GATEWAY 1: How and why have food consumption patterns changed since the 1960s?

How do food consumption patterns vary between DCs and LDCs over time?

- **Food** refers to any nutritious substance that is consumed by the body.
- Global food consumption patterns vary between developed countries (DCs) and less developed countries (LDCs) over time.
- These can be seen in terms of the indicators of food consumption and changing food preferences.

Indicators of Food Consumption

- Food consumption per capita refers to the average amount of food a person consumed per year. Usual unit for measurement is kilogrammes per capita per year.
 - DCs usually have higher food consumption per capita than LDCs.
 - Total daily calorie intake represents the total number of calories obtained from food consumed per person per day.
 - People in DCs usually have higher total daily calorie intake than people from LDCs.
 - Starchy staples as a percentage of all calories can be used a a measure of food consumption because staple foods usually form the main part of the diet.
 - People in DCs have a larger portion of their diet composed of starchy staples as opposed to people in LDCs.

Changing food preferences

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- <u>Food preference</u> is the choice of one food type over another. Food preferences change due to a variety of reasons, such as an increase in income. When a country is more developed economically and its citizens have a higher disposable income, there is a change in diet from crop-based products to meat-based products.
 - For instance, China today consumes less cereals but more eggs, meat, eggs, fish and fruits and vegetables.
- <u>Cereals</u> are crops harvested for their grain and they are the most important food source in the world, composing a large percentage of global calorie intake.
 - Consumption of cereals per capita declines at higher income levels.
 - One type of cereal is often substituted for the other at higher income levels.
- Meat is the meat of domesticated animals such as cows pigs and sheep.
 - Increase in income usually leads to an increase in meat consumption.
 - In LDCs, people are increasingly starting to eat meat because of a rise in disposable income.
 - In DCs, red meat consumption is beginning to decline because it has been linked to health diseases.
- Eruits and vegetable consumption has risen for both DCs and LDCs, in the latter's case due to increase in disposable income.

Why do food consumption patterns vary between DCs and LDCs? (PES)

Political Factors

- **Stability of food supply** may cause variations in food consumption. A country has a stable food supply when safe and nutritious food is available to all people at all times.
 - Stability of food supply can be ensured by the following methods.
 - Increasing of food production through means like the improving of technology to the use of more agricultural land can help ensure food supply.
 - Increasing amount of imported food can also help ensure food supply by ensuring an adequate amount of food for the country's population.
 - In general, DCs have a better ability to ensure a stable food supply than LDCs.
 - <u>Civil wars</u> can lead to a disruption of food supply such as in the case of the Libyan civil war in April 2011, where food stocks in the country were being rapidly depleted but not adequately replenished. This leads to a situation where people do not consume as much because there is no stable food supply.
 - **Natural disasters** can also lead to a disruption in food supply, such as in the case of Zimbabwe in 2008 where after a severe drought destroyed most of the country's corn harvest, leading to a lack of stable food supply and hence affecting food consumption.
- **Food safety** refers to a system that provides guidelines and ensures that proper handling, preparation, transportation and storage of food to prevent foodborne diseases is present.
 - The government plays an active role in regulating food consumption patterns by ensuring food safety by ensuring standards are met and that contaminated foods are removed.
 - One example is during the bovine spongiform encephalopathy outbreak in 1990s, where cattle exports were heavily restricted by the government, leading to a fall in beef consumption.

Economic Factors

- **Disposable income** refers to the amount of income left to an individual after taxes have been paid.
 - DCs such as USA usually have populations with higher disposable income and hence they can afford to buy more food as well as well as afford different types of food like meats.
 - On the other hand, LDCs usually have a lower disposable income and so not as much money can be spent on food, leading to a reduction in amount of food consumed and causing a larger percentage of their diet to be composed of cereals.

- One example of this would be in Taiwan from 1959 to 1991. During this period, Taiwan experienced high economic growth, causing income per capita to soar to a level comparable to DCs. As such, rice consumption in taiwan declined by half and meat consumption increased four times, reflecting this change in food consumption.
- Pricing of food may also lead to variations in food consumption patterns.
 - People in LDCs are generally more affected by food prices than people in DCs. This is because many people in LDCs have lower disposable incomes than people in DCs, so they cannot afford to spend more on food.
 - One example in which the price of food affected food consumption is in the Food price crisis of 2006-2008 where a combination of factors led to prices of foods such as rice doubling.

Socio-cultural Factors

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- Food preferences refers to what people choose to consume and hence what their diets are composed of.
 - **Fast foods** such as McDonald's refers to foods which can be prepared easily and quickly.
 - The entry of globalisation has allowed many fast food chains to set up chains in LDCs like India where fast food chains such as Domino's PIzza, McDonald's and Pizza Hut have set up outlets.
 - People may then choose to dine at these places instead of their local food stalls.
 - **Organic foods** refers to food grown without the use of artificial inputs and more people are choosing organic food, especially in DCs because of the perceived health benefits associated with them. This is prevalent in the US where a survey revealed that more than half of the population would rather eat organic food to non-organic food.

Food Type	Organic food	Non-organic food
<u>Fertilisers</u>	Produced with organic fertilisers like manure and compost which help retain soil moisture.	Produced with chemical fertilisers which are chemically perfected to release certain quantities of nutrients
<u>Crop yield</u>	Smaller crop yield as farmers do not use chemicals or growth hormones	Use of chemicals tends to result in a larger crop yield.
<u>Labour</u>	Requires more labour to man farm such as weeding crops because no pesticides are used.	Use of herbicides and pesticides reduced dependence of human labour, no need to weed plants et cetera.
<u>Cost</u>	More expensive because higher costs of production	Less expensive because of lower costs of production
<u>Health</u>	Perceived to be healthier because no chemicals are used.	Perceived to be less healthy because of the use of chemicals which may remain on the food after it is produced.

- Population growth refers to the increase in population and as such the increase of food consumption worldwide.
 - Population growth rates are higher in LDCs than DCs because of lack of proper family planning and a need for farm labour in many LDCs, so increasing demand of food caused by population growth is higher in LDCs than in DCs.
 - Vietnam is an LDC that has recently been undergoing economic growth, leading to a higher birth-rate. This creates strain on the system as more mouths have to be fed.

Consequences of Variations in food consumption patterns

Impact of inadequate food consumption on individuals and countries (PESH)

Political impacts

<u>Social unrest</u> is a political situation in which people protest or behave violently, often to communicate their unhappiness about a political system. For example when food prices in Mozambique rose by as much as 30% in 2010, violent protests broke out, leaving 400 people injured and at least 10 dead.

Economic impacts

- Lowered productivity can result from inadequate food consumption.
 - People who consume inadequate amounts of food are more prone to illnesses and as a result take more sick leave.
 - This results in less amount of man hours worked by workers and a loss in educational opportunities for students as a result of lost school days.
- <u>Greater strain on economy</u> as a result of diversion of financial resources to healthcare can result from inadequate consumption of food.
 - People fall sick more often as a result of malnutrition which causes public healthcare expenditure to increase.
 - This can thus also slow a country's economic development and growth as less of the budget is able to be used for development of other sectors.
- Long term debt due to food and financial aid can arise.
 - Some countries may take to applying for food aid or financial aid to deal with their inadequate supply of food.
 - However, this may result in them spending more money to import the food than it would take for them to produce it
 - domestically, causing them to incur losses in the long run. Such aid, better known as tied aid, is counter-productive.

Social impacts

- Scavenging is the act of searching through things that other people throw away, usually in hopes of finding food.
 - People in LDCs such as those living in Smokey Mountain, Philippines may resort to scavenging to find food.
 - However, scavenging carries health risks because scavenged food may contain high amounts of bacteria or heavy metals.

Health impacts

- <u>Malnutrition</u> is the condition in which the body does not get the required amount of nutrients it needs to stay healthy.
 - Malnutrition results in a weakened immune system which is the underlying cause of child deaths associated with diarrhoea, pneumonia and malaria.
 - People in LDCs are especially prone to malnutrition because they may not have the variety and supply of foods that a person in a DC may have access to.
 - For instance, a lack of calcium in their diet may lead to them developing osteoporosis which is a condition in which the bones become weak and fragile.
 - This can result in a loss of workdays or productivity as people are unable to do manual labour when suffering from osteoporosis.
- **Starvation** is the state of extreme hunger caused by a severe lack of food.
 - When suffering from starvation, a person's body becomes skeletally thin and his organs become permanently damaged.
 - Starvation is also more prevalent in LDCs than in DCs because people in LDCs have less access to and supply of food.
 - In just 2012 alone, more than 5 million people in Mali were threatened with starvation due to poor harvests and a civil rebellion.

Impact of excess food consumption on individuals and countries (PESH - P because who not happy when got food). Economic impacts

- Lowered productivity may result from overconsumption of food.
 - People who over-consume food may be more prone to obesity-related illnesses or health issues and hence may take more sick leave.
 - This causes workers to work less man hours and causes children to lose educational opportunities as a result of the lost schooldays.
- Greater strain on economy can result as funds are diverted to healthcare.
 - Public health expenditure increases as a result of the increased amount of obesity-related health conditions such as cardiovascular diseases or diabetes.
 - When more people suffer from obesity-related diseases, governments have to channel more funds to the healthcare system, reducing budget left for economic development.
 - For instance, the US has the highest amount of money spent per capita for healthcare partially as a result of the increased prevalence of obesity.

Social impacts

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- Dieting is the practice of regulating the amount of food consumed in order to maintain an ideal body weight.
 - People who diet may eat low-calorie foods such salads and exercise so as to regulate their body weight.
 - This trend is more prevalent in DCs, where the stable and rich supply of food results in an increased responsibility for an individual to not over-consume in spite of the increased ability to do so.
- Food wastage may result from societies having excess food.
 - Food wastage results in increased landfill strain and causes inefficiency in food usage because not all the food produced is eaten, resulting in the usage of more oil and water than is necessary to produce all the food.
 - Each year, consumers in DCs waste as much food as the entire amount of food available in sub-Saharan Africa.

Health impacts

- **Obesity** is the condition of having excessive fat accumulation due to overconsumption of nutrients, to the extent that it may have a negative impact on health.
 - People who are obese may suffer from health problems such as high blood pressure, diabetes and certain cancers.
 - Obesity is more common in DCs because people in DCs typically have a higher disposable income with which to purchase more food.
 - However, it is also becoming more common in economies like those of the BRIC nations because growing affluence leads to an increase in food consumption and overconsumption.

GATEWAY 2: What are the trends and challenges in the production of food crops?

Trends in the production of food crops (rice and wheat) from the 1960s

• Intensification refers to an increase in the productivity of a farm.

- **Productivity** of a farm is measure of how efficient a farm is.
 - Labour per unit area
 - Crop yield

What factors affect the intensity of food production? (PPES)

Physical factors

- **<u>Climate</u>** is the average condition of the atmosphere of a specific place over a long period of time.
 - It affects the type of crops that can be grown because climatic factors such as **temperature and rainfall** affect the growth of plants.
 - <u>Temperature</u> affects the rate of photosynthesis in general for most plants so temperatures below 5 degrees centigrade are usually unconducive to plant growth.

- However, the ideal temperature for plant growth can vary from plant to plant.
- For instance, plants such as strawberries grow best in low temperatures but other plants such as tomatoes require higher temperatures to grow well.
- Rainfall is also important for plant growth although the amount of rainfall required for growth varies from plant to plant, though in general places with very little rainfall are usually inhospitable for plants.
 - However, the amount of rainfall required for ideal growth varies from plant to plant.
 - For instance, plants such as corn require more water than plants such as soybean.
- Seasons may affect the length of the growing season, therefore affecting intensity of food production.
 - Tropical countries usually have more than one growing season compared to regular temperate countries which only have one growing season, therefore tropical countries are able to have further intensified food production.
- Therefore, in general high temperatures and high rainfall are usually the most conducive for plant growth.
- Soils and drainage

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- Fertile soil is rich in minerals which are essential for plant growth like nitrogen, phosphorus and potassium.
 - Fertile soil is usually found in volcanic areas or alluvial floodplains. This creates high crop yields in these areas.
- Soil drainage, which refers to the ability of the soil to retain or drain off water, can also affect the growth of crops.
 - For example, oats require more sandy soils that are well-drained.
 - On the other hand, soils with more clay and hence retain larger amounts of water are better suited for growing
 rice through the use of paddy fields.
- Relief refers to the slope and altitude of a land surface.
 - When the relief is steep, rain is more likely to remove the topsoil as it becomes less stable when it is saturated with water and hence gets washed down the slope.
 - However, steep relief allows for well-drained soil, which may be suitable for certain crops like grapes, tea and coffee.
 - The altitude also affects temperature as the higher the altitude of a place, the lower its temperature.
 - The cooler temperature of mountainous areas may be suitable for growing certain crops such as strawberries.
 - Slopes can be modified to create flat land for farming.
 - This can be done through terracing which is the cutting of steps into a hillside to create flat land. This results in the creation of terrace farms such as those found in Banaue in the Philippines.

Political factors

- **Government policy** is a plan of action by the government to change a specific situation, in this case to achieve food security.
 - Agricultural policy refers to policies pertaining to domestic agriculture.
 - By deciding how limited resources such as money or land may be used, the government can influence the intensity of food production.
 - The government can also choose to channel resources into educating farmers on more efficient methods of farming.
 - For instance in India, the Punjab Agriculture Department started an education programme for its wheat farmers where they were taught about best available seed varieties, pesticide treatment and irrigation methods.
 - **Food policy** refers to a decision made by a government that affects how food is produced, processed, distributed, purchased and packaged.
 - Some ways to ensure food security include stockpiling and diversification of food supply.
 - <u>Stockpiling</u> is the setting aside and storage of food to ensure food security during emergencies.
 - Stockpiling ensures that even if excess food is produced, it can still be stored and hence not go to waste.
 - This means food production can be intensified without having to worry about food waste if production exceeds consumption.

• International policy (ASEAN)

- **ASEAN** is an organisation of 10 Southeast Asian countries.
- In October 2011, ASEAN signed the ASEAN Plus Three Emergency Rice Reserve agreement with China, Japan and Korea to contribute rice to a stockpile which will be used to provide food aid to countries affected by disasters.
- During 2012, Thailand, as the largest rice producer amongst the ASEAN countries, started a programme for other ASEAN nations to intensify food production in the region.
- Greater international cooperation allows for more stable agreements, allowing food production to be intensified reliably and without fear.

Economic factors

٠	Purpose of farming	affects	the intensity	of food	production.
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Purpose of Farming	Subsistence farming	Commercial farming
Description	 The production of crops to feed the farmer and his family. 	 The large-scale production of crops intended for sale, rather than to meet the consumption need of the farmers or the farmer's livestock. Such crops are known as cash crops.
Land	 Small (1-3 hectares) 	 Large (30 hectares to thousands of hectares)
<u>Labour</u>	Family members of the farmer	Hired labour

<u>Capital</u>	Simple farming toolsSeeds from previous harvests	 Machinery such as tractors or combine harvesters Special strains of seeds including high-yielding varieties or just GMO crops.
Examples	 Widely practised in sub-Saharan Africa. 	 Widely practised in developed countries. Crops grown include animal products of typical commercial farms or crops such as tea or coffee.

Demand and supply

- **Demand** refers to people's willingness and ability to obtain a particular food crop or product.
- The demand for certain food types affects their intensity of food production because it directly affects how much supply producers will create.
- The demand for food changes according to the tastes and preferences of the consumer.
- China used to be a producer and exporter of corn, however in recent years more corn has been used to feed the livestock as a result of the increased demand for meat.
- This results in a heightened demand for corn in China and hence the USA directly increased its production of corn for export to China.
- **<u>Agribusiness</u>** is a business or industry involved in food production.
 - It usually refers to the large-scale farming and related business activities such as commercial farming, processing, packaging, distributing and retailing.
 - Agribusinesses are better able to exploit their agricultural land because they have better access to technologies such as GMO crops, advanced machinery and better commercial networks.

<u>Technological</u>

- Green Revolution refers to the rapid increase in the productivity of agriculture through the use of science and technology.
 - **<u>High-yielding varieties</u>** are improved strains of crops such as rice, wheat and other cereals that have an increased growth rate.
 - They are developed through selective cross-breeding to emphasise certain traits.
 - Wonder Rice, for instance, has a growing season of 100 days compared to the conventional 120 days, allowing for higher yields per unit time.
 - **Fertilisers** are substances that are added to the soil to provide nutrients for healthy plant growth.
 - They are applied to farms because nutrients will be naturally depleted, especially after continuous use of the farmland.
 - They also ensure that the plants get sufficient nutrients, allowing them to grow to their fullest, thereby increasing crop yield.
 - **Pesticides and herbicides** are chemical substances used to kill insects and small animals or other plants which threaten crops respectively.
 - By doing so, they ensure that plants can grow unencumbered and that the harvests are not eaten by insects like locusts or fruit flies.
 - This reduces pest damage and hence increases crop yield by protecting plants from being eaten.
 - One example of this is the widespread usage of Malathion in the 1980s to address a fruit fly problem in orchards in California, USA.
 - **Irrigation** is the method of supplying water to the land other than by natural means, such as rain, to help crops grow.
 - By supplying water to an area that used to be too dry for farming, a country can increase the amount of land available to be used for agriculture.
 - This directly increases amount of arable land and hence increases crop yield as more crops can thus be grown.
 - One example of irrigation is in Libya where the Great Man-made River supplies water to many farms out in the Sahara desert, which would have normally be considered too dry for agriculture.
 - **Mechanisation** refers to the growing use of machinery to replace traditional labour.
 - This has allowed farmers to use more advanced machinery to perform tasks which they otherwise would have had to do manually.
 - This speeds up processes involved in preparing the land and allows for higher crop yields as more land can be tended more efficiently with less labour.
 - For instance, combine harvesters have increased crop yields due to their ability to combine multiple facets of traditional agriculture into one machine.

What are the effects of continuing intensification of food production?

- **Eutrophication** is the presence of excess nutrients in the water, leading to algal bloom.
 - The overuse of fertilisers and pesticides causes chemicals to be concentrated in the soil.
 - Over time, they may be washed into streams and rivers, where they become nutrients for algae to bloom on the surface of hte water.
 - This causes **eutrophication**, and the resulting algal bloom depletes oxygen in the water and blocks sunlight from reaching aquatic plants, causing a further depletion of oxygen.
 - This results in the death of many underwater species.

• Contamination of groundwater

- The overuse of fertilisers and pesticides causes chemicals to be concentrated in the soil.
- Over time, they may seep into groundwater, contaminating it.
- The contaminated water may be unsafe for drinking as it may poison its drinkers.
- This is a problem in countries such as the USA, where about 23 percent of water is sourced from groundwater.

Salinisation

- It occurs when water added to the soil during irrigation evaporates directly from the moist soil, causing salt to be left behind on the soil after evaporation.
- It can also occur when there is no proper drainage of excess water which allows groundwater to reach the upper soil layers, bringing up dissolved salts from the ground.
- For instance, the problem of salinisation has been observed in the Murray-Darling basin in Victoria, Australia.
- Waterlogging
 - Waterlogging occurs when too much water seeps into the soil, causing the soil to be over-saturated.
 - This causes roots to be deprived of air and nutrients that the crops need, eventually causing them to die.

• Displacement of labour

- \circ $\;$ As farms are mechanised, the need for labour in them is eliminated.
- This results in a loss of jobs in the agricultural sectors as workers are replaced by machines.
- This can cause farmers to be out of a job.

Why do food shortages still occur? (PPES)

Physical factors

- Climate change refers to the variation in the global climate or climate patterns in the long term.
 - Changes in climate may cause existing farmland to become unsuitable for farming.
 - Crops may no longer be able to grow in certain areas which were once suitable for farming them due to an increased temperature.
 - The seasonal melting of glaciers provides meltwater that feed into several river basins such as those in India and China.
 - Receding of glaciers caused by climate change can cause a loss in water during dry seasons, reducing harvests.
- Extreme weather events refer to weather events which may cause the loss of lives or damage to property.
 - These phenomena include droughts, cold waves, heat waves and tropical cyclones.
 - Droughts reduce the water supply available for crops to grow and can lead to crop failures such as those seen in the Sahel region in Africa, which is particularly prone to this.
 - Cold waves and heat waves may lead to crop failures as the crops are not accustomed to grow in these temperatures.
 Tropical cyclones can lead to flooding of farmland which can suffocate crops.
 - An example of a tropical cyclone damaging farmland is Cyclone Yasi, which struck Queensland, Australia and
 - damaged half of the state's crops like bananas.
 - Such events are likely to become more common as a result of climate change.

Pests

- \circ $\;$ Pests such as wild rabbits, moles and locusts damage crops.
- This can lead to crop failures or a reduced crop yield as some crops are eaten by these pests.
- An example of this

Political factors

- <u>**Civil strife**</u> is a situation in which a country faces major internal conflicts, which may include riots, unrest or civil war.
 - Civil strife leads to disputes over the control of resources that can affect food production such as land and water.
 - These resources may even be destroyed, hindering food production.
 - For instance, many farms in the region of the middle-East threatened by ISIS have been vacated as a result of the
 - sectarian violence, leading to a lack of food supply.

<u>Poor governance</u>

- **Governance** is the exercise of economic and political authority to manage a country's affairs.
- However, poor governance can lead to food shortages as they may lead to corruption, policy errors and an inability to implement policies properly.
- For instance, during the Great Leap Forward of Maoist China, sparrows were ordered to be killed en masse in an attempt to stop them from eating crop yields.
- However, the resulting lack of sparrows upset the ecological balance and ended up allowing the pest population to balloon as a result of the lack of predators.
- This had the opposite effect and rather helped cause the Great Chinese Famine, which led to the deaths of more than 20 million people.

Economic factors

Rising demand for meat and dairy products from emerging economies

- A number of LDCs, most notably the BRIC that is Brazil, Russia, India and China, have been growing economically.
- This has led to an increase in disposable incomes and hence an increase in food consumption in general and an increased consumption of meat.

• This sustained growth in demand depletes global food inventories, most notably grain, which causes exacerbated food shortages in poorer countries as a result of the increased demand leading to higher prices.

Soaring cost of fertilisers and transport

- The cost of fertilisers and transport can directly affect the cost of food.
- As the price of fertilisers increases, the cost of producing food will increase and therefore the price of the food will increase too.
- Likewise, if the cost of transporting the food increases, the price of the food will increase too.
- For instance, the rising cost of fertilisers and fuel led to the 2007-08 world food crisis which saw rice prices double.
- For people in LDCs, a large percentage of their income is already spent on food, so any further increases can cause them to be unable to purchase sufficient amounts of food.

<u>Conversion of farmland to industrial crop production to produce biofuel crops</u>

- As growing crops for industrial use is more profitable than growing food crops, many companies and farmers have converted their farmland to grow crops for biofuels.
- Rising demand for **biofuels**, which are fuels that derive energy from biological carbons, means that less of the food grown is used as nourishment for people.
- For instance, experts estimate that about 25 percent of all food in America became fuel for vehicles instead of food for people.

Social factors

Lack of accessibility

- Accessibility to food refers to how easily residents can reach the food that is available.
- Transport facilities such as road or rail links must be made available so that food can be reached even by people who live far away from food sources.
- In LDCs, food outlets may be few and far apart from one another, leading to people living in these countries to be unable to acquire fresh produce in a timely manner.

Inadequate logistics of food distribution and storage

- **Food distribution** is the movement of food from farms to retail outlets.
- This is only possible with a good transport network which allows for timely transport of food.
- However, in certain countries physical features such a mountains may prevent the construction of a good transport network.
- This is significant when local production cannot meet local demand, making imports necessary.
- For instance, one-third of Timor-Leste experiences food shortages as a result of this, which is also worsened by a lack of storage facilities and the difficulty in accessing the remote communities around the island.

Rapid population growth

- The high birth rates and high population growth rates in LDCs result in a situation where food supply may not be able to grow in accordance to the growing demand for food.
- For instance, sub-Saharan countries have to grapple with this issue as they are not able to readily increase food production to cope with their rapid increase in both urban and rural populations.

What are the strategies to overcome food shortage? (TAPE)

Technological strategies

<u>Strategy</u>	Description of strategy	Successes	Limitations.
<u>Storage</u>	 The use of refrigerated warehouse storage or refrigerated delivery trucks to keep food fresh for a longer period of time. In LDCs, less technologically advanced methods like silos are used to store grains. 	 With the use of refrigerated storage, crops can be distributed to areas further away from their place of production. This increases the accessibility and variety of food for most people. One example of this is in Timor-Leste, where the building of Silos by the FAO has helped reduce the loss of crops to pests by 20 per cent to 40 per cent. 	 The refrigeration of food on a large scale is very expensive, which may add to the cost of food production. Silos may also be unaffordable for farmers who are very poor.
Earming technology	• The use of HYVs, irrigation technology, chemical fertilisers, pesticides, herbicides and machinery to increase crop yields.	 The use of these technologies has enabled food to be grown in areas previously considered unusable for agriculture. For instance, the Great Man-made River in Libya has allowed for areas in the Sahara desert which were once too dry to support agriculture to now be capable of doing so thanks to irrigation. 	 However, the use of these technologies requires a certain amount of capital and so farmers that are very poor may not be able to afford them. This issue is especially present in LDCs.
Biotechnology	 It refers to the science of modifying living organisms such as 	 GM crops have a higher yield than non-GM crops and they are usually better able to withstand certain 	 GM crops are usually proprietary and have to be licensed for use from a

 plants and a better know genetic mod Genetically-crops (GM) to food deriver crops that h their genetic modified. 	animals, n as dification. -modified food refers ved from ave had c make-up animals, crops. This lead farmers a more sel One exal corn whic to the sel to the set to s	s which may plague regular ls to increased crop yields for and helps countries become f-sufficient in food production. mple of this is drought-resistant ch has been grown across the Great Plains of the USA where ainfall conditions prohibit the	vendou to offse As suc usually large-s farms farms them r to use	such as Monsanto et research costs. h, GM crops are only viable in cale commercial in DCs and not in n LDCs which need nost but are unable them due to a lack
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Agricultural strategies

<u>Strategy</u>	Description of strategy	<u>Successes</u>	Limitations	
Multiple cropping and crop rotation	 Multiple cropping is a practice of growing two or more crops on a single piece of land at the same time. <u>Crop rotation</u> is a way of growing several crops on the same land area in a specific order, following the changes in seasons. 	 Multiple cropping allows for plants to grow better whilst retaining crop yield efficiency. For instance, leguminous crops when grown with non-leguminous crops actually help them to grow by enriching the soil with nitrogen compounds. This fertilises them and hence increases crop yields as the crops grow better. Growing a variety of crops together also reduces the problem of pests as some species when grown with another can protect the other species from pests. For instance, crops like garlic can repel pests such as aphids away from tomatoes. Crop rotation reduces dependence on one crop so factors like diseases, prices, pests and climates do not have such drastic effects on the economy. 		
Water and soil conservation	 Water and soil are conserved when no-till farming is practised. No-till farming_allows plant materials such as leaves and branches from the previous growing season to be kept on the surface of the soil, maintaining the quality of the soil by returning nutrients to it. 	 No-till farming helps keep farm times, ensuring that farming is sustainable food supply. The increased soil fertility also In contrast, tilling reduces the materials. Tilling also causes the soil to b machinery is used, causing so causing the roots of plants to b crop yields. 	 No-till farming helps keep farmlands fertile for longer periods of times, ensuring that farming is sustainable and hence ensuring a sustainable food supply. The increased soil fertility also leads to increased crop yields. In contrast, tilling reduces the fertility of the soil by removing plant materials. Tilling also causes the soil to be compacted over time, especially if machinery is used, causing soil infiltration to be lowered and hence causing the roots of plants to be unable to draw water, thus reducing crop yields. 	
Leasing farmland to other countries	 Some countries which do not have sufficient land suitable for farming may choose to lease farmland from other countries. 	 For LDCs with lots of excess arable land, the leasing out of land to other countries can help generate income which can then be channeled back into helping local farmers improve their farming methods, thereby solving local food shortages. For instance, in 2008, South Korea negotiated a 99-year lease for a large amount of farmland in Madagascar for \$12 an acre. 	 However, in countries that do not produce sufficient amounts of food to feed their own population, there are concerns that leasing out farmland could reduce the local food supply. In Ethiopia, despite having millions of people who rely on food aid, farmland is still leased out to other countries which may further exacerbate the situation. 	

Social strategies

<u>Strategy</u>	Description of strategy	<u>Successes</u>
Support local farmers	 Consumers can support local farmers by purchasing locally produced food in the country. The food security of the country is enhanced because the reliance on food imports is reduced. 	 The purchase of locally produced food helps keep local farmers in business by ensuring demand for their produce. This ensures that local farms are not displaced by international competition and can help ensure a reliable local food supply. Local food is also cheaper than imported food as a result of reduced transportation costs, so ensuring that local farmers are kept in business helps reduce food costs in the long-term.
Population control	 In many LDCs, the growth in food production is slower than population growth. This results in there being not enough food for the entire population, leading to food shortages. 	 By educating people in areas such as family planning or helping to improve access to reproductive health facilities, governments can help ensure that families do not have more mouths than they can feed. This ensures that there will be sufficient food to go around as parents do not have more children than they can afford to feed. One example of this is in the Philippines where people living in certain areas are provided with contraceptives in order to alleviate issues regarding food shortage.

Political and economic strategies

National Strategies •

Strategy	Description of strategy	<u>Successes</u>	Limitations
<u>High-tech farming</u> (<u>Singapore)</u>	 Agrotechnology parks that house high-tech farms are built. These parks are built with modern infrastructure such as computers and can help increase crop yields or increase land-use efficiency. 	 Despite Singaporean farms' small size and limited arable land, the high-tech farms here are able to produce 8 per cent of vegetables, 8 per cent of fish and 26 per cent of eggs consumed in Singapore. This helps reduce the reliance on food imports by ensuring that Singapore has a source of local produce despite its small size. Seng Choon Eggs 	 High-tech farms are very expensive to set up, which may translate into higher food prices for consumers. Imported food may still be cheaper and as consumers tend to pick cheaper food, this can lead to a inability to sell produce.

International strategies					
<u>Strategy</u>	Description of strategy	<u>Successes</u>	Limitations		
Responding to emergencies (UNWFP)	 Provision of emergency food assistance during wars and natural disasters. 	• Food was successfully delivered to 99.5 percent of targeted recipients during the 2011 Sudan food crisis, successfully reducing the impact of food shortage.	 During such emergencies, food prices may be inflated which results in high costs for the UNWFP. The extent of its assistance is also limited by how much funds they receive from donors. 		
Cash and Voucher Scheme (UNWFP)	 Distribution of cash and vouchers in places where food is available but people are unable to afford it. 	 Cash and vouchers benefit the local economy because beneficiaries spend the money in local markets. This means farmers can earn more and hence can invest in more technology to make more food. 	 Over time, this may create a culture of dependency among beneficiaries. Thus, instead of alleviating food shortage it may have the adverse effect of causing intensification of food production to stagnate. 		
<u>School Meals</u> (<u>UNWFP)</u>	 Provisions of school meals to provide nutrition for school children. 	 School feeding provides an incentive for enrolment and attendance and can help children learn more effectively. 	 The coverage of these programmes is uneven across countries. In low-income countries only 18 percent of children receive a daily meal at school, compared to nearly 49 percent of children in middle-income families. 		
Global Agriculture and Food Security Programme (GAFSP) (World Bank)	 GAFSP provides financing to countries that need help in increasing agricultural productivity. 	 The GAFSP funded a project in Rwanda in 2010 to help reduce soil erosion and improve productivity in hillside agriculture. This has increased potato yields by seven times and cereal yields by four times, increasing food security in the region. 	 GAFSP relies on donors which can influence how the funds are used to their advantage. 		