SL IB Geography

Your notes

10.4 Building Sustainable Urban Systems for the Future

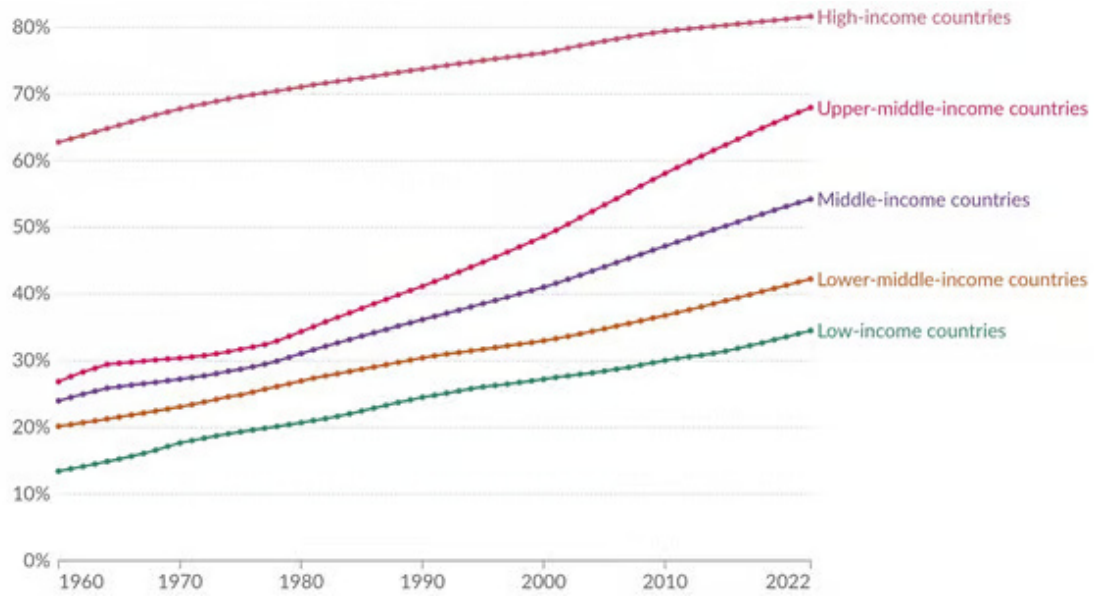
Contents

10.4.1 Urban Growth Projections

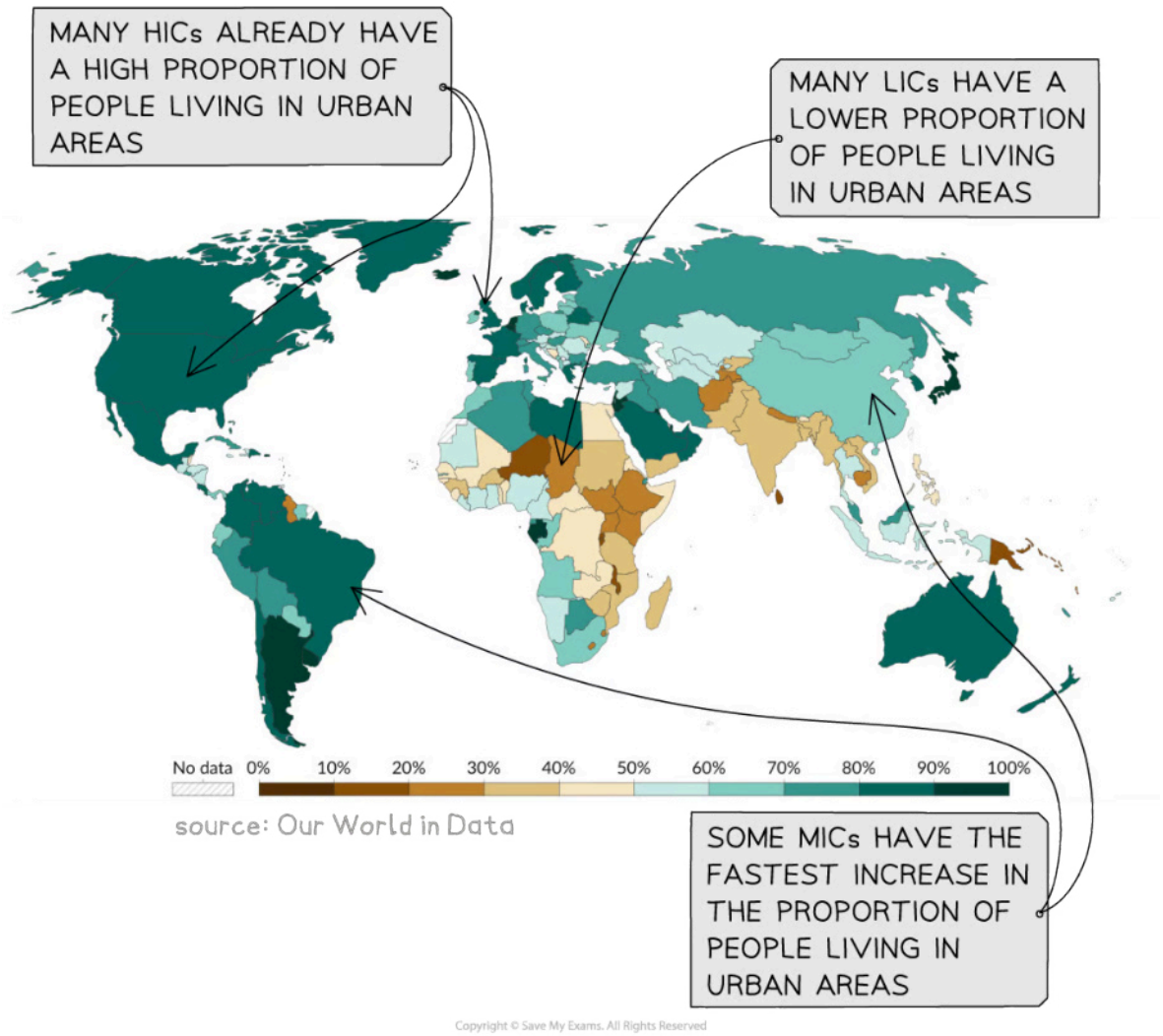
Your notes

Regional Patterns of Urban Growth

- By 2050, it is estimated that **68%** of the world's population will live in cities
  - This has more than doubled since 1960, when it was **33%**
- The countries with the highest proportion of people living in urban areas are mainly HICs, with many countries having over 80% of people living in urban areas
- Middle-income countries have between 40% and 70% of people living in rural areas
  - The proportion of people living in urban areas in these countries is increasing at the fastest rate



Percentage of people living in urban areas in countries at different levels of development



Map showing the percentage of people living in urban areas

Future trends

- It is predicted that Asia will experience the largest growth in urban population
- Cities in Sub-Saharan Africa will experience **increased birth rates** and **rural-urban migration** leading to rapid urban growth
  - Lagos, Nigeria, is already the eighth fastest-growing city in the world
- The rate of growth of cities in North America and Europe will slow

Your notes

Trends of Rural-Urban Migration


Your notes

- Globally, **rural-urban migration** accounts for **40%** of urban growth
- Rural-urban migration happens in all countries but the greatest levels of rural-urban migration are occurring in MICs and LICs
  - In these countries, approximately **60% of urban growth** is due to rural-urban migration
- People are migrating to urban areas due to **pull factors**, including:
  - More and better jobs
  - Educational opportunities
  - Better access to healthcare
- The impacts of rural-urban migration include:
  - Declining population in rural areas
  - Economic growth in urban areas
  - Increased pressure on housing and services in urban areas

Rural-urban migration in Kenya

- More than 250 000 people a year move from rural Kenya to towns and cities like Nairobi
- Most migrants are young people, often men

Causes of Rural-Urban Migration

- Rural-urban migration in Kenya has a number of causes:
  - Loss of land: commercial farms taking over best farmland
  - Low productivity of land due to soil erosion and desertification
  - Poor access to healthcare and education services
  - Increasing frequency of drought
  - Lack of clean water

Impacts of Rural-Urban Migration

- Ageing populations in rural areas
- Lack of skills
- Reduced productivity as the elderly and children are not able to farm as effectively
- Birth rates decline
- Rural area development falls further behind urban areas

Changing Population Sizes & Structures


Your notes

- Population growth in LIC and MIC cities is rapid, particularly in Asia and Africa
- Rural-urban migration is dominated by younger age groups, which leads to
  - High birth rates
  - Pressure on jobs and services
  - A reduced dependency ratio
- In Lagos, Nigeria the largest age groups are:
  - Young children age 0 to 4 years
  - Young adults age 20 to 29 years
- The rate of population growth in HIC cities is slowing
- This leads to:
  - Lower birth rates
  - A higher dependency ratio
- In Tokyo, Japan the largest age groups are:
  - Older adults between 45 and 50

10.4.2 Resilent City Design

Your notes

Resilient City Design

What is urban resilience?

- **Resilience** is defined as:

> "
>
> The ability to recover and rebound from challenges and setbacks

- **Urban resilience** is how well the communities, businesses, population and systems in a city are able to function and be economically productive, no matter the issues faced
- Although similar to sustainability, it focuses on:
  - Chronic stresses such as water and transport infrastructure
  - Shock events such as flooding or terrorism

Why are cities vulnerable?

- The larger cities become and the higher the population densities, the more vulnerable they are
  - The UN estimates that **3 out of every 5 cities** with a population over 500 000 are **vulnerable to natural hazards**
  - Some cities, such as Manila and Tokyo, are vulnerable to up to five natural hazards
  - There are only three of the world's megacities which are at low risk or no risk of natural hazards
- Urban areas are centres of population and economic activity
- When natural hazards affect urban areas, the effects are frequently more severe and expensive
- Climate change is increasing the vulnerability of cities due to the increase in frequency and severity of flooding, drought and tropical cyclones
- To be able to withstand these hazards, cities need to be resilient

Measuring resilience

- The **Organisation for Economic Co-operation and Development (OECD)** states there are four components of resilience:
  - Economic
  - Social
  - Environmental
  - Governance
- These can be assessed using the following criteria:

Criteria to Assess Resilience

Economic	Social	Environmental	Governance

Diversity within its industries A dynamic economy Innovation Access to education and skills training	An inclusive society Active communities Safe neighbourhoods Healthy citizens	A diverse ecosystem An infrastructure to meet basic needs Sufficient natural resources Policies regarding land use	Clear leadership and management Integrated approaches Skilled public sector Open governance


Your notes

Resilient city design

- There are many ways in which resilience can be incorporated into urban planning, city and building design including:
  - Infrastructure improvements and resilience
  - Urban heat reduction
  - Energy efficiency
  - Creation of green spaces
  - Emergency preparedness
  - Flood mitigation
- In cities which are vulnerable to tectonic hazards, there are several mitigations which may be put in place, including:
  - Improved planning and building regulations
  - Earthquake-resistant building design
  - Land use zoning to ensure vital infrastructure and buildings are not in the most vulnerable areas
  - Education to make the population aware of the actions to take before, during and after an event
  - Hazard mapping to identify the most vulnerable areas

Strategies to Manage Climatic Risks in Urban Areas


Your notes

- Climate change brings additional risks to urban areas
- Many cities are located on **coastlines** and **floodplains** which are high-risk locations
- Climatic risks include:
  - Flooding
  - Storms
  - Water-borne diseases
  - Heatwaves
  - Wildfires
  - Drought

Managing climatic risks

- Many cities are now integrating planning and building design to mitigate these risks
- In **Mexico City**, water supply issues caused by drought mean that 40% of the population lacks access to regular water supplies
  - The city now has a goal of installing 10 000 **rainwater harvesting systems** each year in households across the city
- In **Melbourne, Australia,** there have been increases in:
  - **Stormwater harvesting** to irrigate parks
  - Investment in **green space** to provide shade and enhance biodiversity
  - **Permeable surfaces** to reduce flooding risk
- Many parts of The Netherlands are at risk of flooding. Rotterdam's strategies include:
  - Building design to cope with flooding and sea level rise
  - Plans for a **floating neighbourhood,** which will have homes, offices, a school and a park
  - **Water squares,** which are areas set lower than the surroundings, can fill with and store water
  - Increased green spaces and permeable surfaces to allow water to infiltrate
  - Working with residents to adapt housing by:
    - Moving wiring to upper floors
    - Replacing wooden floors with more water-resistant coverings
    - Subsidising green roofs
    - Collection of rainwater

Strategies to Manage Geopolitical Risks in Urban Areas


Your notes

- **Geopolitics** are politics which are influenced by geographical factors, including:
  - Level of development
  - Resource availability
  - Land ownership
- The main geopolitical threats to urban areas include:
  - War
  - Terrorism
  - Protests
  - Segregation of communities
  - Loss of economic power

Managing geopolitical risks

- Increased threat of terrorism and protests have led many cities to implement strategies to reduce these risks
- In **London, UK**, some of the strategies which have been implemented include:
  - External barriers to prevent vehicles from ramming buildings or infrastructure
  - Improved building materials which are blast-resistant
  - Better communications system
  - CCTV
  - Increased security measures for people entering public buildings

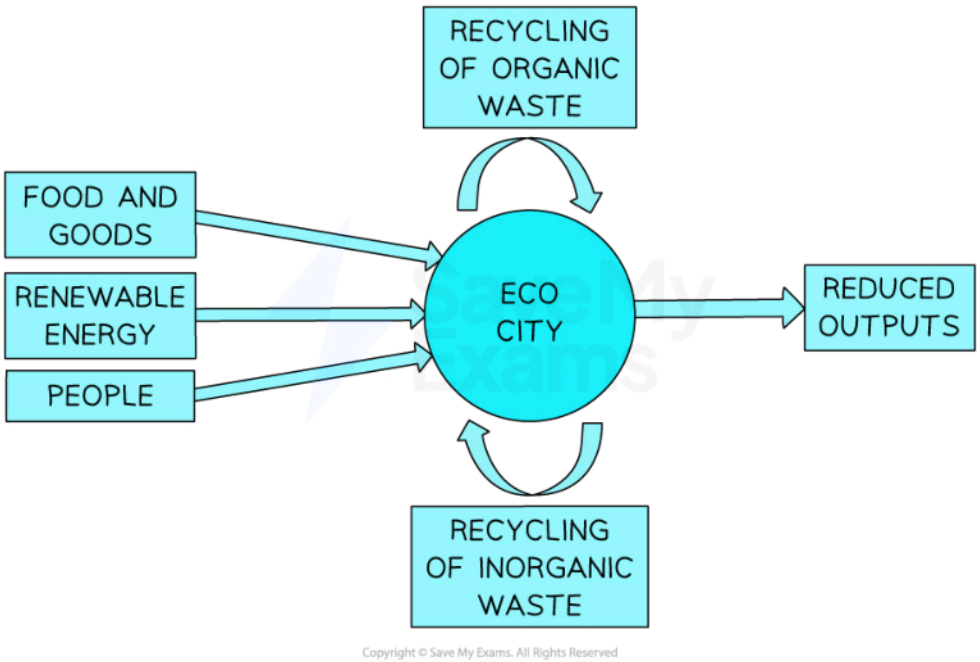
10.4.3 Eco City Design

Your notes

Strategies to Manage the Urban Ecological Footprint

What is an eco-city?

- The aim of an eco or sustainable city is to have the least possible impact on the environment
- This may involve:
  - Minimising waste
  - The use of renewable energy and resources
  - Conservation of non-renewable resources
  - Green spaces
  - Local community involvement
  - Public transport
- A city can be considered an eco-city when the needs of the present population are met without compromising the ability of future populations to meet their needs
- The **Rogers model** outlines a 'circular metabolism city'
- This model demonstrates how cities can be sustainable by being compact because:
  - Minimises the distance people have to travel
  - Reduces the amount of infrastructure required
  - Makes it easier to provide public transport



Roger's model of the circular metabolism city

Urban ecological footprint

- An urban ecological footprint is made up of several parts, including:
  - Carbon emissions
  - Land occupation
  - Water consumption
  - Waste production
- The footprint is a measure of the urban population's:
  - Use of natural resources
  - Impact on the environment from the use of resources


Your notes

Copenhagen

- Copenhagen is the capital of **Denmark**
- Located on the coastal islands of Zealand and Amager, it has a population of just over 600 000
- With the aim of becoming **carbon neutral** by 2025, Copenhagen is regarded as a leader in eco-city development
  - The target will not be met in 2025 due to emissions from a waste incineration plant being too high but the city is determined to meet the target in the next few years
  - By 2018, the city had reduced emissions by almost 60%, despite population growth of 22%
  - This has been achieved by:
    - Increased use of public transport and bicycles
    - Working with businesses to monitor and reduce energy consumption
    - Increasing the use of **renewable energy** (50% comes from wind and solar energy)

Transport

- Only 29% of households have a car
- Over 45% of people in Copenhagen cycle to work or school everyday
- Introduction of more **cycle lanes** and cycling initiatives
  - Some hotels provide guests with bicycles to reduce tourist use of cars
  - Bike sharing
  - Increased safety measures to make cycling safer
- Sustainable districts which connect to public transport and bicycle networks
    - Formation of '**five-minute neighbourhoods**' where residents can access all they need within a five-minute walk
- **New Metro City Circle Line** to connect the outer areas of Copenhagen

Energy

- **Smart street lights** are the replacement of old lighting with LED lights which increase or decrease in brightness as pedestrians or cyclists pass them
- Over 98% of households are connected to a **centralised heating system**
- Most of the city's electricity comes from wind energy
- New buildings in Copenhagen have to meet strict energy efficiency regulations
  - The Copenhagen International School has a solar façade
  - More than 70% of hotels have some form of eco-certificate

- The regional headquarters of the UN have solar panels, rainwater recycling and a seawater cooling system


Your notes

Waste

- The **Circular Copenhagen** plan (2019–2024) aims to reduce waste going to landfill and incineration
  - All residents have access to bins for a variety of types of waste so that it can be separated for recycling
  - There are five district recycling stations, which also include donation points for items which can be used again
  - Less than **2%** of waste is sent to **landfill**
  - The city aims to **recycle 70% of waste** by 2024
  - The remaining waste is incinerated at plants such as **Copen Hill**

10.4.4 Smart City Design

Your notes

Smart City Design & New Technology

- **Smart cities** are those which are successful in six areas:
  - Economy
  - Environment
  - Population
  - Living conditions
  - Governance
  - Mobility
- The aim of smart cities is to manage resources effectively so that:
  - The population's needs are met
  - The environment is protected and improved
- Smart cities have a number of characteristics

Characteristics of Smart Cities

ICT	Sustainability	Connectivity	Public Involvement
Technology is utilised to make urban systems more efficient; for example, traffic lights are programmed to adapt to congestion to reduce traffic jams	Solutions to urban issues have sustainability as a focus to reduce the impact of urban areas on the environment. Air quality sensors in Copenhagen are used to identify areas where emissions need to be reduced	The integration of digital technologies to manage the urban area efficiently. AI can be used to predict potential issues	The sharing of data between the urban systems and the population. The involvement of the population in planning and decision-making

What are the advantages and disadvantages of smart cities?

- The advantages of smart cities include the efficient:
  - Use of resources
  - Disposal of waste
  - Transport systems
  - Housing
- The disadvantages of smart cities include:

- **Cost:** the technology used is very expensive so smart cities are located in HICs
- **Energy use**: technology uses lots of energy, although this may be balanced by reduced energy use for transport, lighting etc.


Your notes

Purpose Built Settlements

- Several smart cities are in development around the world
- These are purpose-built settlements
- The advantages of purpose-built smart cities are:
  - Old infrastructure does not have to be adapted it is all built as new
  - There is no existing population who will be disrupted by the changes

Songdo, South Korea

- Located approximately 20 miles southwest of Seoul
- The area has a population of 210 000 (2024)
- The smart city is built on an area of reclaimed land
- Still under development the city is due to be completed in 2025
- **Sensors** within the infrastructure of the city are used to **monitor and regulate** a range of activities and processes
  - Water pipes ensure that clean drinking water is not used in toilets
  - The sensors in the streets measure energy use and traffic flow
- **Automated rubbish bins** connected by pipes to an underground sorting centre
- The city has the highest concentration of projects in the world which meet the **Leadership in Energy and Environmental Design (LEED)** standards
- Large areas of green space
- There is an **integrated transport system** where there is a bus stop or subway stop within 12-minute walk of each neighbourhood
- An extensive bike infrastructure

Retrofitting Technology in Older Settlements


Your notes

- Although urban areas can be built from scratch to be smart cities, most smart cities of the future already exist
- To improve the sustainability and resilience of these cities, they need to be adapted
- The adaptations involve adding new smart technology to the existing infrastructure
  - This is known as **retrofitting**
- Retrofitting is expensive and can lead to lots of disruption because the existing infrastructure has to be disturbed

New York

- A range of organisations, together with City of New York government, are working towards making New York a smart city
- The city is adopting smart technology to improve transport, health, safety and productivity
- The technology also works to reduce waste water and energy use

Transport

- Sensors to streamline traffic flow
- Charging stations throughout the city for electric vehicles
- Car-sharing schemes to reduce congestion and emissions

Safety

- **CompStat** logs crime; it then uses the data to help predict where and when crime will occur

Health

- **Air quality sensors** to identify areas of air pollution
- Seventy-five temporary air monitoring stations are moved every two weeks to new sites
- There are also eight permanent air monitors

Energy

- The replacement of old bulbs with **LED bulbs** in 650 government buildings
- **Smart meter** readings for energy use to discourage waste
- Switching some residents from oil to gas, which has fewer emissions

Waste

- Solar-powered rubbish bins '**BigBelly**' which compact the waste
- The bins request emptying when full

Water

- **Automated meter reading (AMR)** units have been installed in over 800 000 properties
- The AMR units:
  - Warn of potential leaks
  - Monitor how water is used