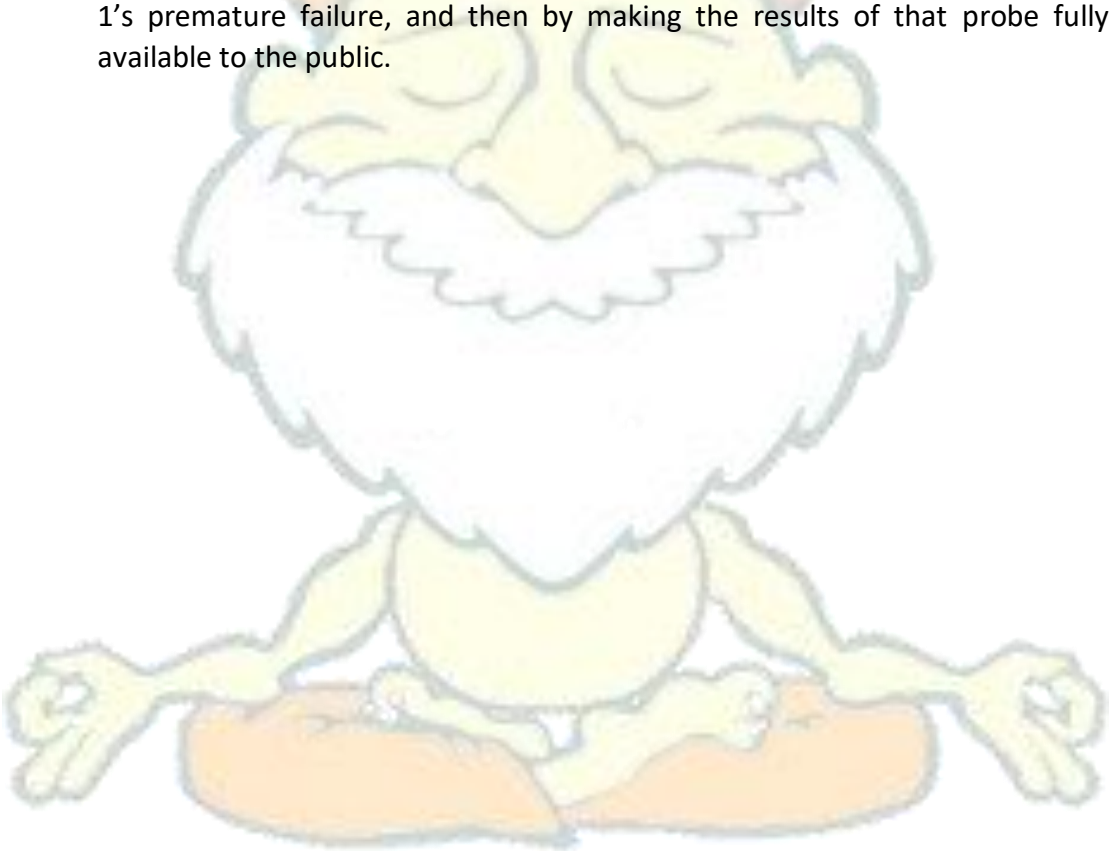
**Key learnings from the project:**

- The technical error that ultimately doomed Chandrayaan-1 likely could have been avoided given all that has been learned about the lunar-orbit environment through measurements taken by NASA and other space agencies dating back to the 1960s.
- The experience will inform ISRO's future planetary endeavors, just as NASA has had to learn from past mistakes like the measurement-conversion error that led to the Mars Climate Orbiter failure a decade ago this month.

- Hopefully, ISRO also has learned something about managing the disclosure of information about civilian space missions, particularly those involving international partners, even if the news is bad. Unfortunately, Chandrayaan-1 stands out as an example of how not to do it.
- In announcing that Chandrayaan-1's orbit had been raised to 200 kilometers, for example, ISRO said the probe's primary mission had essentially been completed and couched the maneuver as a means of carrying out additional studies. No mention was made of the overheating problem that appears to have been the actual reason for the maneuver.

**Conclusion**

- ISRO demonstrated its ability to lead an international mission with Chandrayaan-1, and is collaborating with Russia on a follow-on mission that will include a lander and rover. Part of the responsibility that comes with such a leadership role is being forthright and up front with details when things go wrong. ISRO can and should do better. It can start by including representatives of its partner agencies in the investigation of Chandrayaan-1's premature failure, and then by making the results of that probe fully available to the public.



**24. Discuss the geopolitics of the Suez Canal during the aftermath of WWII.**

**Approach:**

Question is straight forward in its approach students are expected to write about Suez canal and geopolitics arising out of it during the aftermath of WWII. Also it is important to give a brief about geography of Suez canal in the introduction of the answer.

**Introduction:**

The Suez Canal is an artificial sea-level waterway running north to south across the Isthmus of Suez in Egypt to connect the Mediterranean Sea and the Red Sea. The canal separates the African continent from Asia, and it provides the shortest maritime route between Europe and the lands lying around the Indian and western Pacific oceans. It is one of the world's most heavily used shipping lanes. The canal is extensively used by modern ships , as it is the fastest crossing from the Atlantic Ocean to the Indian Ocean .Tolls paid by the vessels represent an important source of income for the Egyptian government. The Canal runs between Port Said harbor and the Gulf of Suez , through soils which vary according to the region. At Port Said and the surrounding area, the soil is composed over thousands of years of silt and clay sedimentations deposited by the Nile waters drifted by Damietta branch.

**Body:**

**Geopolitics of Suez canal during the aftermath of WWII-**

- Colonel Gamal Abdel Nasser, one of the participants at the conference of non-aligned African and Asian countries held in Bandung in 1955, was seeking to unify the Arab world around Egypt, of which he became President in June 1956. In order to stimulate the economic and agricultural transformation of the country, he planned the construction of a huge dam at Aswan, but the United States, despite seeing Nasser as a preferable alternative to communism, refused to contribute to the enormous building costs. So on 26 July 1956, Nasser announced his intention to nationalise the Suez Canal Company. The majority of shareholders in this internationally vital waterway were French and British, and their concession was not due to expire until 1968. For Nasser, the revenue from operating the canal was necessary to allow Egypt to finance the building of the Aswan Dam.
- France, angered by the aid given by Egypt to the Algerian rebels, and Britain, which wanted to maintain its control over the strategically important Suez passage, decided to launch a joint military attack with a view to regaining control over the administration of the canal. They were supported militarily by Israel — a state that since its creation in 1948 had felt directly threatened by any hint of Arab expansionism or reinforcement. Moreover, Nasser had never stopped proclaiming his desire to destroy Israel. On 29 October 1956, Israeli forces took the Sinai Peninsula, a vital area for the protection of the

Jewish state. One week later, Anglo-French troops disembarked in Port Said. The operation was entirely successful — the Egyptian army was defeated in a few days, even though Nasser had ordered the sinking of some forty ships in order to block the Suez Canal completely.

- However, the world powers did not appreciate the actions of France and Britain in the slightest. The Soviet Union, which was in the process of forcibly putting down the insurrection in Hungary, threatened Paris and London with nuclear reprisals. For their part, the United States, despite being traditional allies of the European powers, complained that they had not been consulted beforehand. They did not appreciate this kind of neo-colonial gunboat diplomacy at all, and exerted enormous financial pressure on the United Kingdom through the United Nations — so much so that the Anglo-French force had to withdraw despite its military success. Israel also evacuated Sinai. The UN took on the task of repairing the Suez Canal, which was reopened to shipping in April 1957. In the meantime, Nasser had ordered the destruction of several oil pipelines, meaning that Western European countries faced their first cuts in fuel supplies.
- The upshot of all this was that Nasser, boosted by his political and diplomatic victory, enjoyed immense prestige in the Arab world. He exploited to the full his image as the victim of an imperialist plot. The European powers were forced to recognise once and for all that they were not world powers and that their role on the international stage could not be more than that of supporting the United States. Indeed, it became difficult for them to pursue an independent policy on the world stage. Their influence in the Middle East became almost non-existent. The Suez Crisis therefore ended in a moral defeat and a diplomatic fiasco for the former colonial powers, while Colonel Nasser consolidated his position as defender of the Arab cause and champion of decolonisation.
- Today, nearly a decade on from the beginning of the Arab Spring, things have changed. It has become necessary for states across the region to reassert themselves and seek to restore stability and economic development. Key to this process will be economic cooperation within the bounds of power politics in two leading geographical areas of the Middle East and North Africa (MENA) region: the Red Sea and the Eastern Mediterranean.
- Both “Saudi Vision 2030” and “Egyptian Vision 2030” place great emphasis on the optimum economic utilization of the Red Sea area, inclusive of the Red Sea’s waters, coastlines, and islands, with all the touristic and mineral resources the sea offers and its potential to serve as a multidimensional bridge between the Arabian Peninsula and Egypt. In fact, Saudi Vision 2030 views the bridge as a means to bolster the Saudi geo-strategic position by extending it to the Eastern Mediterranean via the Suez Canal. It was no coincidence that the agreements signed during the visit by the Saudi monarch to Cairo in April 2016 included a $1.5 billion Sinai development project and a plan to build a King Salman Mosque in Ras Sudr on the eastern shore of the Gulf of Suez.

**Conclusion:**

About 12% of world trade passes through the canal each year, everything from crude oil to grains to instant coffee. Without Suez, a supertanker carrying Mideast crude oil to Europe would have to travel an extra 6,000 miles around Africa's Cape of Good Hope, adding some $300,000 in fuel costs (although there would be savings from avoiding the Suez passage tolls, which can run hundreds of thousands of dollars.) Because it has no locks, it can even handle aircraft carriers. With this the geostrategic importance of Suez canal has become even more significant which the world powers has realised since the Suez crisis of 1956.

**25. The Development Finance Institution holds the potential to give the much needed stimulus to the infrastructure sector. Comment.**

**Approach:**

Students are expected to follow the directive properly and highlight the potential of development finance institution for infrastructure sector by providing detailed explanation to the points.

**Introduction:**

Development finance institutions are specialized institutions set up primarily to provide development/ Project finance especially in developing countries. These DFIs are usually majority-owned by national governments. The source of capital of these banks is national or international development funds. This ensures their creditworthiness and their ability to provide project finance in a very competitive rate.

**Body:**

In India, the first DFI was operationalised in 1948 with the setting up of the Industrial Finance Corporation (IFCI). Subsequently, the Industrial Credit and Investment Corporation of India (ICICI) was set up with the backing of the World Bank. The Industrial Development Bank of India (IDBI) came into existence in 1964 to promote long-term financing for infrastructure projects and industry.

**Need of Development finance Institutions in India-**

- According to the estimates of a recent report – India will require a whopping Rs 50 trillion (US$ 777.73 billion) in infrastructure by 2022 for sustainable development in the country. It is also showcasing a myriad of opportunities for foreign investors to invest in the country's infrastructure development.
- A DFI differs from a commercial bank in that its mandate balances positive development outcomes with profit maximization, often prioritizing the former over the latter. It typically provides necessary financing for activities that are in the realm of public good, but are not lucrative from a financial risk-return perspective, such as environmental projects, long gestation greenfield infrastructure projects and even supporting innovative startups.
- Theoretically, the establishment of a DFI could be justified by the dual existence of massive infrastructure needs and availability of bankable projects.
- The establishment of such an institution is considered as a positive step as banks do not have the long-term funds to finance such projects.
- Banks cannot afford to lend for such projects because that would shrink their lending capacity as the funds get locked up in such projects for that time period.

- Health of banks has been a cause of concern for policy makers because of rising NPAs and the impact of COVID-19 pandemic has made the establishment of specialised infrastructure financing institutions important.
- Successful completion of infrastructure projects is capital intensive and requires a massive capital inflow. The most crucial strategy to stimulate growth in the sector is an effective deployment of capital resources by the government.
- Any sector that needs a strong push needs to identify the roadblocks and come up with a solution for its progress. In the infrastructure industry, one of the biggest hurdles is incomplete projects. These are usually left for too long in the last stage of development and the completion of them would make way for new projects as well as provide support for them. This case is evident especially with physical infra projects such as roadways and railways. Focus on physical infrastructure projects will make the movement of resources easier and also provide aid to logistics.

**Conclusion:**

India needs DFI's to boost economic growth which would increase capital flows and energize capital markets. To improve long term finances, provide credit enhancement for infrastructure and housing projects. As India does not have a development bank, DFI would fulfil the need for us to have an institutional mechanism.

**26. Has India's rail infrastructure been sufficiently utilised to create an integrated transportation network for agricultural produce? Comment. What are the constraints and potential on this front? Examine.**

**Approach**

The question given has two parts and students are expected to address each part equally. In the first part demand of the question is, has rail infrastructure been sufficiently used to create an integrated transportation network for agricultural produce both positive and negative views need to be given as the directive given is comment. In the second part students are expected to mention constraints and potential of the railway infrastructure in transporting agri produce.

**Introduction**

Indian Railways is among the world's largest rail network, and its route length network is spread over 1,23,236 kms, with 13,523 passenger trains and 9,146 freight trains, plying 23 million travellers and 3 million tonnes (MT) of freight daily from 7,349 stations. India's railway network is recognised as one of the largest railway systems in the world under single management. Indian farmers incur Rs 92,651 crore per year in post-harvest losses, the primary causes of which are poor storage and transportation facilities. There are scarce transport facilities because only a small number of villages are joined by railways and pukka roads to mandi's. As a result, farmers carry their produce to Mandi on either bullock carts or other such means.

**Body**

**Has rail infrastructure been sufficiently used? –**

- The movement of food grains has regularly used railways wagons and is an ongoing intervention on freight trains. Since majority of shipments are undertaken by FCI, bulk handling is possible. To compete with roadways and to bring more idle rolling stock into use, railways also developed discounts and incentives for carriage of food grains.
- The agricultural trade, especially in case of perishable commodities, faces a perpetual shortage of time, once the produce is harvested. The agri-logistics of such produce has to resort to technologies such as precooling and cold-chain to enhance the marketable or holding life of the perishable goods because of lack of market access in the normal lifespan of the produce. On the other hand, assured connectivity to market centres is not possible until a certain economy of scale is generated from a single commercial entity.
- Indian farmers incur Rs 92,651 crore per year in post-harvest losses, the primary causes of which are poor storage and transportation facilities. Ironically, according to the high-level Dalwai committee report , an investment of Rs 89,375 crore—a figure marginally lower than the annual

post-harvest losses—is all it takes to improve the state of storage and transportation facilities for food crops.

- Since a market is the primary medium for farmers to exchange their produce for money, lack of logistics connectivity to ensure that their harvest reaches markets in time results in lowering of the farmers' ability to monetise their produce. This becomes even more critical in case of perishable fruits and vegetables.
- At the all-India level, the proportions of the produce that farmers are unable to sell in the market are 34 per cent, 44.6 per cent, and about 40 per cent for fruits, vegetables, and fruits and vegetables combined," finds the committee on Doubling of Farmers' Income. This means, every year, farmers lose around Rs 63,000 crore for not being able to sell their produces for which they have already made investments.
- Although this seems to be a good show on the state of cold storage in the country, but it should be underlined that the existing cold storage capacity is confined mostly to certain crop types and not integrated with other requirements. In fact, close to only 16 per cent of the target set for creating integrated pack-houses, reefer trucks, cold storage and ripening units has been met. This means, there is an overall gap of about 84-99 per cent in achieving the target on improving the state of storage and transportation of the farm produce. Out of these, the country is far-far behind in meeting the requirement of integrated pack-houses, reefer trucks and ripening units.

**Use of rail infrastructure and initiatives in this regard –**

- Budget 2020 has provided for the implementation of Kisan rails across the country with an intent to boost farmers' welfare by doubling their incomes by 2022.
- The most important among them is the robust network of Indian railways, which cuts through the remotest villages of the country and has helped small farmers get an opportunity to connect to the mainstream market and sell their agricultural produce. Second, the government has allowed a 50 percent subsidy for the transportation costs of fruits and vegetables, thereby, making it economically viable for farmers to transport their produce through the railways rather than the conventional roadways. The Kisan Rails, on an average, save up to 15 hours of travel time and cuts the transportation cost by 1,000 rupees per tonne.
- Further, no minimum price or quantity requirement is set for farmers' consignment, facilitating even the small farmers with lesser quantity of produce to reach the bigger markets. These farmers — who often could not afford the roadways and were cut off from the larger markets owing to logistical and cold storage issues — now find an alternative in the veritable cold storage on the wheels (Kisan Rails).
- Kisan Rails is a step ahead towards transforming the traditional practices of purchase and sale of agricultural produce and exploring new possibilities in agriculture. Further, on the one hand, India today stands as the world's

second largest producer of fruits and vegetables; on the other, it has also been the country that wastes 16 percent of its agricultural produce owing to factors like inadequate logistical support, lack of cold storage facilities, supply chain bottlenecks, and under-developed market channels. The monetary worth of this wastage stands at around US$ 8.3 billion and it uses more than 230 cubic kilometers of water, which is enough to provide drinking water to 100 million people annually. The introduction of Kisan Rails has helped tremendously in reducing wastage, providing a cheaper and safer transport mode, and thereby creating a win-win situation for both the farmers and railways. The Kisan Rails, apart from directly impacting the lives and livelihoods of farmers, have also additionally helped changing smaller railway stations into major farm produce loading hubs. Kisan Rails is emerging as a profitable model for all the stakeholders involved in the process.

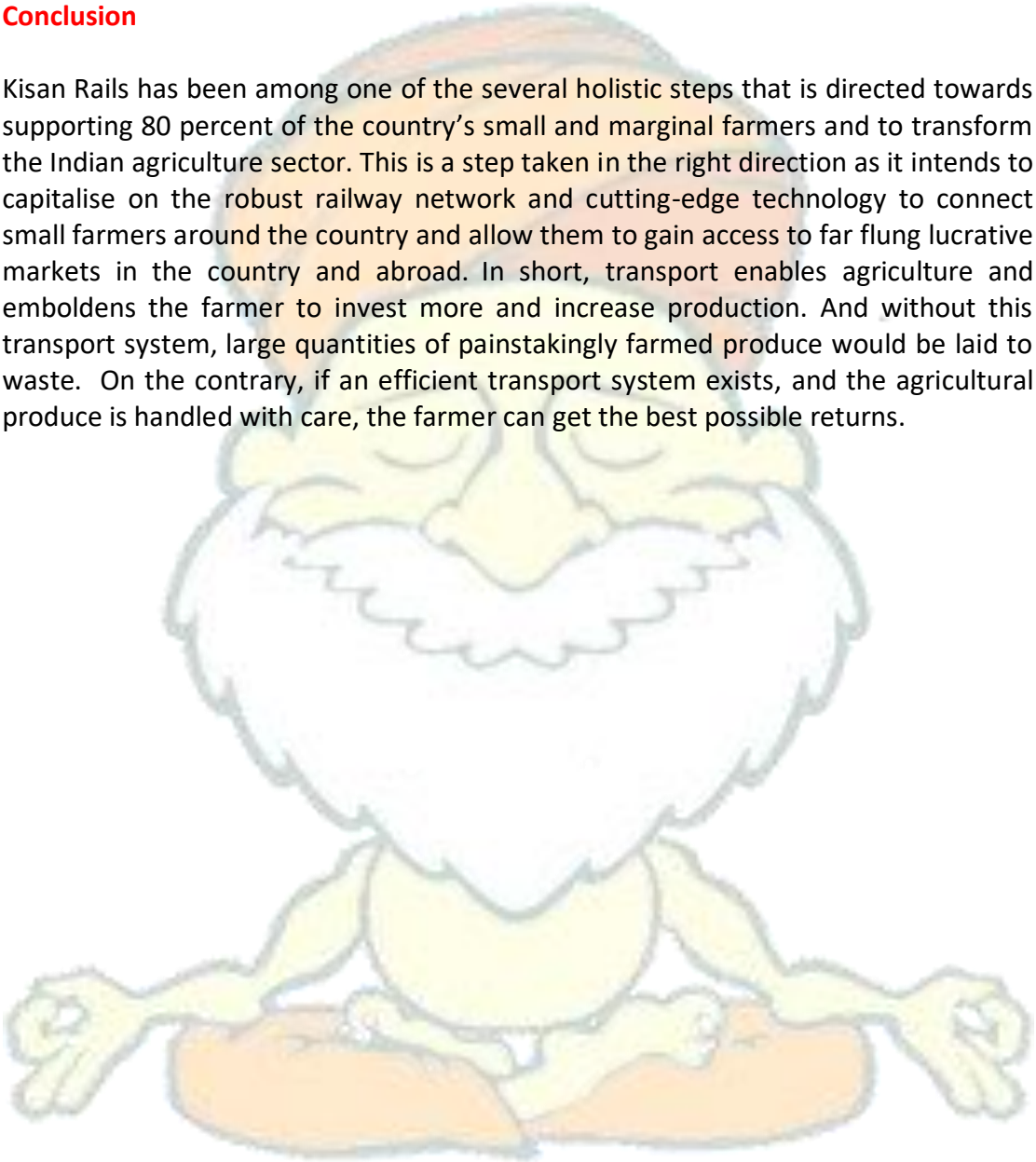
**Constraints and potential –**

- Lengthy exercise that farmers need to undergo if they want their produce to be transported through the Kisan Rails. The product is handled in their crates at least six times — at the farm, at the source station, while loading it to the train at the source, unloading at the source, at the destination station, and finally at the mandi, resulting in increased chances of wastage of the produce. Efforts to streamline this lengthy exercise could be an instrumental step towards bringing in more traffic for the Kisan Rails.
- Secondly, the cold storage facility in the country needs to significantly improve and more and more stations must have cold storage facilities to maximise the potential of Kisan Rails.
- Overcrowded rail infrastructure makes less apace available for allowing specialized trains to operate on regular basis thus creates another challenge of increasing dedicated agri transport services.
- Cost of rail transport also is high compared to road and other means of transport thus acts a disincentivising factor for the farmers to opt for the rail services to transport their produce to the mandis.
- Railways can play an important role in the coming second green revolution, wherein railheads can locate the modern produce collection centres (or be linked to the same), maintain certain floating stock of containers dedicated for food cargo and to be the backbone to the Unified National Agricultural Markets. Railways not only speeds up the logistics connectivity, which is important in case of perishables, it also covers larger distances which is key to achieving improved value realisation for farmers.
- Indian Railways with its pan-India network is the optimal and preferred choice for Hortiproduce movement. Yet, this burgeoning demand is not fully tapped or planned for in full.
- Assured income from logistics service from agri-hubs. Any producer with efficient and easy access to rail transport will rarely opt for long haul roadways transportation.

- The ability to use railways to cover longer distances in shorter times, empowers farmers by allowing them to expand their market reach. While existing trade into local markets will continue, the amount that is surplus to localised demand can be connected to consumers farther away thereby mitigating loss and increasing recovery from surplus. Otherwise the surplus produced is incurred as total waste.

**Conclusion**

Kisan Rails has been among one of the several holistic steps that is directed towards supporting 80 percent of the country's small and marginal farmers and to transform the Indian agriculture sector. This is a step taken in the right direction as it intends to capitalise on the robust railway network and cutting-edge technology to connect small farmers around the country and allow them to gain access to far flung lucrative markets in the country and abroad. In short, transport enables agriculture and emboldens the farmer to invest more and increase production. And without this transport system, large quantities of painstakingly farmed produce would be laid to waste. On the contrary, if an efficient transport system exists, and the agricultural produce is handled with care, the farmer can get the best possible returns.



**27. To make agriculture the growth engine for rural India, the involvement of the public sector is a must. Do you agree? Critically examine.**

**Approach**

Candidates are expected to write about agriculture growth in India and then critically examine about involvement of public sector to make agriculture the growth engine for rural India.

**Introduction**

Agriculture continues to be a prime pulse of the Indian economy and is at the core of socio-economic development of the country. It accounts for around 19 per cent of GDP and about two-thirds of the population is dependent on the sector. Indian agriculture has both public and private sector involvement.

**Body**

Public sector in agriculture is crucial for building necessary infrastructure and investment let us examine how public sector involvement sets a growth engine for rural economy in India.

- Public sector intervention needed in agriculture especially in rural economy to achieve the goal price stability at the time of bumper harvest or below normal production and provide a guaranteed price to producer farmers. Public sector organisations also supply food to vulnerable and poor sections at a lower price.
- The role of infrastructure is crucial for agriculture development in rural India and for taking the production dynamics to the next level. It is only through the development of infrastructure, especially at the post-harvest stage that the produce can be optimally utilized with opportunity for value addition and a fair deal for the farmers.
- To make strengthen growth of rural economy NABARD is facilitating Rs 1 lakh crore finance for funding Agriculture Infrastructure Projects at farm-gate and aggregation points like Primary Agricultural Cooperative Societies, Farmers Producer Organizations, Agriculture entrepreneurs, Startups, etc.
- Local initiative rural level for building community infrastructure, like water harvesting, canal irrigation network, huts for community market centers etc. may generate employment opportunities in this way public sector can revitalise growth engine of rural economy.
- One of the important objectives of public sector is to protect the interest of poor and marginal farmers by abolishing intermediaries through land reforms expanding institutional credit support to poor farmers etc. Credit supply will set growth for rural market economy.
- Government investment to promote agricultural research and training facilities and to percolate the fruits of such research among the rural farmers

by establishing a close linkage between research institutions and rural farmers can be beneficial.

However these central and state government initiatives and subsidies are concentrated on a few crops and still too heavily subsidised in favour of the big players therefore there is need to diversify the source of investments.

- Involvement should be encouraged from private investment in agriculture it is made either for augmenting productivity of natural resources or for undertaking such activities, which supplement income sources of farmers. Private sector investment includes investments made by private corporates and households.
- The corporate sector investment includes investment by organised corporate bodies like big private companies and unorganised entities like sugar co-operatives and milk co-operatives.
- The household sector investment comprises investment on farm equipments, machinery, irrigation, land improvement and land reclamation. With about 90 per cent share, households dominate the private investment scene. These investments enable farmers to grow existing crops more productively and intensively and take up non-conventional/high value crops.
- The public investment in agriculture has been declining and is one of the main reasons behind the declining productivity and low capital formation in the agriculture sector. With the burden on productivity-driven growth in the future, this worrisome trend needs a reversal.
- Technological innovation by Private agribusiness companies are at the forefront of heavy investment in agricultural R&D and technological innovation. Eg: Trithi Robotics uses drone technology to allow farmers to monitor crops remotely.
- Private player also lead in seed treatment, agricultural chemicals, biologicals, plant growth regulation, animal genetics and health, biofuels, machinery, irrigation, soil analysis and data-intensive precision farming tools.
- The private sector's milk processing capacity grew steadily since deregulation, and in 2012-2013 was 70 percent greater than that of cooperatives.
- Sales of the private processing sector and food services industry are growing rapidly. Performance and market shares of the formal food processing industry exceed those of the more traditional "unorganized".

**Conclusion**

The idea is to modernise the agriculture sector through conscious investments and bring down the ICOR and thereby allow the agriculture sector to perform well like industrial sector. Investment in agriculture, the prime mover needs to be accelerated to achieve the desired level of growth of over 4 per cent per annum and 5 trillion economy in future.

**28. What are the potential strategic implications of artificial intelligence? Discuss.**

**Approach**

As the derivative is discuss so it necessitates a debate where reasoning is backed up with evidence to make a case for and against an argument and finally arriving at a conclusion.

**Introduction**

An AI Strategy defines your AI priorities, goals, milestones, mission, and vision. An AI Strategy focuses on the AI implementation of technology goals while a business strategy focuses on the execution of corporate goals. AI Strategies are being used in corporations around the world and are taking the world by storm. From self-driving cars to health biometrics - from predictive equipment failure to Netflix algorithms - the impact of AI is rippling across an expanding range of industries.

**Body**

**POTENTIAL STRATEGIC IMPLICATIONS OF ARTIFICIAL INTELLIGENCE –**

- Artificial intelligence can dramatically improve the efficiencies of our workplaces and can augment the work humans can do.
- When AI takes over repetitive or dangerous tasks, it frees up the human workforce to do work they are better equipped for—tasks that involve creativity and empathy among others.
- Although it could take a decade or more to perfect them, autonomous cars will one day ferry us from place to place.
- AI powered robots work alongside humans to perform a limited range of tasks like assembly and stacking, and predictive analysis sensors keep equipment running smoothly.
- In the comparatively AI-nascent field of healthcare, diseases are more quickly and accurately diagnosed, drug discovery is sped up and streamlined, virtual nursing assistants monitor patients and big data analysis helps to create a more personalized patient experience.
- Textbooks are digitized with the help of AI, early-stage virtual tutors assist human instructors and facial analysis gauges the emotions of students to help determine who's struggling or bored and better tailor the experience to their individual needs.
- Journalism is harnessing AI, too, and will continue to benefit from it. Bloomberg uses Cyborg technology to help make quick sense of complex financial reports.
- Last but hardly least, Google is working on an AI assistant that can place human-like calls to make appointments at, say, your neighbourhood hair salon. In addition to words, the system understands context and nuance.

Already much has been made of the fact that AI's reliance on big data is already impacting privacy in a major way. as is the case with most emerging technology, there is a real risk that commercial and state use has a detrimental impact on human rights. However, if implemented responsibly, AI can benefit society.

**Conclusion**

One may think that AI systems will likely achieve superhuman performance in more and more domain-specific tasks, but not across all domains at the same time, which makes it a gradual process rather than an intelligence explosion. But of course, one cannot justify high confidence in these views given that many experts disagree. One of the absolute prerequisites for AI to be successful in many areas is that we invest tremendously in education to retrain people for new jobs. More generally, one of the best ways to handle pervasive uncertainty may be to focus on "meta" activities such as increasing the influence of effective altruists in the AI community by building expertise and credibility. This is valuable regardless of one's views on AI scenarios."