

**Education for Sustainable Development  
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**Lecture - 27  
ESD for Food Security (Contd.)**

Hello viewers, welcome back to this course on Food Security we are discussing about ESDs role in food security.

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The slide features the IIT Kharagpur logo in the top left corner. The background is a light beige color with a faint, repeating pattern of hands holding a globe. The main content consists of four bullet points in green text. In the bottom right corner, there is a circular inset image of Prof. Atasi Mohanty, a woman with glasses wearing a colorful patterned shawl.

- **Drip irrigation** and solar panels for electricity generation will lead to the **conservation of natural resources**.
- **Investment is needed** for the development and distribution of **climate-resilient crops** that can handle temperature variation and precipitation fluctuations.
- It is crucial to reconsider **providing subsidies for certain crops** as they are having an adverse impact on the natural resources.
- Given the risks associated with farm incomes, the **government must continue rendering support in the form of agricultural credit, subsidies on inputs and disaster relief along with micro-insurance** for crop, weather and livestock.

So, we are the discussing about the poverty then what are the drawbacks of you know lack of jobs and pandemic effects so many things we are talking about. So, to just to recapitulate all the things, now how can we enhance our food security? So, there are so many techniques that we have already discussed. Now, another techniques as we can see that is the drip irrigation, drip irrigation and solar energy panels.

So, these can these two things can also lead to the conservation of the natural resources especially in the field of agriculture and food security so on. However, more and more investment is also required to be given.

So, investment is needed so as to enhance the distribution of you know climate resilient crops to deal with the temperature variation, to deal with any kind of climatic fluctuations etcetera.

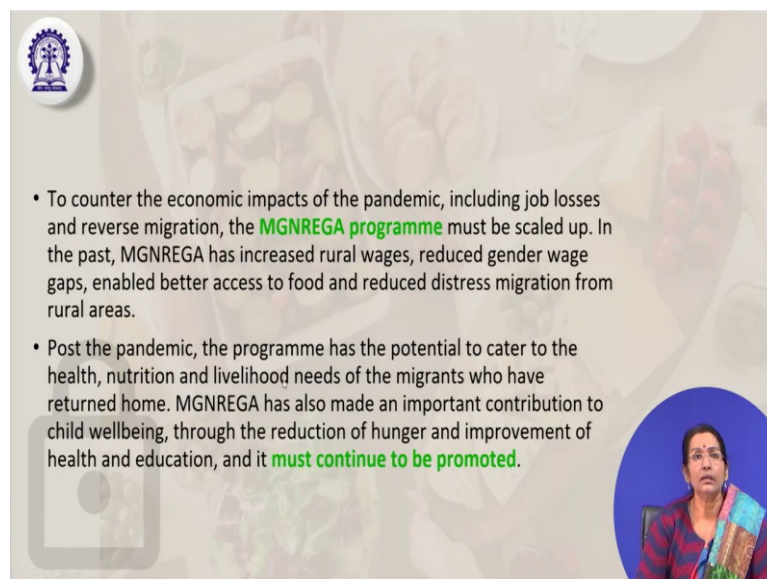
So, we need to invest more and more in the invest, more in the research, in the development, in the technique latest technology that is which would be more climate resistant resilient.


So, next providing substitute subsidies for the certain crops to the farmers which; that means, as they are having some kinds of that means how to reconsider that is there are some of some kind of subsidies they are also having the advanced adverse impact on the natural resources.

So, how to reduce that negative impacts? That means, in terms of you know soil erosion or soil deteriorating the soil quality etcetera. So, how to we have to reconsider; that means, evaluate again to before providing subsidies for certain crops.


So, then sometimes government also must continue to render the support in forms of the agricultural credit and subsidies and then in inputs and disaster relief and microfinance, micro insurance all kind of the crops livestock etcetera. So, government also need to monitor it regularly and render support in terms of various facilities privileges to and in various kinds of the disaster reliefs also, in terms of micro insurance, micro finance all to all the farmers agriculture farmers and the rural people.

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- To counter the economic impacts of the pandemic, including job losses and reverse migration, the **MGNREGA programme** must be scaled up. In the past, MGNREGA has increased rural wages, reduced gender wage gaps, enabled better access to food and reduced distress migration from rural areas.
- Post the pandemic, the programme has the potential to cater to the health, nutrition and livelihood needs of the migrants who have returned home. MGNREGA has also made an important contribution to child wellbeing, through the reduction of hunger and improvement of health and education, and it **must continue to be promoted.**

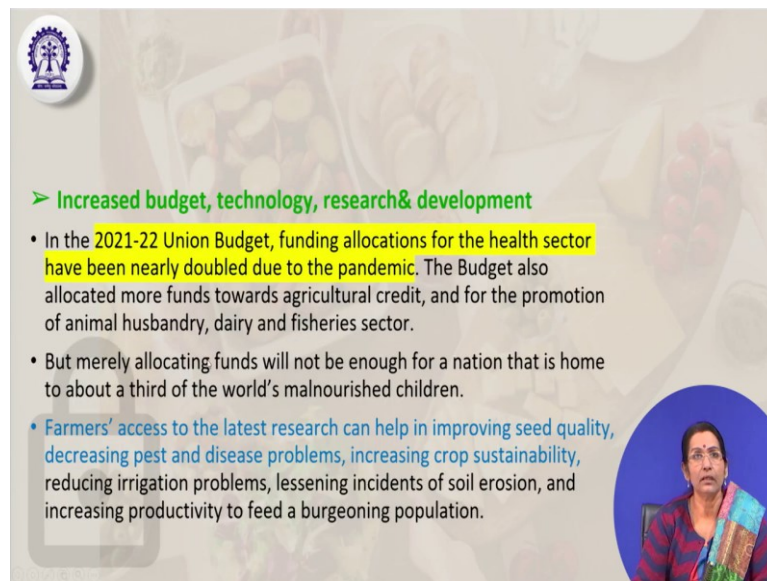


So, now our popular very popular program governments program is the MGNREGA programme; MGNREGA programme already it has increased the rural wages, and reduce the gender gaps in the wage in the wage discrimination differences between the male worker and

the female worker. It also enabled already enabled us the better access for the food and reduce the distress of migration etcetera.

So, that has to be continued. So, all the MGNREGA facilities the programme activities that has to be promoted, that has to be enhanced, that has to be continued continue with more with primarily focusing more on the women health childrens wellbeing and the improvement of the health and education, like this thing.

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**> Increased budget, technology, research& development**

- In the 2021-22 Union Budget, funding allocations for the health sector have been nearly doubled due to the pandemic. The Budget also allocated more funds towards agricultural credit, and for the promotion of animal husbandry, dairy and fisheries sector.
- But merely allocating funds will not be enough for a nation that is home to about a third of the world's malnourished children.
- Farmers' access to the latest research can help in improving seed quality, decreasing pest and disease problems, increasing crop sustainability, reducing irrigation problems, lessening incidents of soil erosion, and increasing productivity to feed a burgeoning population.

Now, with the increased budget: with the increased budget technology and research and development the starters of food security that can be enhanced. Now in 2021-22 our union budget has already allocated the fund funding allocations for the health sector have been nearly doubled due to this pandemic issues.

So, the budget also for allocated more funds in agricultural credit then the; now recently I think prime minister has also announced that some of the that means, cash and capital cash capital has been sent to the farmers account and there is a large boosting policy. So, similarly all the other areas like animal husbandry, dairy farms, fisheries, poultry farms these things can also be promoted from time to time.

So, primarily the focus would be given to more malnourished children and the malnourished mothers. So, the farmers they must have the access to latest research, they can help improving the seed quality, decreasing the pest and disease problems, and increasing the crop

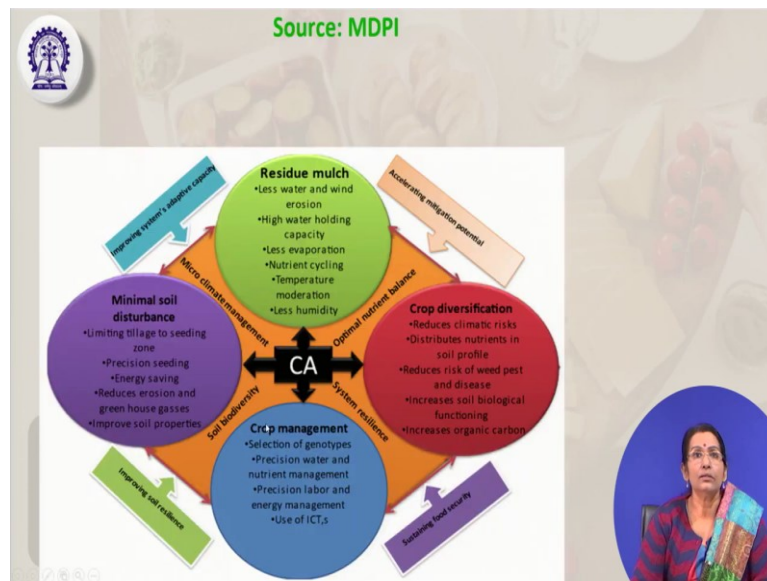
sustainability you know through rigorous kind of workshop awareness camps, media you know media news media's like through.

At the regular feature in our All India Radio that is the Krishi news Krishi (Refer Time: 05:01) Krishi news etcetera, but besides that I think they also should be given all other kinds of opportunity to enhance their awareness and knowledge in seed quality updated research development that is happening in agriculture and food sustainability.

So, how to increase the scrub sustainability and again there are different kinds of pesticides available for different disease, plants disease problems etcetera that has to be that has to be informed to them and how to reduce this soil erosion how to deal with the biodiversity.

So, all these kinds of knowledge this should be updated. So, the all the agriculture farmers, rural people they should be updated with all these kinds of information from time-to-time through different media channels and media sources.

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So, this is the this is a framework given by MDPI; MDPI is a very popular very international society, it is international society working on sustainability. So, MDPI has given this framework like framework for example, how this that means how to reduce; that means, how to reduce the soil erosion, water erosion, and the how to that means, how to enhance the quality of the soil, with less like temperature how to keep it moderate how to; that means, enhance the water retention capacity of the soil.

These are some of the things that has to be that is one domain that is the research can update from time to time. And the crop management, post harvesting how the crops should be managed could should be managed properly like for example, with precision of water and nutritional management, with low wastage, with energy management or (Refer Time: 06:41) ICT facilities, how this crop can be managed post harvesting.

And again along with this the minimum soil disturbance then even if; that means, our farmers are in are being engaged in different kinds of seasonal foods and plants and the plantations and the food crops etcetera, but with the minimum soil erosion, with the minimum soil disturbance.

Like without destroying the quality of the soil with the you know how the energy can be saved, how to reduce the soil erosion, how to make the, how to reduce the greenhouse gases also with all kinds of these all these steps and techniques that intention, the purpose is how to improve the soil property, soil feature, soil properties.

Then crop diversification with the protection of the soils again, how can we diversify our crop farming or agriculture products and the crop in the throughout the year in the according in the in a very diversified things. Like from one type of, one type of crop harvesting to another kind of things like for the distributing the different sometimes from time to time distributing the soil nutrients, reduce the risk of the weeds through pesticides.

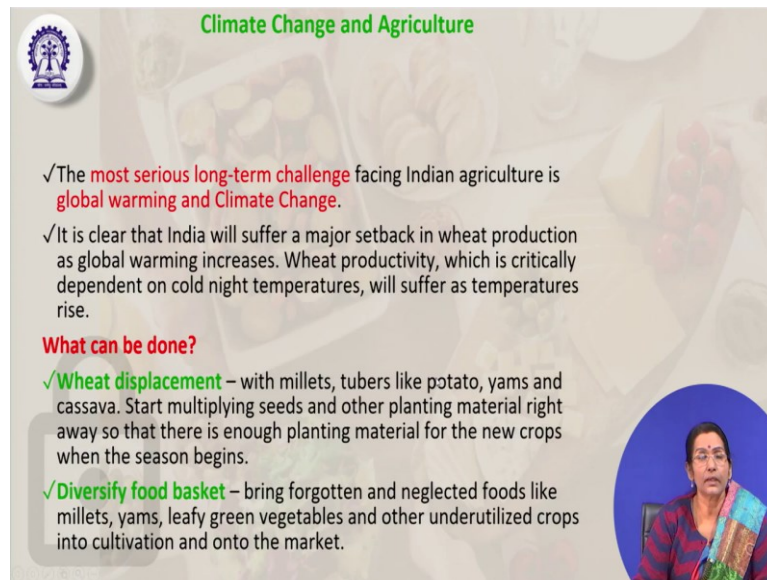
And how to; that means, increase the soil biological functioning and depending on the seasonal effects, seasonal effect how can we vary in the same land in the same field same field how can we produce different types of crops from time to time with the variations.

So, that can also not only that can on not only enhance our food security, but also it also gives a kind of you know, kind of relax kind of you know kind of protect the earth the earth quality and the land quality also so that the other kinds of the; so other kinds of the things can be managed, like optimal nutritional nutrition should be balanced, then systemic resilience can be enhanced, then soil biodiversity can be protected and the similarly climatic management can also be enhancement.

So, then the MDPI has given this framework so before planning for our next season or the next years plantation or the food processing plantation all the harvesting kind of agricultural activities.

Now, we should take into account this framework starting from the how to protect the our land, the earth quality, land quality then crop management then minimum (Refer Time: 09:16) of the lands and quality and how to enhance, how to enhance the sustainability or the resilience of the land through diversifying the crops and taking other measures also.

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**Climate Change and Agriculture**

- ✓ The **most serious long-term challenge** facing Indian agriculture is **global warming and Climate Change**.
- ✓ It is clear that India will suffer a major setback in wheat production as global warming increases. Wheat productivity, which is critically dependent on cold night temperatures, will suffer as temperatures rise.

**What can be done?**

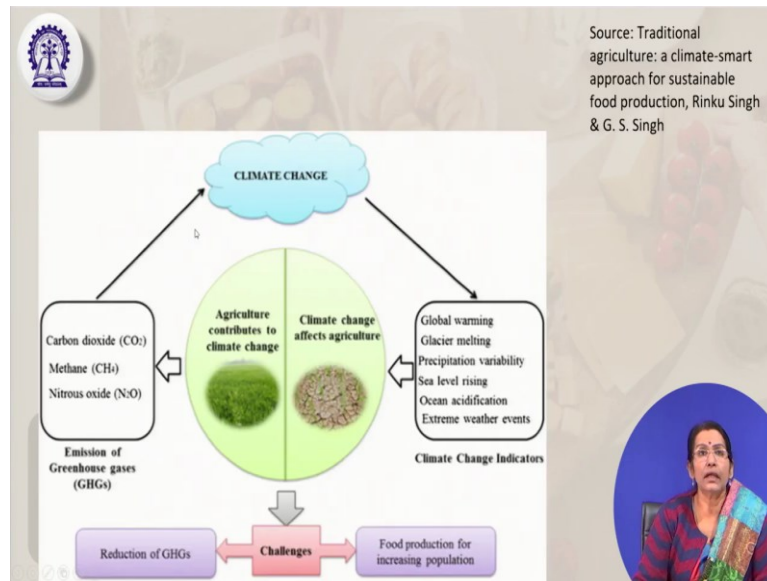
- ✓ **Wheat displacement** – with millets, tubers like potato, yams and cassava. Start multiplying seeds and other planting material right away so that there is enough planting material for the new crops when the season begins.
- ✓ **Diversify food basket** – bring forgotten and neglected foods like millets, yams, leafy green vegetables and other underutilized crops into cultivation and onto the market.

So, yeah as all of us we know climate change is a very important factor in agriculture, the most you know the most serious challenge, you can say long term challenge, we can say with global warming etcetera. So, it has been posed as a; it has posed as a very long term challenge for agriculture.

So, what can be done in this context? So, what can be done? Wheat displacement, wheat displacement is such a thing like for example, we can also go for other kinds of crops, you know we can go for other kinds of crops as we have just discussed about diversifying our crops like for example, millets, then the potatoes, yams and cassava then you can say our dahlia; that means, all kinds of other kinds of crops bajra these kind of things can be planted.

In the next, in the as a new crop with the seasons with the beginning of the new seasons similarly, we can also diversify our food baskets in the so, in the terms like the varieties of things can be produced like from time to time with the seasonal variations like leaf green leaf, sometimes green leaf vegetables, to millets, to yams, to different kinds of food products can be items can be increased so that we can diversify our food varieties and accordingly we can also go for the new varieties of plantations.

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So, again this is a, this is again this is a framework how climate change affects our agriculture like the climate change do. So, because of the agriculture what agriculture contribute to the climate change with the use of the excessive manufacturing; that means, pesticides and all kinds of things pesticides and fertilizers, chemical fertilizers.

Now, it also increases this kind of gases like carbon dioxide, methane and the nitrous oxide. So, that is that causes one, that has the linkage that has the that causes the climate change that also affects the climate. Similarly, again it results in terms of global warming, glacier melting, sea level rising, ocean so acidification, all kinds of that is. So, these are the after effects of this climate change.

So, this cycle that is climate change that affects agriculture and again a agriculture also contributes something towards the environment and which again is a these are directed towards the climate change and then it has a impact negative impact on the environment. So, this cycle is go is going on.

So, that is why we are nowadays we are facing the challenges like you know gas has, emission of the greenhouse gases these are the this is the biggest challenge, emission of the greenhouse gases and again food production for the increasing population again more and with increasing population our food demand requirement also increases like anything.

So, in order to meet these challenges one is the greenhouse effect another is the more demand for the food productions. And keeping intact the food safety and security so how can we adopt a sustainable framework for our agricultural products and practices.

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• Watersheds are important to recharge groundwater but to increase agriculture production in the shorter term, the farmers need to access the water for the winter crop.

1 inch of rainfall on a 2,000 sq. ft. roof = 1,250 Gallons of Water

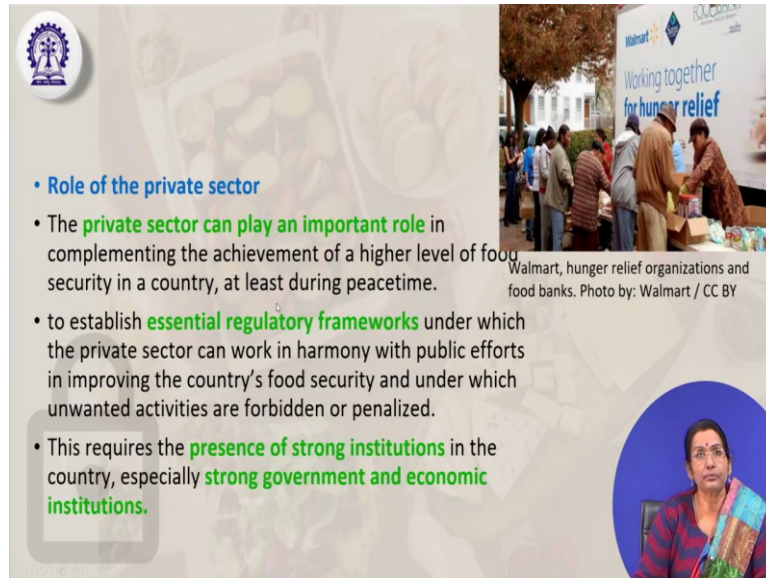
**DID YOU KNOW?**

So, similarly watershed are also important for the recharge ground water. So, watersheds are also but in terms of agriculture productions and in the short term. For example, farmers they need to have the access to the water.

So, rain water harvesting and other kinds of arrangements are the other kinds of arrangements to preserve water, to conserve water so that it can be throughout the it can be utilized for the ongoing agricultural plantations and the farm activities and the farmland activities. So, how to again, how to restore, how to conserve, how to sustainably use the water as a major resource that is also an important factor.

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**• Role of the private sector**

- The **private sector can play an important role** in complementing the achievement of a higher level of food security in a country, at least during peacetime.
- to establish **essential regulatory frameworks** under which the private sector can work in harmony with public efforts in improving the country's food security and under which unwanted activities are forbidden or penalized.
- This requires the **presence of strong institutions** in the country, especially **strong government and economic institutions.**

Walmart, hunger relief organizations and food banks. Photo by: Walmart / CC BY

So, here again so, again here we can say that a private sector also plays a very important role. So, of course, this agriculture activity is a multi stakeholder partnership program. It is not just about farmers, it is not just about the rural people and agricultural lands of the policies, but a multi sector partnership. So, here private sector can also play a very important role major role.

So, private sector can play important role in the sense that like for example, to establish certain essential regulatory frameworks under the private sector, like for example, from their point of CSR fund.

They can also utilize their CSR fund in the agriculture for the agriculture benefits or the benefits of the rural people so that it can enhance the food security in the rural things and it can also forbid, it can also it can also protect from the food; that means, food wastage it can also reduce the food wastage in terms of their policies and the penalty and the punishment mechanisms.

So, essential regulatory frameworks are also required to; that means, to bring harmony in the society in terms of multi stakeholder partnership, like public effort, private sectors investment, then farmers effort, food security and for again you know avenues for the food security, conservation etcetera.

So, for that reason we need to have the strong institutions. So, we need to have the strong institutions which regulate, which coordinates, which controls this multi stakeholder partnership with the strong government and economic institutions. Like for example, NABARD, I am saying that NABARD; NABARD is providing giving the funds to the agricultural land etcetera.

Similarly, like NABARD if you can have other regulatory mechanisms or the institution which can not only manage and coordinate with the stakeholders some of multiple stakeholders, but also can have an watch on the quality checkup, quality and assurance, quality improvement and reducing the wastage and enhancing the sustainability of the earth, quality to the water resources to all kinds of things.

To coordinate all kinds of its activities we must have the strong institutions, strong government, strong policies and strong economic institution also who; that means, along with the private sector and other stakeholders. So, they can monitor regulate and from time to time give us the feedback.

So, in this food security also private sector they contribute significantly and they should also take up the responsibility of reducing this you know food wastage and enhancing the food security in terms of the you know local needs, global requirements and local needs and how to work in harmony with the public efforts.

So, on how to engage the people the direct and indirect stakeholders engage the people with enhancing the awareness of not to waste food items and what they are taking care of the health, taking care of the health and cleanliness and sanitation and drinking water all kinds of things they should be educated from time to time.

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- **Supporting harmonious global trading institutions**
- Most countries in Asia, especially in East Asia and Southeast Asia, will increasingly rely on imports to maintain their domestic food supplies. As such, **stable food imports** will become more important. Such import stability can be best protected by world peace; thus making contributions to **long-term world peace** would be most rewarding.
- Even in a peaceful world, **trade barriers exist**, and trade disruptions occur; it would be most beneficial for India to contribute to the **establishment and maintenance of harmonious global trading institutions**, through which trade disruptions can be minimized.
- **Empowering women TO PROMOTE FOOD SECURITY**



So, here again supporting the harmonious global trading institution; again trade is also whatever we are producing not just that we are risk keeping it storing it for our own purpose, but we are also exporting it. So, the import and export transactions is trading that are being conducted by the global trading institutions.

So, there are the there are; so definitely they are updated we need to have the updated import policy, export policy to maintain the long term world peace ok as per the requirement of the countriesm different countries requirements, food grains, materials etcetera.

So, again due to; that means, due to some imbalance or due to some kind of conflict in the international scenario, sometimes some trade barriers also take place because of some other issues, political issues and maybe defense or security reason issues also. So, trade barriers also sometimes arises which has to be these trade barriers to be taken; that means, consensually that is to impose a barrier on which items and which are the necessary now on which items and are not on other necessary items.

So, therefore, that is why so there must be a proper council, proper agency that is proper establishment for this regulatory mechanism of trades and transactions some maintenance of harmonious global trading institutions.

So, these things should be there, the councils of the regulatory bodies should be there to maintain the world peace and manage this manage with these trade barriers wherever it exists. And the next is empowering the women to promote the food security, differently as because the women take the major responsibility at the household activities.

So, though starting from the cooking to the managing the food, put throughout the month etcetera, managing the crops managing the even in helping the agricultural land etcetera. So, how to enhance, how to promote the food security and reduce the food wastage all kinds of thing it also it is also very important factor and the women primarily women should be educated and power because they primarily deal with these kind of things at home.

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✓ **Educating women** about how to **empower** her household. It is imperative because women suffer from malnutrition, and women are closer to children who also suffer negatively from food insecurity.

✓ So, to teach women and give them an **education about food and nutrition** would be suitable for food household security.

✓ "**Mother's education** is positively associated with better children education, health, and nutrition outcomes" (Sidh, 2011).

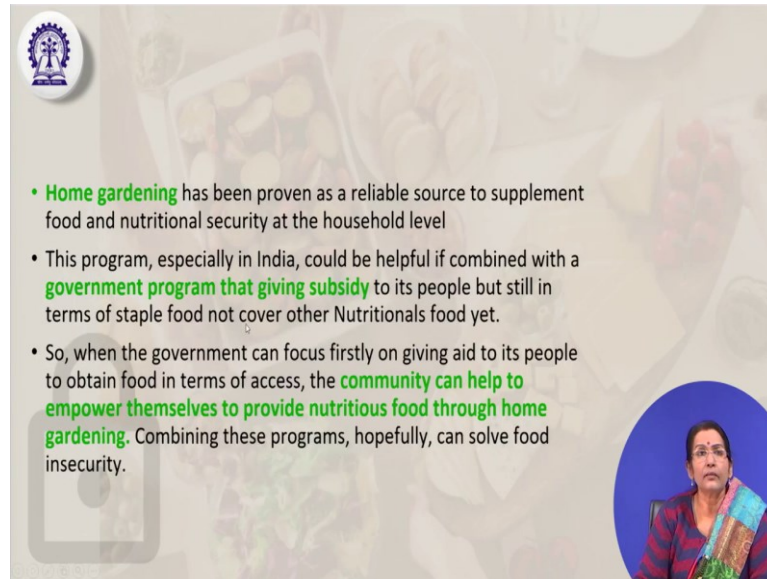
So, educating women and empowering them regarding this kind of thing, what is health consciousness and malnutrition how which type of crops, which type of foods consist of what type of proteins and nutrients and etcetera. So, what is food security? How this food security is being negatively affected by our each and each and every familie's consumption rate that has to be educated.

So, education about the food and nutrition, not only the general education about their health consciousness, but also how to ensure the household security, food security Then mothers that that is why mothers education is very very important and again also kind of thing a kind of; that means, a distributed practice of like, distributed practice of you know circulating and distributing the you know distributing the access and opportunities and the knowledge and information among the women society.

Like the through focus group discussion, through you know through panchayath meetings, through women society, women co-operative societies also thing. So, not only they will be they will be empowered to, produce to, learn to protect all kinds of things they will be more exposed to all kinds of preservation techniques also from time to time.

That is to preserve for the long run that is the for the like for the different kind of cooperatives activities on the pickle making and all kinds of the dry fruits, dry fish and all the kinds of things that is again another method of the food security for the long term purpose.

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- **Home gardening** has been proven as a reliable source to supplement food and nutritional security at the household level
- This program, especially in India, could be helpful if combined with a **government program that giving subsidy** to its people but still in terms of staple food not cover other Nutritional food yet.
- So, when the government can focus firstly on giving aid to its people to obtain food in terms of access, the **community can help to empower themselves to provide nutritious food through home gardening**. Combining these programs, hopefully, can solve food insecurity.

So, another next the home gardening so, kitchen garden all of us mostly were very fond of kitchen gardens due to the scarcity of space and urbanization etcetera it has been limited, but again. Now the terrace gardening, terrace gardening is also very popular nowadays in city cities. So, home gardening, terrace gardening so government also sometimes gives some kind of subsidiary subsidies and the loans etcetera for maintaining this kind of kitchen gardens.

So, women and the women especially rural women can be given this kind of loans, this kind of access to develop their own kitchen gardens, home gardens and even in the cities also terrace gardening also. So, community can be helped in empowering themselves to provide this kind of nutritious food in their home garden.

So, due to the limited stock of you know stock of these vegetables and the in the market. So, the price rise is a price rise of by usually normally price rise of you know onions, onions are is the you know is the regular feature in our market so, how to reduce this kind of things.

So, to enlighten, to empower, to educate our people especially the rural women not only regarding the health, but also the food security and the productivity of productivity and how to engage them in our in creating this kind of sustainable food items even in their kitchen garden.

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The slide features a logo in the top left corner and a circular inset image of a woman in the bottom right. The main content is a list of bullet points under the heading 'REDUCING FOOD WASTE'. To the right of the text is an infographic titled 'ANNUAL GLOBAL FOOD WASTE' showing a trash bin with '1/3' on it, surrounded by statistics: 20% of food is lost or wasted, 30% of food is lost or wasted, 35% of food is lost or wasted, and 40-50% of food is lost or wasted. The infographic also states that 1/3 of the world's food is wasted each year, equivalent to 1.3 billion tons.

- **REDUCING FOOD WASTE**
- The government, on its part should make laws that penalize companies for wasting food within their supply chain and encourage repurposing and recycling of food items.
- For example, since 2016, France has been fining grocery stores for throwing away edible food.
- 'Disposing is cheaper than using or reusing' attitude should be changed gradually.
- Private companies should invest to bring out potential solutions to minimize food wastage.
- Companies can influence consumer behavior by advocating-'Buy one get one free—later' programme wherein customers can buy certain food items and take the free product later when they actually need it.

So, again another that we are discussing reducing the food wastage. So, many as we all of us we witness so much of food wastage is being taking place in the urban cities and urban areas. So, there must be some law, there must be some law to penalize all these kind of things for wasting the product.

So, nowadays in very; nowadays gradually the trend is shifting like for example, in the hostels etcetera when the extra foods etcetera being distributed to animals and being this and extra foods are being sent to some kind of orphanage and some poor, distributed among the poor people that sort of things should be there.

But otherwise a strict law and penalties should be imposed because sometimes disposing the food their people are habituated of you know disposing the food, they think that it is a very easiest method and cheaper method than reutility reusing the this kind of thing or distributing or sending it to somebody else some other place.

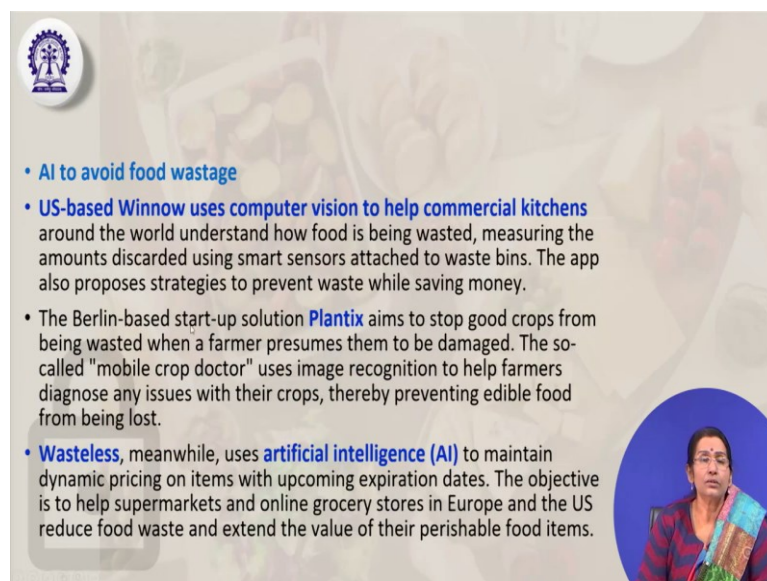
So, that for that in that situation people should be penalized some kind of penalties and the punishment and the laws and regulatory acts should be there. Again private companies should also invest to bring out these potential solutions to minimize the food wastage, they must have come up with some kind of mechanism some kind of you know strategy to minimize this food wastage.

So, companies can also influence consumer behavior by advocating, by motivating them, by educating them so, about the cost effectiveness about its utility, about the hunger, the state of hunger of the people in our country across the world. So, making that enhancing that awareness and so that means, and you know inducing their conscience to be empathetic towards others and how hunger poverty and hunger is a very it is a global it is a global problem.

And how can we individually contribute little bit amount also towards the mitigation of this kind of global problem. So, they should be from time to time, they should be educated, motivated and regarding the sustainable consumption behavior and not to waste the food.

And how even if the food is being the overall left out then how can we utilize it by distributing among the animals, even animals and the poor people how can we distribute the poor people also from time to time.

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The slide features a circular logo in the top left corner. The main content is a bulleted list of AI applications for food waste reduction. In the bottom right corner, there is a small circular video inset showing a woman with glasses speaking.

- **AI to avoid food wastage**
- **US-based Winnow uses computer vision to help commercial kitchens** around the world understand how food is being wasted, measuring the amounts discarded using smart sensors attached to waste bins. The app also proposes strategies to prevent waste while saving money.
- The Berlin-based start-up solution **Plantix** aims to stop good crops from being wasted when a farmer presumes them to be damaged. The so-called "mobile crop doctor" uses image recognition to help farmers diagnose any issues with their crops, thereby preventing edible food from being lost.
- **Wasteless**, meanwhile, uses **artificial intelligence (AI)** to maintain dynamic pricing on items with upcoming expiration dates. The objective is to help supermarkets and online grocery stores in Europe and the US reduce food waste and extend the value of their perishable food items.

So, then again; now the latest technology is that artificial intelligence is also being used is artificial intelligence is also being used to avoid this food wastage, like you know like this recycling process this is recycling process the recycling of the waste management or the you know plastics or other kinds of the waste products recycling. Similarly, the AI can be artificial intelligence can be used for to avoid this food wastage, like a US based window uses the computer vision to help the commercial kitchens.

So, they used to guide this commercial kitchens though who produce so who produce the large quantity of the foods and around the world to and give them the suggestion strategies that how to how food is being wasted and how to minimize it, how to minimize it. Similarly, Berlin based start-up also solution Plantix also, it also aims to stop these good crops from being wasted when the farmers they can presume them and to be damaged.

That means, when the like for example, all of it; that means, this kind of a climatic change due to sudden rain or certain kind of climatic change how to restore our how to restore our food crops being wasted from the from being wasted so that restoration, storage, conservation these kind of things can also be given through the you know through the process like through a solution called Plantix that is the mobile crop doctor, that is called the mobile crop doctor ok.

So, by using this image recognition of the health that help the farmers to diagnose these issues of the crops and can save it and protect it. So, wastelessness again, wastelessness is another thing that is artificial intelligence that maintain to dynamic price pricing on the items with experience expiring date.

So, this through this how this price regulation can be monitor, price regulation, price fluctuations can be monitored and how the timely the farmers can be informed, intimated regarding the risks involved in this particular in particular climate. And with the varieties of the crops, how to restore how to be alert with regard to the risks involved in different kinds of crops and the food products.

So, how to reduce how to reduce the wastage, food wastage etcetera that is not only through AI this is the technology is we are using AI. Not only through AI, but like it is AI is easily available for the developed countries, but for the other developing countries it is through the advocacy, it is through the motivation, it is through the regulation especially laws regulations and the corporates.

And the corporates and private sectors being actively engaged in a and we and with the strong institutions, nodal agencies, strong institution to regulate, to implement these policies and monitor and regulate the laws and rules must be established to reduce this food wastage and enhance the food security especially in the developing countries. So, for that matter its again it is a continuous learning.



So, all the stakeholders from the starting from the agriculture people to, ministry to, you know stakeholders to, investors to, farmers to, consumers also even the public common public as the consumers we must be updated from time to time regarding all the mechanisms of food processing.

And as similarly, so education departments would also be established like for example, here in our IIT Kharagpur that is the food processing, food engineering food agriculture and food engineering department is there, which takes care of all kinds of research activities organic farming, technology based thing all kinds of.

Similarly, so, similarly more and more such robust so, strong department's research department academic departments should be established in across the country which not shown not only educate our youth and adults.

But also empower them to you know to even to start the small business in the agriculture field also, to start up to start for the start up entrepreneurship for the you know for you know food processing units, to conservation to all kinds of things agriculture related of food processing related things can be done by our present youths and adults also.

So, these things kind of so education information, education and follow up monitoring follow up it is a regular cycle learning cycle that has to be carried out. So, with this I am just completing stopping it right now. We will continue in the next class.

Thank you very much.