cities in a sustainable future

Sustainable Urban Development

Chapter 1: Sustainable Development

- **Definition of SD:** According to the Brundtland report, SD is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This involves the maximising of goals across economic, environmental and social dimensions
- **Concept of "Needs"**
  - Essential needs -> food, water, shelter, employment
  - Perceived needs -> demand for electronic devices, overconsumption of food
  - Intragenerational equity needs to be met: at the *present*, essential needs of the poor must be met
  - Intergenerational equity needs to be met: ensuring essential needs can be met in the long-term
- **Interdependency of dimensions:**
  - Socio-economic system is dependent on environment as environment provides us with ecological resources and services and acts as a sink for wastes
  - When humans try to maximise the production on one environmental service, there will be unexpected and unwanted declines in provisions of other environmental services
  - Examples: Overfishing -> Collapse of Atlantic cod stocks (coast of Canada in late 20th century); Decline of Mayan civilisation in Central America due to large-scale deforestation, excessive use of soils and over-reliance on maize
  - Challenge in maximising goals across the different dimensions: Many aspects of the environment are not properly valued in economic terms
    - Basically tragedy of the commons (air, oceans, fisheries have transboundary nature so hard to assign value to environmental impact)
- **Concept of "Trade-offs"**
  - (certain goals have to be compromised for the achievement of others)
  - Another challenge in achieving SD: Institution responsible for managing the environment is institutionally separated from those responsible for the economy
    - Global environment and development has an integrated nature so achievement of SD difficult without a change in how policies are implemented
  - Examples:
    - Biodiversity is disappearing at alarming rates (environmental) but cost of conservation / making areas protected will rise and opportunities for development might be lost (socio-economic)

            - *however, one solution is for governments to stem the destruction of reservoirs of biological diversity by developing them economically (eg: ecotourism)*
        - Industrialization, agricultural development and rapidly growing population of developing nations need a lot of energy (socio-economic) but increase in use of non-renewable fossil fuels place a strain on ecosystems (environmental)
            - *solution would be for economic growth now to be less energy-intensive than in the past*
- **Concept of "Limits"**
    - Current Level of Technology:
        - Existing technologies are still resource- inefficient. For example, older irrigation or mining techniques waste water or minerals, reducing availability and limiting the supply available for future generations
        - Despite current levels of technology allowing for the harnessing of renewable energy like solar energy, they currently lack adequate storage capacity. Without efficient solar panels or large-scale storage, countries remain dependent on finite fossil fuels in the longer term and may have insufficient energy sources to meet their needs
        - While modern waste treatment exists, they may not be advanced enough to cope with the increasing amounts of waste that is being generated by cities in both countries of higher and lower levels of development. This can render contamination of soil/water sources by improper disposal of waste, which can reduce resource quality and availability over time.
    - Environment's ability to meet needs:
        - Earth and environment provides us with the input needed for human activities
        - Ecological footprint should be below Earth's biocapacity => both in terms of resource use and generation of waste
        - Definition of Biocapacity: The ability of the environment to replace resources and withstand impacts of waste
        - Currently we in ecological deficit (ecological footprint > biocapacity)

Chapter 2a: Challenges In Progressing towards Sustainable Urban Development

- **High Urbanisation Rates & Rapid Urban Growth — more prevalent in CLLDs (currently undergoing development / industrialisation)**
    - Urbanisation: a process whereby an increasing **proportion** of the population in a geographical area lives in urban settlements
    - Urban Growth: an increase in the population of urban areas (**ABSOLUTE number**)

- increase in the population size of cities due to:
  - natural increase (birth rates > death rates due to low life expectancy, large young population)
  - Rural-urban migration (various push and pull factors)
    - This growth often outpaces the capacity of rural areas to provide sufficient employment, educational opportunities, and essential services.
    - The agricultural sector, traditionally the mainstay of rural economies, may not be able to absorb the burgeoning young labour force, leading to underemployment and a search for better prospects elsewhere.
    - At the same time, cities attract youths as they are typically centres of economic activity, offering a greater diversity of jobs in manufacturing, services, and the informal sector.
    - Furthermore, the concentration of educational institutions, from universities to vocational training centres, in urban areas presents another significant draw. Young people seeking to enhance their skills and future earning potential are naturally attracted to cities where these opportunities are more readily available.
- If unplanned (too rapid), can result in
  - poor urban infrastructure which reduces cities' competitiveness and economic prospects (congested roads, poor public transport, inefficient ports, inadequate schools, not enough housing)
  - failure to provide the necessary basic infrastructure and public services (lack of proper waste management, water shortage) → This is manifested in the rise of slum settlements whereby the poor standard of living amongst the urban poor can widen inequality within the current generation (intra-generational inequity)
  - Eutrophication and water pollution if factories / agricultural farms are built near water bodies
  - The demand for more urban areas necessitates deforestation of surrounding forested areas, which can result in the destruction of habitats and biodiversity loss
  - Growing urban populations increase demand for energy, food, and water, which can result in the over-extraction and overconsumption of resources faster than they can be naturally replenished. The unsustainable use of resources will leave future generations with fewer resources, compromising their ability to meet basic needs

- **Urban Population Loss — more prevalent in CHLDs (started development / industrialisation earlier and more DINKs)**
    - decline in the population size of cities due to:
        - natural decrease (birth rates < death rates due to less couples starting families since more women enter the workforce + other factors)
        - counterurbanisation (residents of urban areas move out of the city into the rural areas since teleworking allows people to work remotely)
    - can result in:
        - **Impact on environmental sustainability**
            - With a decline in population, there is an increased probability of property abandonment which suggests that the built environment is likely to experience neglect/ will not be maintained as buildings degenerate into a state of disrepair, causing pollution and attracting vandalism and pest infections. Services such as waste disposal might also cease, causing environmental degradation.
        - **Impact on social sustainability**
            - Urban population loss is likely to result in ageing of urban areas as the younger population are more willing/able to move out of the city areas. This might result in greater demand for healthcare and other social support services by the elderly which might not be able to be met adequately if city authorities lack the financial means/ willingness to do so.
            - decrease in middle and upper-class population may lead to a decline in tax base => affects social sustainability as the reduction in government revenue may result in less investments in the availability of public services and amenities (e.g. healthcare, education), which could lead to more health problems and lower literacy rates.
            - Reduced manpower for policing due to decline in police patrol may cause lower security levels, increasing crime rates due to reduced deterrence effect.
        - **Impact on economic sustainability**
            - With an ageing population, there will be a shrinking workforce, and investors are not confident that the smaller workforce is able to cope with the job scope and would reduce investment into the city.
            - In a city that is experiencing deindustrialisation, businesses shift to other cities or overseas locations and industries, and the industries in the city decline. The lack of job opportunities will lead to a subsequent decline in the urban population as

people leave to other locations in search of jobs. Other industries are also cautious about investing in this area due to a falling demand in goods and services.

- Furthermore, lower-income groups with lower levels of education and fewer financial means to relocate will be left in the city. As they compete for limited jobs, rates of unemployment and poverty will rise.
- Abandoned buildings may also further deter investors from investing.

Chapter 2b: Demand placed on natural environment

- **Cause 1: High concentrations of waste**
  - Occurs because:
    - most city dwellers rely on industrialised and packaged foods -> large quantity of household waste
    - waste is not perceived as a critical challenge
    - affluent lifestyles enables consumers to purchase household appliances, electronics, cars , etc -> a lot of solid waste
- **Cause 2: Large ecological footprint**
  - Refers to: Measure of productive land and aquatic ecosystem needed by humans to produce the food, energy and water resources that we need for consumption, and absorb the wastes that human produces
  - The higher the ecological footprint, the more resources are needed to produce the resources we need and absorb the waste we produce.
  - Can be measured in hectares and at different scales - it is measured in total hectares at the global scale, regional and national scale, and in hectares per person at the individual scale
  - When the EF exceeds the biological capacity, there will be an ecological deficit. Similarly, When the EF is less than the biological capacity, there will be an ecological surplus.
- **Cause 3: Vast quantities of resources absorbed by urban areas from surrounding non-urban areas**
  - occurs when cities cannot manage resources which are demanded for sustainable urbanisation
  - examples of resources absorbed from other areas include ecosystem services from natural environments (so can provide food, water, timber, fibre and fuel) and land (so can make roads, ports, discharge pollutants)
- **Cause 4: Waste is not viewed as a potential resource**
  - Food Waste
    - Can be used as compost -> reduce resources used to produce fertilisers & increases crop yield

        - Instead of: being thrown into landfills which produces a lot of methane (very powerful greenhouse gas) when it rots
    - Electronic Waste
        - Can be recycled so raw materials can be recovered to produce more electronics
        - Instead of: polluting the environment as e-waste is toxic and not biodegradable
    - Plastic Waste
        - Can be recycled to make new plastic items or recovered to make synthetic fuel
        - Instead of: causing landfills to overflow, rivers to choke and marine ecosystems to be threatened which negatively impacts sectors like tourism, shipping and fisheries
- **Results in:**
    - exceeding the earth's biocapacity (resources used up faster than they can be replenished)
        - more resources are needed to produce more food / electronics / plastic products to meet the needs of the people
    - deforestation which leads to environmental degradation, hence resulting in loss of biodiversity / water catchment areas, soil erosion
    - pollution
        - factory waste and sewage improperly disposed of into water bodies
        - pesticides / fertilisers washed into water bodies which create harmful algal blooms, leading to formation of oxygen-depleted zones which kills most animal life

Liveable Cities

Chapter 3: SUD and Liveable Cities

- **Subjective Nature of Liveability**
    - Liveability assessments may be subjective as the assessment intent would influence the choices of indicators used in the measurement. [Different stakeholders assess liveability using different criteria based on their varied needs.]
        - For example, as EIU and Mercer's assessment are used to calculate hardship allowance, indicators are chosen from the perspective of a well-renumerated expatriate. As such, they include indices such as the standard of international schools as a key determinant of the quality of education in the country.
        - In contrast, Monocle's assessment is targeted at the wealthy, mobile and cosmopolitan reader, as such the indicators are often more related to culture and lifestyle. For example, Monocle includes metrics such as how late clubs stay open as it prioritises a vibrant nightlife.

- Liveability assessments may also be subjective as they can change over time. The COVID-19 pandemic changed the perception of liveability and wellbeing as greater prioritization was given to effective healthcare and management of the spread of virus.
    - In 2021, Auckland emerged as the most liveable city in EIU's index for the first time due to its good healthcare policies and strict border closures that led to the slowing down of the virus.
    - In contrast, many European and Canadian cities fell down the rankings, having battled a second Covid-19 wave by restricting cultural and sporting events, and closing schools and restaurants.
- Variation across places results in great subjectivity - Liveability differs across locations due to differences in cultural expectations, climate, infrastructure, and governance.
    - For example, access to clean public transport may be a priority in London, whereas access to informal housing and utilities may define liveability in parts of Nairobi. In the case of Camden, liveability perceptions may vary between residents of gentrified King's Cross and low-income tenants affected by rising costs.

- **Factors influencing Liveability of a place**
    - Environmental Factors
        - The liveability of a place is influenced by its climate. In general, it is agreed that mild temperatures and low risks of weather-related disasters help to make a place more liveable. For example, Paris with acceptable humidity and temperature is more liveable compared to Phnom Penh where there is intolerable humidity and temperature
        - Another environmental factor influencing the liveability of a place is the quality of its environment. The quality of air, water and land in cities are important components of liveability for both health and aesthetics reasons.
    - Economic Factors
        - The access to services and facilities helps make a place more liveable as the essential needs of people are better met, and the quality of living is higher as well For instance, Singapore is considered one of the most liveable cities in the world due to access to good infrastructure like transport, housing and reliable energy supply, as well as access to good healthcare and education facilities as compared to Dhaka where poor infrastructure result in great strain in these resources resulting in issues (slums, improper waste disposal)
    - Social Factors
        - safety and stability too. In general, cities are more liveable when a city has a low crime rate, and is politically stable (free from conflict). Being

the world's least safe city where personal safety is classified as intolerable, Damascus is ranked one of the lowest in terms of liveability. This is in contrast to Tokyo, a liveable city, due to its low crime rate and high political stability

- **Relationship between SUD and Liveability**
  - Complementary / Overlapping / Interdependent Nature of SUD and Liveability
    - Urban liveability focuses on promoting intragenerational equity by improving the immediate quality of life for all social groups. This can then contribute towards the longer-term goals of sustainable urban development
      - Making public transport more efficient / attractive can reduce air / noise pollution and reduce GHG emissions too
      - Sustainable cities prioritise green infrastructure, such as parks, urban forests, and waterways. These spaces improve air quality, offer recreational opportunities, reduce urban heat, and enhance residents' well-being, boosting overall livability.
    - Liveability issues such as access to healthcare are immediate and tangible making them more relevant and actionable for governments, NGOs, businesses, and citizens. Unlike how abstract sustainable urban development can be, focusing on improving liveability can thus help cities to rally support amongst residents and drive sustainable urban development.
  - Tensions between SUD and Liveability
    - Urban liveability might sometimes over-prioritise the needs of the present generation, at the expense sustainable urban development which emphasises the importance of future generations' ability to meet their own needs. This is often seen in the forms of increased consumption of resources such as fossil fuels to generate electricity which can lead to intensified environmental degradation
    - Other tensions

SUD	Liveability
Global perspective	Individual perspective
Attractive vision but now just a theory	More pragmatic so strategies are more focused
Static vision	Dynamic because need to evolve to changing urban conditions and values

Chapter 4: Liveable Cities for Elderly

- **Elderly in Urban Areas**
  - Population Ageing happening in a lot of cities
    - Refers to inevitable increase in the share of older persons that result from decline in fertility and improvement in survival
  - Exponential increase in the number of of persons aged 60 years or older in CLLDs but in CHLDs, this is a gradual increase
- **Issues faced by the Elderly**
  - Underlying key concepts:
    - cities are largely designed for the young and mobile working population which is why the lack of consideration in urban design in catering to the needs of the elderly can result in spatial exclusion and segregation for the elderly
    - The elderly is a heterogenous group with highly diverse needs so successful ageing is dependent on a variety of factors
  - Economic issues:
    - Ageism and lack of job opportunities
      - Negative perceptions of elderly being unproductive and slow reduces their economic mobility and job opportunities (forced out of jobs they held previously and unable to find work in their prior careers)
      - nature of jobs the elderly engage in are often labour-intensive that tend to have low pay
      - *In USA 2020, one fifth of American workers 55 and over earned so little that they qualified for working poor*
    - Poverty
      - Some elderly may not have sufficient savings to guarantee income security for their whole lives which makes meeting essential needs like housing, access to basic amenities and food security an issue (some even turn to crime as a way to seek refuge)
      - *In San Diego USA 2018, 35% of the homeless population is 55 and above because of the lack of affordable housing. 3 in 8 of such seniors also have to choose between food and rent every day so many don't have stable and nutritious diets*
  - Social Issues (ability to make connections, build healthy relationships, staying active and taking care of oneself and others)
    - Physical Health
      - Elderly have continuous loss of functional, physical and mental abilities that come with older age

            - Not every elderly can afford or access healthcare services in cities
            - There is also a rise in non-communicable diseases due to unhealthy urban lifestyles
        - Spatial and social exclusion
            - Some elderly have a lack of mobility (unable to move oneself within community environments that expand more one's home to the neighbourhood and etc, hence cannot lead dynamic and independent life)
            - Dementia is also a factor as those with dementia cannot use transport unaccompanied so they are limited to amenities available within their immediate locale
            - Increasing rate of crime and violence also makes elderly afraid of cities and hence they prefer to stay at home
        - Social isolation
            - Elderly are vulnerable to social isolation due to the loss of family and friends, mobility and income => limited social contact
            - Sense of loneliness is detrimental to mental health
    - Psychological Issues
        - Discrimination
            - People don't understand that as people grow older in cities, their needs change but cities may not be designed or adapted to their needs => leads back to ageism which causes poorer physical and mental health among the elderly
        - Elder abuse and social neglect
            - The elderly can be abused by their children / caregivers (vent on the elderly)
            - Some elderly are unaware that a crime has been committed or because they are socially isolated, they are afraid or unable to seek help
            - *In Taipei Taiwan 2019, the city government received over 1500 reports of abuse of elderly people (on a national scale, cases of elderly abuse increase nearly four-fold over a 10 year period)*

- **Strategies to address Issues**

Issue	Strategy
Housing (Spatial and Social exclusion)	WHERE: Singapore WHEN: 2021-2023 WHO: MND, MOH and HDB WHAT: Community Care Apartments

	WHY: So more seniors can live independently HOW: CCAs are senior-friendly housing which is integrated with amenities such as a hawker centre, community garden, fitness station and an activity centre. All residents also subscribe to a Basic Service Package which includes simple home fixes, basic health checks, 24Hr emergency response and etc
	WHERE: Taipei, Taiwan WHEN: 2022 WHO: Government, Poor Elderly Residents, Taxpayers WHAT: the government plans to refurbish the old housing development, however even after 10 years no agreement between the government and various stakeholders has been reached. Many elderly folks still continue to have difficulties getting about their houses and pass away alone at home since they cannot access stairs WHY: Poor households are unable to foot the downpayment, night market vendors below the houses don't want to move, taxpayers are also often not convinced on why the government should provide housing for the elderly
	WHERE: Beijing, China WHAT: More than 10,000 applicants are waiting for the 1,100 beds on offer, with only about 12 spots opening up annually in Beijing's top social welfare home. Governments' policies are likely to continue with the basic concept of 'nine-seven-three'—90% of elderly will stay at home, 7% will receive government care, and 3% will live in nursing homes. However, the majority of the elderly prefer to live in nursing homes because they don't live with their children and hence feel lonely.
Healthcare	WHERE: Bolivia and Bogota, Columbia WHEN: 2016 WHO: HelpAge International WHAT: Information services by volunteer groups to raise awareness about dementia WHY: public awareness, recognition or understanding of dementia is low (elder abuse social neglect) HOW: providing clear and easily understandable guidance to families and carers of people with dementia and signposted them to other resources and sources of support available in the community
	WHERE: SINGAPORE WHO: Seniors born in 1950s or before (poverty) WHAT: All Pioneer Generation (PG) and Merdeka Generation (MG) seniors receive medical subsidies at CHAS clinics. Depending on their household monthly income, seniors who are born later than the 1950s also have access to other CHAS subsidies.
Transport (spatial social exclusion)	WHERE: Toyama, Japan WHAT: Compact city strategies WHY:Promotes high density, public transport, and avoids urban sprawl HOW: Elderly live in high density residential areas that are close to services and have good public transport (Eg trams that circle the city, development focused along tram line and city centre, making public spaces easily accessible to everyone)

	WHERE: USA WHAT: Paratransit services WHY: to provide shuttle service to people with disabilities to get them to a bus or subway stop
Safety (physical health)	WHERE: Singapore WHAT: Silver Zones which implements a series of traffic-calming measures and senior-friendly road safety features at areas with a high proportion of senior residents, and where there have been past accidents involving seniors. As of 2023, there are 30 Silver Zones located islandwide
Reducing discrimination and promoting social inclusion	WHERE: Cologne, Germany (social isolation) WHAT: 2005 Living for Help programme brings college students and older people in need of daily assistance together to share housing
	WHERE: Singapore WHAT: TAFEP Anti-discriminatory law: Workplace discrimination in respect of protected characteristics is prohibited. These are (i) nationality, (ii) age, (iii) sex, marital status, pregnancy status, caregiving responsibilities, (iv) race, religion, language, and (v) disability, mental health conditions
Social and Community Support	WHERE: Singapore (discrimination) WHAT: Dementia-friendly Communities contain Dementia Go-to-Points which act as a resource centre and a safe-return point for lost elderly. There is also an outreach team in each DFC which provides mental health and dementia care services. Volunteers also Increase dementia awareness through talks, workshops, event booths and door to door outreach
	WHERE: Bangladesh (poverty) WHAT: the social support system in Bangladesh only provides pensions to the better-off such that only 38% of older people receive an old-age allowance
Promoting Active Ageing	WHERE: Yokohama, Japan (physical health) WHAT: Yokohama Walking Point Programme aims to encourage citizens to walk by giving them rewards at local shops depending on how many steps they walk. Since its start in December 2014, more than 100 000 citizens registered to participate in the programme
	WHERE: Lisbon, Portugal (discrimination/ageism) WHAT: The Senior University (The academy of culture and cooperation) has been established to offer open classes in which senior volunteers offer lectures on such topics as literature, history, drawing or computer sciences. Classes are open to anyone over the age of 50, regardless of their level of education.

Chapter 5: Liveable Cities for Women

- **Importance of Gender Equality towards liveability**
    - Problems of gender inequality faced in cities diminishes liveability of cities → In order for cities to become more liveable for all its residents, not just some, Gender equality in cities is necessary.
        - Women and girls make up half of the population of city residents, but they continue to suffer systematic gender discrimination in cities.

        - cities are not designed in a way that helps women → Men and women use cityscapes in different ways, leading to different experiences and perceptions of cities by both groups.
        - Urban planning takes greater consideration of the needs of men and how they move around and experience the city as compared to women.
    - Gender equality improves liveability of cities, as the move towards gender equality in cities will also help to improve economic wellbeing and quality of life of all residents.
        - When cities are more inclusive towards women and take into consideration the needs of women in urban planning, this would encourage a greater number of women to enter the workforce, increasing the purchasing power of the residents.
- **Issues faced by Women**
    - Economic Well-Being
        - Women spend a disproportionate amount of their time carrying out three quarters of the world's unpaid work (Unpaid work refers to services provided within a household for its members, including personal care and housework)
        - Unpaid care work is a major factor in determining whether women enter and stay in paid employment and the quality of their work => Spending a large proportion of their time completing unpaid care work leaves women with little to no time left for paid employment.
        - Poor women in cities often bear simultaneous responsibilities for child rearing, household management and income generation outside the home => frequently work in the informal economy where they are less likely to have employment contracts, legal rights and social protections.
        - This issue is reinforced by how care work is unpaid and hence it is devalued, with those getting paid for care work to be earning low salaries.
    - Social Well-Being
        - Women are exposed to danger when spaces are not well lit at night, with insufficient surveillance and authorities to help them feel safe => women might go out for social activities less, limit their social activities to the day time and end up spending more on transport
        - When a public transport system is not well connected, women also face inconvenience having to walk longer distances between public transport nodes and their destinations => creates difficulties for mothers with children and women with disabilities

        - When paid maternity leave is not mandated by the country, women are often subjected to discrimination for missing work, affecting their careers and adverse impacts on women's health => a higher risk of postpartum depression due to managing the stress of returning to work, adjusting to motherhood, unpaid work at home while they lack time to rest and recover after giving birth.
        - When public spaces lack facilities such as ramps, public toilets, dustbins and pavements, women might use these spaces less as they become inaccessible to women. (public spaces include parks, streets, sidewalks and footpaths that connect, playgrounds of recreation, marketplaces, but also edge space between buildings or roadsides, which are often important spaces for the urban poor.)
    - Psychological Well-being
        - Sources of stress for women: childbearing, managing unpaid care work at home, contributing financially to the family => compounded with the lack of safety that comes with travelling around the city hence affects the mental health of women.
        - Although male infertility contributes to more than half of all cases of global childlessness, women tend to be blamed for the couple's childlessness as they are expected to conceive children.
        - Women also tend to be blamed for miscarriages, even though the miscarriage might have occurred due to other factors that are not within their control => adds more stress and more guilt to their grief and loss they experience from losing the child.
        - housewives and single mothers also tend to feel more lonely => a sense of isolation and helplessness due to the situations they are in and the lack of financial independence and time for social activities.

- **Strategies to address Issues**

Issue	Strategy
Economic, Social, Psychological Well-Being	WHERE: Vienna WHAT: Gender Mainstreaming – ensuring women and men are accounted for equally in policy, legislation and resource allocation HOW: Urban landscape that benefits everyone such as more effectively lit parks to provide safety and access, wider pavements for parents and elderly and longer street crossings
	WHERE: Brazil WHAT: even though there is a 30% quota for female candidates in elections at any level, women represent only 15% percent of legislators in Brazil WHY: violence against women in politics such as dissemination of false information and hate speech HOW: women lag behind men in economic participation and opportunities
Social/Ps	WHERE: Madrid, Spain

ychologic al-Well Being	WHAT: 'demand stop' services – asking the driver to stop between two official stops in the night bus service for women and minors to reduce the distance between the stop and their destination WHY: give women more comfort and safety
	WHERE: Shenzhen, China WHAT: "Women priority" carriages on the first and last carriages of public metro trains HOW: During rush hour, many did not notice the pink logos on the carriage so there were more men than women and many women did not have time to look for the specific carriage
Economic Well-Bein g	WHERE: Singapore WHAT: herCareer initiative provides a range of programmes to help women transition back to the workforce. Some of these programmes include trial and part-time job opportunities, training services and career conversion programmes WHY: support more women who are willing to come back to work
	WHERE: Latin America and Caribbean WHAT: As of late 2021, over four million women in Latin America and the Caribbean had not yet returned to work WHY: for more specifically in Venezuela, the absence of cross-sectoral public policies focussed on early childhood care is why the opportunity cost for women is high when returning to the workforce.

Sustainable Cities

Chapter 6: Management of Non-Hazardous Solid Waste

- **NHSW & SUD**
    - Linear Metabolism vs Circular Metabolism
        - Linear Urban Metabolism: production -> consumption -> disposal [promotes waste generation!]
            - Raw materials extracted and manufactured into consumer goods which end up as rubbish which is rarely reabsorbed into living nature or returned to the environment as a resource
        - Circular Metabolism: production -> consumption -> disposal -> production
            - Waste is reused as raw materials for goods manufacturing, hence reducing amount of waste generated and amount of resources consumed
            - Can be achieved through recycling
            - Usually more observed in developing countries due to poverty resulting in low resource consumption and high recycling rates
    - Landfills/Dumps vs Incineration
        - may reduce the reliance on the burning of fossil fuels for energy.
        - However, use of incineration without EfW releases harmful emissions into the atmosphere, such as particulate matter and greenhouse gases.

        - Landfills can pollute groundwater systems through leakage of toxic leachates; Open landfills site may attract pest and bacteria fermentation during decomposition
        - landfills release of methane during decomposition, which contributes towards the enhanced greenhouse effect.
    - Overgeneration of waste
        - amount of waste generated in cities in developed countries is much higher than in developing countries due to high levels of urbanisation and affluence
        - Cities hence have a very high ecological footprint which often exceeds the available biocapacity
        - Cities in developed countries also have the capacity to draw resources far beyond their immediate regions

- **Difficulties in managing non-hazardous waste + effect on achieving SUD**
    - Political:
        - Government may lack the manpower to enforce laws against illegal dumpsites → land pollution
        - There is no single strategy that can work universally since the waste profile and socio-economic profile differs in the city → hard to decide what type of strategies to implement at a city-scale.
    - Social:
        - Lack of sorting and separation of waste types to facilitate recycling and correct onward disposal.
        - Low rates of recycling
        - High rates of per capita waste generation / large urban population
        - Not-in-my-backyard syndrome: locals want to have more landfills but they oppose to having them near their place of residences due to the air and land pollution; The introduction of incineration plants may be not well received by the residents due to the release of particulate matter, heavy metals, toxic gases and ash. Residents do not want to be exposed to these gases in on a daily basis
        - Some living near dumpsites may rely on scavenging as a source of livelihood and forceful eviction can cause them to lose their homes and income.
    - Economic
        - Government prioritise upgrading infrastructure and economic facilities instead of providing proper waste management
    - Environmental:

- The land and water pollution is too widespread for the government to contain high rates of solid waste disposal => Landfills take up significant land space and may not be sustainable

- **Strategies to Manage Non-Hazardous Solid Waste**

Waste Management Hierarchy: Reduce -> Reuse -> Recycle -> Recovery -> Landfill

Strategy	Describe the Strategy + How it helps to manage non-hazardous solid waste (+ve) [Include case studies]	How the strategy may be ineffective in managing non-hazardous solid waste (-ve) [Include case studies]
Landfill	Description: Disposal of waste materials by burying it ● the waste in the landfill is isolated from the surrounding environment -> waste will not contaminate the surface or leak toxic leachates -> little harm to the environment +'ve Case Study: Singapore – Pulau Semakau ● 7 km perimeter rock bund encloses part of the sea off the island to create the space for the landfill. ● Bund is lined with impermeable membrane and a layer of marine clay so the leachate is contained within the landfill	Open dumps (which is also considered a landfill) brings environmental and social consequences -'ve Case Study: India, Kolkata ● Waste dumped at Mathkal dump site degrades water quality -> traces of cadmium are detectable in leachate which contaminates groundwater -> toxic as drinking water

Strategy	Describe the Strategy + How it helps to manage non-hazardous solid waste (+ve) [Include case studies]	How the strategy may be ineffective in managing non-hazardous solid waste (-ve) [Include case studies]
Incineration	Description: controlled burning of waste at high temperatures ● Waste is completely combusted -> bulk and volume of waste is substantially reduced ● Also destroys pathogens in waste +'ve Case Study: Denmark, Copenhagen Amager Bakke WTE Facility ● Treats more than 400,000 tonnes of waste every year ● Energy is exported as hot water for heating networks and electricity; Bottom ash produced also reused for road construction	Incineration releases harmful emissions into the atmosphere such as particulate matter and toxic / greenhouse gases -'ve Case Study: China, Suzhou ● Per tonne of waste is incinerated with 250kg of coal -> CO_2 emitted and heavy metals released are primary contributors to global warming and ecotoxicity in soil

Strategy	Describe the Strategy + How it helps to manage non-hazardous solid waste (+ve) [Include case studies]	How the strategy may be ineffective in managing

		non-hazardous solid waste (-ve) [Include case studies]
Recycling	Description: converting waste materials into new materials and products for use Recycling participation / source separation (waste generators must separate designated materials for collection and recycling): A) 'Hard' approach – recycling is mandatory ○ Laws require a certain proportion of recycled materials to be used in products ○ Imposition of a tax on product that do not have a certain amount of recycled materials ○ Polluter Pays Principle: Make residents pay a certain fee based on the amount of non recyclable garbage they produce B) Non-mandatory recycling ○ Engaging community through public education, recycling campaigns and community-based initiatives Recycling Service Provision: setting up the right infrastructure and systems to provide recycling services. (generators don't sort that waste)	Recycling requires active participation from all stakeholders involved in waste management process -'ve case study: Singapore ● Only 13% of domestic waste recycled in 2020 and 2021 ● Low rates mainly due to contamination in blue recycling bins (40% of contents in the blue recycling bins cannot be recycled due to leakage from food, liquid and e-waste.)

Strategy	Describe the Strategy + How it helps to manage non-hazardous solid waste (+ve) [Include case studies]	How the strategy may be ineffective in managing non-hazardous solid waste (-ve) [Include case studies]
Enhanced Producer Responsibility	Description: requires manufacturers of products to take responsibility for environmental impacts throughout the whole product life cycle => prevent waste generation at the source +'ve case study: Germany ● Green Dot Packaging Ordinance created in 1991 where producers of all kinds of packaged products required to either individually take back their packaging or join the Duales System Deutschland ● Material-specific recycling targets of 60-75% met by 2000 & volume of material used in packaging dropped dramatically since programme began	Free-riding: producers do not adequately comply with their obligations under EPR (producers do not finance collection and recycling of their products up to the required level or do not provide accurate data about the quantities of the products put on the market) -'ve case study: Germany ● Duales System Deutschland nearly collapsed in 1993 as a licence fee had been paid by only 55-60% of all packaging bearing the Green Dot Symbol. System was then reinforced to strengthen detection and the right to levy fines when the symbol was used without payment of licence fee Companies past costs to consumers -'ve case study: Germany

		• Requirement imposed by the DSD to bear Green Dot symbol made it costly for packaging firms with a single production line to supply small quantities bearing the symbol to German consumers

Strategy	Describe the Strategy + How it helps to manage non-hazardous solid waste (+ve) [Include case studies]	How the strategy may be ineffective in managing non-hazardous solid waste (-ve) [Include case studies]
Reuse	Description: taking products that seem to be at the end of their lifespan, or end of their use, and finding new uses for them => extends lifespan of products +'ve case study: Singapore • Treatsure, collaborates with chains, including the Accor group and Hyatt Hotels, and the Singapore Marriott Tang Plaza Hotel to allow app users to pick out and collect a "buffet-in-a-box" of food that would otherwise be thrown out. With more than 30,000 users, treatsure has saved an estimated 30 tonnes of food from going to waste since it launched in 2017 (as of 2022)	Public awareness and willingness to engage in reuse practices are often low, partly due to convenience-driven consumption habits and a preference for new items. -'ve case study: UK • A Waste and Resources Action Programme WRAP report found that consumer habits are a significant barrier to reuse initiatives. For example, in clothing, over 60% of UK consumers preferred buying new items rather than repairing or reusing old ones, even when alternatives like clothing swaps or second-hand stores were available.

Strategy	Describe the Strategy + How it helps to manage non-hazardous solid waste (+ve) [Include case studies]	How the strategy may be ineffective in managing non-hazardous solid waste (-ve) [Include case studies]
Waste Reduction and Prevention	Description: Stop waste from occurring in businesses and consumers (Consumers opt for products that do not use excessive packaging) +'ve case study: Ireland 0.15 euro charge on plastic bags since 2002 => 90% decline in their use	Changing consumer habits and business practices to prevent waste can be difficult -'ve case study: California, USA despite implementing one of the strictest bans on single-use plastic bags in 2016, a 2021 study found that many consumers simply switched to thicker, reusable plastic bags but continued using them as disposables. Lack of enforcement -'ve case study: • Delhi implemented a ban on single-use plastics in 2022, but enforcement is weak due to limited resources and the widespread informal use of such materials in street markets and small-scale vendors.

Chapter 7: Slum Management

- **Reasons for Development of Slums**
  - Global Scale (economic reasons)

CHLDs	CLLDs
Restructuring of the global economy ● Globalisation of the economy -> relocation of economic processes on a global scale ● Rise in international migration -> influx of foreigners into cities for jobs -> further strain cities to provide for jobs and adequate housing	Rapid industrialisation and urbanisation ● Global shift of manufacturing industries into CLLDs-> influx of rural migrants into cities -> higher rates of natural increase ● Advancements in technologies also ensured better healthcare so decreased child mortality rates
Deindustrialization ● Globalisation of the global economy -> TNCs outsource manufacturing to other countries -> existing firms go out of business because they cannot produce goods at a cheaper rate -> deindustrialisation and unemployment	Low economic growth ● More people than jobs available -> urban poor seek opportunities in informal economy (does not produce government revenues to support welfare policies)-> authorities don't have enough taxes for public services Lower levels of development and higher levels of urban poverty ● infrastructure not so developed, less resources to be able to afford good quality housing

  - National Scale

CHLDs	CLLDs
Political: ● Changes in state policies and strategies related to housing => disinvestments in neighbourhoods => reduced access to social rented housing (low cost rented housing for those who can't afford private housing) ● Social rented housing in	Political: ● Government revenue < Government spending ● Economic development and infrastructural development (providing tax incentives for manufacturing companies and building transport networks) > social spending (housing and healthcare facilities)
	Social: ● Rate of population growth in urban areas (brought about by high rates of natural

older housing estates is too expensive to maintain => Demand for social rented housing is too high for government to manage	increase and rural-urban migration) > rates at which housing is provided for by the government ● Newly arrived rural migrants cannot gain formal employment -> cannot afford proper shelter in formal housing sector

- CLLDs:
  - High rates of urban population growth & role of migration
    → Demand for housing often far outweighs the available supply of formal housing units as high rates of rural-urban migration persist due to significant push-pull factors that exist between rural and urban areas → e.g. job prospects; provision of social amenities etc
  - Urban poverty and lack of affordability of housing
    → Decrease in formal employment opportunities
    → Higher cost of living in urban centres
    → Commercialisation/ privatisation of goods and services
  - Failure of governance to provide affordable housing
    → Inability to respond to rapid urbanization which occurs at a pace that far exceeds the planning process to incorporate new migrants into the city
    → General inertia on the part of urban authorities in taking steps to tackle the illegal occupation of urban lands, often due to the scale, sensitivity, and/or complexity of the issue → their sheer magnitude overwhelms the capacity/capability of existing programmes or policies to effectively address the issue
    → Lack of acknowledgement of rights of urban poor → Governments often fail to incorporate them into urban planning, thereby contributing to the growth of slums

- **Impact of Multiple Deprivations Experienced by Slum Dwellers on SUD**
  - Environment
    - The absence of proper waste management systems and sanitation in slums leads to the accumulation of solid waste and the pollution of waterways. This not only poses a direct health risk to residents but also degrades the urban environment.
    - Slum housing is often constructed from flimsy, non-durable materials and is highly vulnerable to natural disasters like floods and fires.
  - Social
    - Slum dwellers are exposed to waterborne and infectious diseases due to lack of access to clean water and sanitation and cramped and

overcrowded housing conditions. This not only results in high morbidity and mortality rates but also places an immense strain on the city's public health system.

- Children growing up in slums often lack access to quality education. Overcrowded and under-resourced schools, coupled with the need for children to contribute to household income, lead to high dropout rates. This perpetuates the cycle of poverty, as a lack of education severely limits future employment prospects.
- The marginalization of slum dwellers from the formal city can breed social unrest and higher crime rates. A lack of social services and economic opportunities can push individuals towards informal and sometimes illegal activities.

- Economic
  - The majority of slum dwellers work in the informal economy, characterized by low wages, job insecurity, and a lack of social protection. This not only limits their ability to improve their living standards but also means they contribute less to the city's formal tax base, which in turn limits the government's capacity to fund urban development projects.
  - The presence of large, impoverished slum areas can deter both domestic and foreign investment. The social and environmental problems associated with slums can create an unstable and unattractive business environment.

- **Strategies to Manage Slums**

Redevelopment (top-down from government)

Strategy	Describe the Strategy + How it helps to manage slums (+ve) [Include case studies]	How the strategy may be ineffective in managing slums (-ve) [Include case studies]
Resettlement Relocation of slum dwellers to new dwellings through public housing or new towns	Public Housing — state-owned property which is usually constructed to address issues of housing shortage and unaffordability +'ve case study: Singapore ● squatter settlements were prevalent till Housing and Development Board (HDB) flats were set up by the government in 1960. Now, more than 80% of the Singapore population live in public housing.	Public Housing – governments may not have enough funds or misuse project for political agenda -'ve case study: Cingapura Project, Sao Paulo Brazil ● Lack of government funding: Of the projected 140,000 apartments, only 14,000 were completed. And Residents were expected to pay a monthly rent of approximately $26, which many could not afford, exacerbating their financial strain

	New Towns – free-standing urban centre planned on a completely new site, usually near city centre and urban fringes. Aimed to create self-contained settlements to provide housing for overspill populations +'ve case study: Milton Keynes, England ● Built to ease housing shortages in overcrowded London in 1967 -> has grown from an initial target of 250,000 residents to over 300,000 today ● Met its key targets of only 50% of private housing, hence ensuring affordability of housing and low-density development, with net residential densities of 2-4 dwellings per acre	Requires proper planning and understanding of urban population's needs -'ve case study: 6th of October, Cairo, Egypt ● Only 26% of 500,000 target population reached due to lack of public transport and poor accessibility and prohibiting micro and small informal business sector (this generates jobs for over 69% of urban Egypt)
Urban Renewal	Aimed to improve overall image of city and its economic growth (usually provides housing within redeveloped sites, hence managing slums) +'ve case study: Hyde Park-Kenwood Historic District, Chicago, USA ● Urban renewal funding per capita was associated with an increase in per capita income by $0.198 for Black populations and $0.0479 for White populations in 1990. A $100 increase in urban renewal funding was linked to a 0.074 percentage point decrease in poverty rates for Black populations by 1990	Governments need to work with residents to understand their needs -'ve case study: El Raval, Barcelona ● Barcelona won the bid to host olympics games in 1992 -> demolished 1,384 houses and 293 commercial premises ● However, redeveloped housing only affordable to middle-income despite 60% of housing meant to be allocated to low-income groups -> people felt they were being forced out

<u>Rehabilitation (bottom-up from community)</u>

Strategy	**Describe the Strategy + How it helps to manage slums (+ve) [Include case studies]**	**How the strategy may be ineffective in managing slums (-ve) [Include case studies]**
Self-helping and in-situ upgrading	Focus on the provision of basic urban services, provision of secure tenure and innovative access to credit -> government adopts facilitative role +'ve case study: Kambi Moto Community in Kenya ● allowed 270 households to gain security of tenure and to redesign and construct more secure homes. ● Involved the collaboration of multiple stakeholders such as the Nairobi City Council (to provide security of	May not be sustainable in nature -'ve case study: Lagos, Nigeria ● In 2008, the strategy was to build boreholes using a large sum of money from the World Bank. The strategy aims to increase sustainable access to basic urban services through investments in critical

schemes	tenure to the slum dwellers), the community-based saving group Mungano (to lend money to the residents to buy better construction materials), the Technical Team (to help slum dwellers develop practical solutions for construction-related problems) and the slum dwellers (to build their own houses).	infrastructure. However, more than half of the boreholes have stopped working after 5 years despite aiming to last for 20 to 30 years.
Sites and Services Schemes	New land prepared with service infrastructure in place and are sold or leased to slum dwellers -> ensures security of tenure and adequate infrastructure and freedom to build at one's own pace +'ve case study: The Incremental Development Project, Hyderabad, Pakistan ● The project offered plots at a minimal initial cost of approximately $30, making it accessible to low-income households ● By the end of the project, more than 2,000 houses had been built using permanent materials, with many families upgrading from initial reed huts to more durable structures (Families were allowed to build their homes incrementally as their financial situation improved. This approach not only reduced initial financial burdens but also encouraged residents to invest in their properties over time.)	Root cause needs to be addressed -'ve case study: Beitbridge Housing Redevelopment Project, Zimbabwe ● Lack of infrastructure and slow pace of servicing has increased the cost of construction of a low-cost house so many individuals pulled out of the programme as they were not able to afford it.

Chapter 8: Urban Reimaging

- **Definition:** Urban Reimaging aims to control / influence how others see a place by enhancing & promoting positive images of an urban area (may involve physical reshaping)
- **Reasons**
  - Generic
    - Socially, the old buildings are not pleasant and require new code of paint etc to rejuvenate the image. More vibrant activities also help to inject energy and life to the place
    - Environmentally, old buildings will start to decay as they become dilapidated, if not occupied or maintained. Through the introduction of the new tenants into the area, there can be refurbishment of the old buildings such as new coats of paint, hence helping to maintain and upkeep the pace. This way of conserving the building is also a sustainable use of the original building, since it has given new meanings to the original façade.
    - Economically, boost tourism by transforming the city's image and infrastructure to appeal to visitors. By enhancing cultural landmarks, creating visually appealing public spaces, and modernizing transportation, cities can attract more tourists, leading to increased spending in local businesses and the hospitality sector.
  - Specific to country

CHLDS	CLLDs
Urban reimaging efforts are often driven by the need to attract both domestic and foreign investments. By redeveloping and modernizing urban areas, cities can present themselves as attractive destinations for businesses, which in turn generates economic growth through job creation and increased tax revenues.	Suffer from poor urban image due to consequences of industrialization and rapid urbanisation (lack of planning control makes city look chaotic) -> commercial environment looks out of date and unattractive to employers
Urban reimaging helps attract people and investment back into the city; assert place-uniqueness to stand out from other cities	Urban reimaging helps improve the image of the city so as to attract investment and increase employment for residents

- **Impacts (generic)**
  - Positive Impacts

Social	Economic	Environmental

more opportunities for social activities and leisure for urban dwellers	increased revenue for retailers and food and beverage establishments	reduce traffic congestion and air pollution.
Urban dwellers can cultivate sense of place	property values might increase	Minimise urban heat island effect
	reduced costs of managing pollution and congestion related issues	

- Negative Impacts

Social	Economic	Environmental
urban dwellers would also lose their social networks / their sense of familiarity and sense of place / not identify with the cultural places	Cities end up spending beyond their means and being in debt	If urban reimaging is not planned well, there might be an increase in traffic congestion and air pollution
		Depending on the amount of construction done, pressures might result on the environment of the area and surrounding areas
displace some of the urban dwellers through eviction or high rents from increased property values, causing them to be homeless or forcing them to relocate elsewhere	threats to local businesses as urban reimaging efforts might result in property prices increasing (local businesses are displaced and relocated)	the construction of new buildings to attract investments uses resources and energy. This is especially if urban reimaging adopts a 24-hour city approach, which could result in round-the-clock usage of energy to supply electricity needs.
		higher consumption and more waste being generated. This is especially as urban reimaging increases the number of urban population living in the area, who may have more purchasing power and higher consumption

- **Urban Reimaging Strategies**

Strategy	Describe the Strategy (+ve impacts) [Include case studies]	How the strategy may result in -ve impacts on SUD [Include case studies]
Flagship Developments	Waterfront Developments: any combination of different land uses (can be new projects or re-developments of existing waterfronts into new places) +'ve case study: Redevelopment of Singapore River	-'ve case study: Sabarmati Riverfront Development Project, Ahmedabad ● initiated in 2004 with the aim of converting the 11.25 km stretch of

	• The waterfront redevelopment fostered vibrant mixed-use areas combining commercial, residential, hotel, and institutional spaces, attracting people throughout the day (visitor arrivals to Marina Bay and Singapore River exceeded 19 million in 2019, up from 7 million in the 1990s.) • By the late 1980s, extensive clean-up efforts transformed the Singapore River, which had been declared biologically dead in the 1970s due to the extensive water pollution. By 1987, aquatic life returned, and the river became a prime location for recreation and leisure.	the Sabarmati riverfront into a recreational and commercial hub • However, The project has led to the displacement of thousands of informal settlers. Reports indicate that approximately 11,000 families were affected, with many relocated to areas lacking basic amenities such as drinking water and sanitation facilities.
	Sports-led Regeneration: improving city or area as a result of hosting a major sporting event (like olympics or world-cup) +'ve case study: 1992 Barcelona Olympic Games • Catalyst for wider urban development (better connectivity – build new road to link once peripheral areas; new tourist attractions and sporting venues) • Increased economic growth and tourism – general unemployment rate fell from 18.4% to 9.6% between 1986 and 1992 and number of visitor arrivals increased from 1.7 million in 1992 to 8.3 million in 2015	-'ve case study: 2016 Brazil Olympic Games • Out of the 27 venues constructed for the Games, only 15 hosted events after the Olympics, leaving many facilities abandoned or underutilized • The Maracanã Stadium, which underwent a major renovation costing about $501 million, has also faced vandalism and neglect since the Games
	Iconic Buildings – landmark and spectacular architecture designed by globally recognised architects +'ve case study: Bilbao, Spain • Guggenheim Museum has attracted 20 million visitors (more than 60% from overseas) to a city with only 350000 inhabitants. Ripple effects have created more than 5000 local jobs and generated 650 million pounds of additional revenue for the Basque treasury	-'ve case study: Valencia, Spain • City of Arts and Sciences cost over 1 billion pounds, quadrupling the initial budget and failed to attracted the predicted stampede of visitors • Just over 7 years of completion, parts of the complex are already falling apart
Cultural Quarters	Places where art and creativity are produced and consumed so people are educated and entertained +'ve case study: Temple Bar, Dublin, Ireland • Originally threatened with demolition in the late 1980s, Temple Bar was successfully transformed into a cultural quarter through government support	-'ve case study: Cultural District, Dallas, USA • Cultural leaders have criticized the city's approach to funding, describing it as "Band-Aid" solutions. For instance, the proposed allocation of $15 million for cultural facilities is seen as

	• The Temple Bar Cultural Trust organizes around 400 free cultural events annually, attracting more than 600,000 attendees each year. • The Temple Bar pub, one of the most iconic establishments in the area, reported sales of €4.64 million over just five months, indicating robust financial performance during peak tourist seasons	inadequate, with advocates arguing for at least $60 million to address urgent maintenance needs across various cultural institutions
Heritage Tourism	Heritage and culture is appropriated for the purposes of attracting tourists (often used in conjunction with cultural quarters and waterfront developments) +'ve case study: Edinburgh, Scotland • Edinburgh's Old and New Towns are UNESCO World Heritage Sites, The Edinburgh International Festival and the Fringe Festival are major contributors to the local economy, with an estimated economic impact exceeding £280 million from these events alone • Residents were consulted in conservation projects and events like the Edinburgh Festival Fringe, which fosters a sense of ownership and Collaboration between the city council, private developers, and heritage organizations led to sustainable tourism strategies.	-'ve case study: Lijiang, China • Developers prioritized profit over cultural preservation, transforming the town into a commercialized space (Over 90% of shops in the Old Town are now tourist-oriented, focusing on souvenirs rather than authentic local products) • The Naxi ethnic group, central to Lijiang's cultural identity, was marginalized in decision-making (over 50% of shopkeepers in tourist areas are now temporary residents or Han Chinese migrants rather than local Naxi people, which alters the cultural landscape significantly.)
Environment Revitalisation	Incorporation of green spaces to rejuvenate urban areas / repurpose old buildings and structures +'ve case study: The Bentway, Toronto, Canada • The Bentway hosts over 150 free public programs annually, including cultural events, workshops, and activities aimed at engaging diverse community groups. • Surveys conducted by The Bentway indicate that about 40% of visitors are from neighborhoods adjacent to the site, suggesting that local residents are actively utilizing the space rather than being displaced by new developments	-'ve case study: High Line, New York City, USA • The High Line is a repurposed elevated railway transformed into a linear park. • An increase in economic value of surrounding buildings was also observed, with a 12-15% rise in prices of properties all across the neighbourhood. The insensibly high and unaffordable land prices also resulted in the loss of homes for local poor due to the increase in property price

the future with climate change

Chapter 1: The Science of Climate Change

Evidence of climate change since the last ice age

1. *Describe insights that ice cores provide about past climate variability.*

- The concentrations of GHG trapped in microscopic air bubbles in ice cores reflects concentration of GHG levels at a certain point in time as when snow falls onto a glacier, microscopic bubbles of the surrounding air become permanently trapped in the ice.
- The ratio of ^{16}O to ^{18}O isotopes in ice cores can be used to determine past temperatures and rates of precipitation / evaporation
    - This is because ^{16}O is lighter and it evaporates more readily than ^{18}O, meaning In colder periods, more ^{16}O evaporates from the ocean and hence deposited as snow onto growing ice sheets
    - This can give evidence of the cyclical warming and cooling in the Earth's climate.
- Ice cores provide insights into past dust content in air
    - This is because during glacial times, more dust particles in air due to higher wind speeds and drier conditions so snow layers and hence ice cores are comprised of dirtier layers

2. *Describe insights that ocean cores provide about past climate variability.*

- One way could be the analysis of isotopic composition of the calcite in the shells and bones of sea organisms deposited on the seabed.
    - This can give evidence of the cyclical warming and cooling in the Earth's climate in the past where a higher composition of 18O isotopes in the ocean core will be indicative of colder ocean temperatures.
- One way could be the study of diatoms found within the sediments which can show how past climate has changed
    - The changes in salinity in the area due to changes in temperature/rainfall would change the species composition of the diatoms over time and the study of these changes could identify changes in the local climate
- One way could be the study of glacial debris deposited on the ocean floor when icebergs calved from continental glaciers carrying these material melts over the seabed
    - The changes in the types of rocks found in glacial debris was key in discovering changes to the Northern Hemisphere ice sheets in past climates

Natural Factors influencing Temperature Variability

3. *Explain how a change in solar output could result in temperature variability.*

- Higher solar output leads to greater amounts of solar energy entering and heating the Earth's atmosphere, resulting in a rise in global temperatures
- The gain of heat energy by Earth's surface is systematically returned to space in the form of thermally emitted radiation. However, very little of the emitted radiation

passes directly through the atmosphere as most of it is absorbed by clouds , carbon dioxide and water vapour

- A greater amount of solar energy will thus result in more incoming solar radiation being absorbed by the Earth as heat energy
- The converse is also true with a decrease in solar output leading to lesser amount of solar energy heating the atmosphere, leading to a fall in global temperatures

4. *Explain how a change in thermohaline circulation could result in temperature variability.*

- THC refers to large scale circulation of the world's oceans which is driven by variations in temperature and salt content
- When THC is strong, warm surface water from the tropics moves polewards to the North Atlantic, resulting in heat being released to the air there before sinking and moving equatorwards.
- This results in warmer temperatures in the continental mass of Europe and North America, as well as milder conditions in higher latitudes.
- When the THC slows or collapses, less warm water reaches high latitudes, causing regional cooling, especially in the North Atlantic and Europe
- The tropics may become warmer due to a buildup of heat that is no longer transported poleward.

5. *Explain how a change in ice sheets could result in temperature variability.*

- Ice has higher albedo (reflectivity of a surface) than other natural surfaces
- When ice sheets melt, there are less white surfaces from the ice, and there will be less albedo to reflect sunlight back to space.
- In contrast, there will be more dark surfaces from the greater expansion of dark ocean waters and exposed soils, which will result in more absorption of sunlight onto Earth's surface. As a result, there is a higher temperature.
- This will then result in more melting of ice sheets and higher temperature absorbed, resulting in a positive feedback mechanism

Past Evidences (fyi):

- Solar Output: Maunder Minimum (1645–1715) during Holocene Epoch – A period of near-zero sunspot activity coincided with the Little Ice Age, a time of cooler temperatures in the Northern Hemisphere
- THC and Ice Sheets: During the Younger Dryas episode during the early Holocene epoch, sudden input of meltwater from Laurentide Ice sheet resulted in sudden

cooling of the Earth's Climate for about 1400 years

- Due to global warming, the Arctic region in the North Pole and Antarctica in the South Pole have warmed significantly since the 1980s, more than 3 times the average. This has led to the rapid melting of ice sheets in the Greenland and Antarctic Ice sheets

Significance of Human Activity on Earth's Climate

6. *Explain influence of human activities on the global carbon cycle*

- Human activities have led to an imbalance in the global carbon cycle because there is more carbon dioxide added into the atmosphere than sequestered and stored by vegetation/soil and ocean carbon stores, resulting in a surplus of 19 Gt CO2/year in the atmosphere.

Human Activities that increase Carbon emissions:

- Burning fossil fuels or power plants for electricity in urban areas and industries, and power transportations networks.
- Fossil fuels are storage reservoirs that contain carbon from plants and animals that lived and died millions of years ago. The burning of fossil fuels releases this trapped carbon quickly into the atmosphere as CO2.
- Rearing of livestock as decomposition of manure and methane produced as part of their normal digestive processes

Human Activities that reduce carbon sinks:

- Deforestation reduces carbon sinks as it will lead to fewer trees available to absorb CO2 through photosynthesis.
- Deforestation also increases CO2 emissions when trees are burned down as stored carbon is released back into the atmosphere as CO2.
- When trees are cleared, the soil is exposed to direct sunlight. Higher soil temperatures will increase the rate of carbon oxidation, which is the process whereby carbon in the soil organic matter reacts with oxygen to produce CO2.
- Land Use change refers to conversion of forested land to land that is used for agriculture, industries and cities. the clearing of forests for crops or pasture reduces the ability of the area to store carbon efficiently leaving more carbon in the atmosphere

Other things to note:

Positive and Negative Feedback:

- Positive Feedback = initial perturbation is enhanced: <u>increased GHG in atmosphere</u> -> increased in ocean temperature -> ocean dissolves CO2 less effectively -> <u>increased GHG in atmosphere</u>
- Negative Feedback = initial perturbation is weakened by the changes it causes: <u>increased temperatures</u> -> greater rates of evaporation -> more water vapour in atmosphere -> more clouds -> more insulation is reflected -> <u>cooler temperatures</u>

Enhanced Greenhouse Effect:

- GHG -> CO_2, CH_4, H_2O, NO, NO_2
    - Purpose: trap outgoing long wave radiation from earth to keep earth warm
- Enhanced Greenhouse effect occurs due to increased concentration of GHG in atmosphere -> higher global temperatures

Chapter 2: Possible Effects of Climate Change

Kinds of Impacts

1. *Explain the impacts of climate change on aquatic ecosystems*

- Deoxygenation of oceans with warmer waters being able to hold less oxygen leading to hypoxic conditions.
    - Low oxygen levels reduce survival of fish and invertebrates, especially in coastal waters, impacting ecosystem services and commercial fishing
- Changes in migration and breeding patterns – warming waters shift species distributions and migration timing
    - Fish stocks may move poleward or to deeper waters disrupting ecosystems and affecting fisheries and food security
- Ocean warming and Coral bleaching - Rising sea temperatures stress coral reefs leading to coral bleaching.
    - Corals expel symbiotic algae, leading to widespread bleaching events and loss of biodiversity
    - Increased frequency of harmful algal blooms - These blooms disrupt water quality and reduce oxygen levels, degrading the provisioning and regulating services of aquatic ecosystems critical to humans.
- Ocean acidification and marine life- Increased carbon dioxide absorption by oceans lower pH, causing ocean acidification.
    - This reduces the ability of calcifying organism such as shellfish, corals and plankton to form shells and skeletons, disrupting marine food webs
    - Weakens shell formation in molluscs and crustaceans, threatening commercial aquaculture industries

2. *Explain the impacts of climate change on terrestrial ecosystems*

- Disruptions to present patterns of plant and animal distributions in their geographical habitats like freshwater ecosystems and coastal wetlands due to increase in temperatures (plants and animals have thermal tolerance limits)
- Disruptions to migration patterns and seasonal activities (animal species move to other regions that are less cold / hot)
- Disruptions to diets (lack of caterpillars and other insects for bird species; lack of nutritious eucalyptus leaves for koalas)
    - Lead to Accelerated rates of species extinction

- increase in spread of invasive species which outcompete native plants and animals, bring in new diseases etc

3. *Explain the impacts of changes in aquatic and terrestrial ecosystems on humans*

Decrease in provisioning ecosystem services:

- Food production is affected by droughts, heatwaves, and unpredictable rainfall, leading to lower crop yields and livestock productivity.
- Fish stocks can decline due to ocean acidification and coral reefs resulting in less spawning and nursery grounds for economically important fish populations needed to thrive
- Loss of biodiversity reduces the discovery of new medicines and plant-based materials.

Decrease in regulating ecosystem services:

- Forests and oceans are major carbon sinks. As they degrade, their ability to absorb CO_2 weakens, accelerating climate change
- less coastal protection from storm surges and erosion from waves

Decrease in cultural ecosystem services:

- Coral bleaching and degraded landscapes reduce nature-based tourism.
    - less job opportunities for local people through tourism, fishing and recreation activities

4. *Explain positive impacts of climate change*

- Climate change can extend growing seasons for populations closer to the poles
    - This can lead to increased productivity of farms
- Climate change can lead to warmer summers resulting in an extended summer tourism season
    - This can lead to increased tourism activity for countries closer to the poles.
- Climate change can lead to melting of tundra ice, revealing deposits of coal and oil for extraction.
    - This can allow for economic benefits for countries in the Arctic circle.
- Arctic sea ice is lost → increased accessibility to Arctic ports + opening of new Arctic shipping lanes for longer periods of the year → bottlenecks in other shipping routes is reduced / distance to other countries via boat is shortened → shipping commerce benefits (less time needed to ship goods)

5. *Explain negative impacts of climate change*

Increased flood risk

- larger rainstorms or spring snowmelt quickly drains into streams and rivers → floods occurs → damage to infrastructure, crops and individuals and disrupt ecosystems by displacing aquatic life, diminishing water quality and increasing soil erosion
    - Largest threat to low-lying settlements in coastal areas and deltas
- Cause river floods to be larger or more frequent than they used to be in some places

Agricultural Yields

- Increase in temperatures can result in crop yield to decrease in certain regions as climate is too hot for crops to grow
- Extreme climate events (droughts, flooding) decreases crop yield
- Decrease in crop yield reduces food security

Reduced Water security

- Climate change ⟶ increased precipitation variability ⟶ decreased water storage in snow and ice ⟶ increased variability in river flow ⟶ less reliable surface water supply
- Surface and groundwater availability is needed in agriculture, energy production, domestic water supply, sanitation and freshwater ecosystems

Spread of Diseases

- Climate change ⟶ increased rainfall, humidity, temperature ⟶ increased dengue transmissions in tropical and sub-tropical climates and presence of dengue in places where dengue was not detected before

6. *Suggest why the major emitters of greenhouse gas emissions may suffer the least impact of climate change?*

- Wealth and economic resilience: Major greenhouse emitters are often developed countries or rapidly industrialising nations with strong economies and industries that emit large amounts of greenhouse gases.
    - However, their wealth allows them to invest in climate adaptation measures such as building sea walls, climate-resilient urban planning thus reducing their vulnerability to climate impacts.
- Social vulnerability: Major emitters often experience lower levels of economic and/or social inequality, this means smaller groups of marginalised low income groups living in high risk areas, e.g. slum dwellers.
    - With a small marginalised group of individuals, it will reduce the overall exposure to negative climate change impacts.
- Strong governance: Countries that are major emitters often have more stable governments that can implement more effective adaptive policies such as creating incentives for sustainable practices thus they suffer a lower level of climate change impact.
- Geographical advantage: Some major emitters are located in regions less prone to severe climate impacts.
    - For example, inland USA states may be less affected by rising sea levels compared to low-lying island nations.

7. *Explain how the vulnerability of different groups of people may result in varied impacts of climate change.*

- Income and socioeconomic status: Higher-income groups could afford adaptation measures like air conditioning, flood insurance or relocation to cope with impact of climate change such as warmer temperatures and higher flood risk.
    - Poorer communities often live in high-risk areas (e.g. floodplains, informal settlements) and lack the financial resources to recover from hazards such as tropical cyclones and floods. Climate change exacerbates inequality, leaving the poor more exposed and less able to recover.
- Gender: Women and girls often bear the brunt of climate change in CLLDs due to gender roles and inequalities. In many communities, women are responsible for gathering water and food.
    - These tasks are made harder by droughts and climate change. Women may walk longer distances to find water, reducing time for income-generating or educational activities. Climate change can worsen gender disparities unless responses are inclusive and gender-sensitive.
- Age and health: Children, the elderly and people with pre-existing health conditions are more vulnerable to extreme heat, poor air quality and disease outbreaks due to their lower immunity.
    - Heatwaves in Europe have disproportionately affected elderly populations who live alone. Climate risks can become life-threatening for vulnerable age groups, especially in poorly prepared healthcare systems.
- Communities / people who are reliant on provisioning services from various ecosystems such as agriculture and fishing would be more significantly affected by climate change.
    - Changes in rainfall patterns may affect agricultural yields and breeding season for fish and fish migration.

8. *Explain why impacts of climate change may be uncertain?*

- Lack of full understanding of physical processes + unpredictable natural influences on climate like solar output and volcanic eruptions
    - there is currently still a lack of understanding of how oceanic processes such as ocean currents and sea surface temperature patterns influence atmospheric circulation and weather systems
    - cannot accurately predict temperature rise, precipitations, sea level change and regional climate change
- Incomplete in-situ data on vast expanses of oceans, deserts and polar regions
    - These areas are often inaccessible to scientists and with a lack of data in these areas, it is therefore challenging to understand the variations in the impacts of climate change and project future impacts
- Intrinsic measurement errors in current climate data

    - Records of global climate change in historic past is uncertain especially when methods of measurement over time have changed + lacking in terms of its sensor calibration
- Uncertainty over future GHG emissions
    - Anthropogenic influences on climate are uncertain [Key drivers of GHG emissions : fossil fuel use, cement production, and effectiveness of carbon capture]
    - Political and public resistance hampers emission-reduction efforts.
    - Economic growth in Asia and global urbanization are likely to sustain high emissions.
    - Deforestation continues, but some regions show forest regrowth
    - CO_2 uptake by plants and oceans is uncertain and may be affected by climate changes (e.g., droughts, fires).

Other things to note:
Impacts on Weather

- Global surface temperature increases
    - land -> 1.59 degrees celsius
    - ocean -> 0.88 degrees Celsius
    - summer of 2023 earth's hottest since 1880
- Changes in Precipitation
    - Some places experience more precipitation and flooding while others suffer from drought
    - Changes in frequency vs changes in intensity of precipitation

Case Studies for Impacts of Climate Change:

Illinois, USA → Record breaking harvest of 688 million bushels of soybean in Illinois in 2024! Average yield increased by one bushel per acre from 2023 - 2024. Possible due to Climate change leading to longer growing seasons

Maldives → The total fish catch in the Maldives has decreased from 180,000 metric tonnes in 2010 to approximately 120,000 metric tonnes in 2020

Rotterdam, Netherlands Climate Adaptation Strategy → Maeslant Barrier – A massive, movable storm surge barrier that automatically closes during extreme storms, protecting the city from flooding.; Benthemp Plaza – Public squares that act as recreational spaces during dry periods but temporarily store rainwater during storms, preventing floods.

Cyclone Idai, Mozambique, 2019 → In March 2019, Cyclone Idai struck, becoming one of the worst climate-related disasters in Southern Africa's history. Scientists confirmed that global warming intensified rainfall by about 10% and increased the cyclone's destructive

potential. Over 1,300 deaths across Mozambique, Zimbabwe, and Malawi. More than 3 million people were affected, with 90% of Beira city destroyed.

New Delhi, India: In 2024, Delhi Had a prolonged heat wave, with daily temperatures topping 40 °C in May and June and at one point reaching 50 °C. In just 1 week, Delhi recorded at least 192 deaths among homeless people. This is in contrast to the more affluent Vasant Vihar Neighborhood which experienced significantly lower mortality rates due to residents having well-insulated housing and reliable access to air conditioning and water.

<u>Chapter 3: Responses to Climate Change</u>

Case Studies:
Netherlands:

- The catastrophic North Sea flood of 1953, which resulted in over 1,800 deaths and widespread devastation, led to a series of construction projects constructed between 1954 and 1997 also known as the “Delta Works”. The works consist of dams, sluices, locks, dykes, levees, and storm surge barriers located in the provinces of South Holland and Zeeland.
- The Netherlands only started developing a specific climate change strategy and implementing mitigation measures during the second half of the 1980s. The first National Environmental Policy Plan (NEPP) in 1989 initiated policies and measures to meet environmental targets, and the country ratified the Kyoto Protocol in 1997, committing to greenhouse gas emission reductions
- The Urgenda Foundation, a Dutch climate NGO, sued the Dutch government in 2015 for failing to take sufficient action to reduce greenhouse gas emissions. In 2015, the court ruled in favour of Urgenda, ordering the state to cut emissions by at least 25% by 2020 (compared to 1990 levels).

Green Climate Fund in Kiribati

- Due to Kiribati being one of the most remote and least developed countries in the world, its water supply depends entirely on underground freshwater which is seriously threatened by CCC-induced flooding and prolonged drought. This has led to many households using kerosene to boil seawater which results in more than 100,000 tonnes of CO2 emitted in 20 years.
- The Green Climate Fund established at the 15th Conference of Parties in 2009 and reiterated to extend to 2025 in 2021 comprises funds donated by CHLDs to help CLLDs with financial support for mitigation and adaptation projects.
- Funds from the GCF has helped build a 6,000 cubic-meter-per-day reverse osmosis seawater desalination plant in Kiribati which runs on a photovoltaic power plant →

not only does this project decrease CO2 emissions from boiling seawater, it also ensures people of Kiribati have a reliable, climate-resilient source of freshwater.

Bangladesh

- Bangladesh is a low lying country and since 1960, has built 4000 km of embankments along the coast to guard against rising sea levels. In 2013, Bangladesh spent $400 million from the World Bank to upgrade 600 km of these embankments
- However, fossil fuels still account for 95% of the country's electricity generation in 2023 and coal-fired electricity generation in 2023 doubled from 2022 to a record 17 terawatt hours (TWh)

Brazil

- In 2005, President Lula pledged to reduce deforestation by 80% by 2020. Nearly half the slowdown in deforestation during the late 2000s was due to strong policy efforts including improved monitoring, law enforcement, and legal land ownership for 300,000 landholders
- However, Amazon deforestation surged to 12-year high under President Bolsonaro who encouraged agriculture and mining activities that harm the rainforest as well as cut funding to federal agencies that have the power to fine and arrest farmers and loggers breaking the law

USA

- 2017 – trump withdraw from PA
- 2021 – biden rejoin the PA
- 2025 – trump withdraw from PA
- When Trump took over office, he cut the budget of the Office of Oceanic & Atmospheric Research (which handles most climate R&D) by 32%. The administration also withdrew from the Paris Agreement, signaling a step back from coordinated international climate research.

Singapore

- Priced at $SGD25 / tCO2 equivalent, Singapore's carbon tax covers approximately 80% of Singapore's greenhouse gas emissions, targeting large emitters in sectors like manufacturing, power generation, waste, and water
- However, businesses pass down costs to consumers instead of cutting carbon emissions. On average, every increase of $5 in carbon tax could cause household electricity tariffs to rise by a corresponding 1 per cent. This means electricity bills could go up by about 4 per cent in 2024. Furthermore, despite implementing carbon tax in 2019, Singapore's greenhouse gas emissions in 2021 reached the highest levels yet at 57.7 million tonnes – representing an increase of around 9 per cent from 2020 levels.

Philippines

- A similar trend is observed in the Philippines, where billions have been invested in seawalls and flood barriers, yet Typhoon Haiyan (2013) brought 5-metre storm surges that devastated Tacloban's coastal communities. In Tacloban, 80% of informal settlers lived within 40 metres of the shoreline, and many lacked access to evacuation centres, causing thousands of deaths.
- the government has worked with NGOs such as the Foundation for the Philippine Environment (FPE) to enhance community adaptive capacity to climate impacts. By providing legal frameworks, funding, and technical support, the government enabled FPE to implement large-scale mangrove restoration projects and community-based disaster risk management programs, which increased resilience to flooding and storm surges in vulnerable coastal areas.

UK

- The Met Office Hadley Centre leads the development of the UK Climate Projections (UKCP), which offer detailed simulations of future climate scenarios. These projections are instrumental in identifying potential climate risks, such as increased frequency of heatwaves and heavy rainfall events. For instance, the 2023 UKCP projections indicated a significant rise in the probability of temperatures exceeding 40°C in the coming decades, highlighting the urgency for adaptation strategies

Germany

- Germany's Green Party and broader political leadership enabled the "Energiewende" transition. Renewable energy rose from 6.3% of electricity consumption in 2000 to 51.8% in 2023, supported by legislation that phased out nuclear energy and subsidised renewables.

India:

- Odisha, one of the most climate-vulnerable states in India. While the government has made strides in improving warning systems and shelters, there are still key social gaps in the areas of livelihoods and resettlement. However, NGOs like ActionAid India provided training and microfinance for climate-resilient agriculture and aquaculture, directly addressing what the state's large-scale policies ignored.

China:

- in China, the government's subsidies, preferential loans, and investment in charging infrastructure helped make domestic EV companies like BYD and NIO profitable, enabling them to scale rapidly and drive the national transition away from fossil-fuel vehicles.
- major state-owned enterprises in China such as China Energy Investment Corporation and China Three Gorges Corporation have implemented large-scale renewable energy infrastructure (solar, wind, hydropower) in direct response to national targets set by the state under the Paris Agreement to reduce carbon emissions by 65% by

2030. These firms helped renewables account for over 50% of new power generation capacity in 2023.

fieldwork

1) Suitability of Investigation

a) *Is the Hypothesis / Research Question suitable for investigation?*

- Clearly defined variable and target group / population
    - Terms cannot be up to individual interpretation! (eg: “sustainable practice”; "vicinity of XXX”)
- Suitable / manageable scale with sufficient manpower
- Capable of Research
    - Feasible methods chosen, e.g. questionnaire survey and in-depth interviews.
    - Got familiarise with available secondary data
- Aligned with investigation aim

b) *Are the locations chosen suitable for investigation?*

- Able to test Hypothesis: <XXX> allows students to investigate the specific influence of <XXX> as a variable more easily. This allows the students to better test their hypothesis, as the absence of <XXX> can act as a control in their investigation.
- Proximity of Locations: The close proximity of <XXX> makes it more manageable for the students to collect their data and discuss their findings in one day. <add supporting data if available>
- Able to collect data on target audience (who will give accurate perceptions): The locations of <XXX> allow the students to observe the behaviour of <target audience> more easily. The two outlets are located within <XXX>, which makes it more likely that the <people at location> are <target audience>
- Able to provide wider range of respondents
- Does not introduce sampling bias (esp for community response to climate change fieldwork)

2) Data Collection Methods

a) *Sampling Methods*

- Ensure size of sample is large enough in order for data sample to be representative
    - For CC fieldwork, can also mention to reduce the possibility of selection bias in the data, students may wish to put up their survey on online media platforms to reach <target audience> who have little or no direct personal connection to them
- Ensure that their sample comprise certain types/categories of participants to improve the representativeness of their data sample
    - For elderly fieldwork, can say obtain the demographic distribution of ~ to find out how many elderly of each race/gender there are to determine size of categories of participants in the sample

    - Proportion of certain types/categories of participants should also be representative of population.
- Use a probability sampling method such as simple random sampling, instead of non-probability convenience.
- Sampling Methods

Method	Description	Advantages	Disadvantages
Random	Use random number generator to generate random numbers (up to the sample size) to select members from the population to be part of the sample	Each member in the population has equal chance of being selected	Practical constraints such as availability of time and accessibility to certain areas May not be representative as chosen sample may be concentrated in one part of the population
Systematic	Selecting every kth element of the sampling frame, beginning with a randomly chosen point	Good coverage of population /study area	Each member in the population does not have equal chance of being selected
Stratified	Selecting a sample from given subgroups in the population, based on a known background characteristic in population (i.e. racial or gender composition) For each subgroup in the population, can be either random or systematic	If proportions of subgroups are known, results generated through this method will be more representative of the population Correlations and comparisons can be made between subgroups	Proportions of subgroups must be known for this method to work properly
Convenience	Selecting members of the population that are accessible to make up the sample	Easy to conduct Data collection can be done in a short period of time	Vulnerable to selection bias High level of sampling error Sample is unlikely to be representative of the population being studied

b) *Benefits of various data collection methods*

- Interviews:
    - provide a safe and confidential setting for participants to discuss potentially sensitive issues or their personal experiences. This can help to ensure that participants feel comfortable and willing to share their experiences, leading to more accurate and complete data
        - conducted in familiar and comfortable surroundings including the participants' homes, hence, this relaxed environment enable them to share in a casual and relaxed setting which can allow for freedom of expression
        - Using a voice recorder allows for the points raised during the interview to be captured accurately [but must inform the participants the recording procedures before the start of the FGDs and give them an opt out to be ethical]
        - option if they are uncomfortable with the recording process
        - [for elderly]: conducted in their Mother Tongue which is the language the elderly are comfortable with which can help the elderly to express their opinions with ease or without any misinterpretation
        - Also take note if interviews are conducted in pairs / groups, may result in participants' responses being swayed or influenced by each other's responses or having one participant overpowering the other
    - can provide students with the opportunity to collect rich and detailed data that captures the complexity and nuances of participants' expressions, experiences, and perspectives. This can provide insight into <XXX>
    - can allow the students to ask follow-up questions or seek clarification when participants' responses are unclear or ambiguous. This can help to ensure that the data collected is accurate and complete, and can lead to a deeper understanding into <XXX>
- Pilot survey (especially for elderly):
    - serve as a way of checking the clarity / sensitivity of the questions in the questionnaire.
    - could assess if there is a need for additional information to be collected for their investigation.
    - could make data collection at the locations more efficient and focused as the students could look out for evidence
- Questionnaire/recording sheet:
    - efficient way to gather quick responses about the community's behaviour regarding XXX.

    - The data from the questionnaire can be quantitative, which allows for tabulation of objective data to draw conclusions.
        - Make sure options are not limited → lead to misleading conclusions about intensity of respondent's opinions
    - Based on the data from the questionnaire, students could delve further into some of the areas highlighted by the results of the survey
    - Both the number of questions and the length of questions are short , which would encourage more respondents to respond to the survey instead of abandoning it due to lack of time or attention to sustain the survey
    - The recording sheet allows data to be collected for gender, age and occupation, allowing the data collected to be analysed across different social profiles for more detailed analysis
        - But make sure categories are not too broad (people with vastly different experiences and needs are not lumped together because then important difference in survey results would be masked)
- Participant observation
    - Participant observation allows students to observe behaviours/practices that the community might not declare in their responses.
    - Participant observation allows students to observe a large sample size of staff and students that the questionnaire may not access.
    - The use of both participant observation and questionnaires can help students corroborate results from different data points

c) *Benefits of sequence of data collection methods*

- By searching for secondary data on the internet before the fieldwork, the students have a better idea what features to look out for during their site recce and fieldwork so that they can collect valid data.
- Benefits of Site-recce before fieldwork
    - Students can familiarise themselves with the physical layout of the estate. This helps them identify the most suitable pedestrian pathways and market entrances where elderly residents are concentrated, improving data collection efficiency.
    - Students can carry out a risk assessment of the sites. This allows them to spot potential safety issues such as crowded aisles or uneven pavements, so they can plan precautions in advance.
    - Doing the site recce 2 days before the fieldwork gives sufficient time to students to edit their questionnaire based on their observations at both streets, thus ensuring that their questions in the questionnaire aligns with what can be found at both streets.

- Benefits of Interviews after questionnaire:
    - The questionnaire could serve as a way of checking the clarity of the questions in the questionnaire.
        - For example, if any of the questions were found to be not understood or misunderstood by the survey respondents, they could be rephrased prior to using them for the face-to-face interviews.
    - The collated data from the questionnaire could help determine what additional information will be useful to address their research question.
        - The questionnaire can help students first draw out certain trends on [...] which can inform students on the need to uncover reasons for the trends observed.

d) Strengths and weaknesses of given survey questionnaire

- Strengths:
    - The survey used in Resource 3 covers a range of relevant questions on [...] directly linked to the hypothesis.
    - Clear demographic segmentation (Age groups) as the inclusion of age categories allows analysis of how [..] vary across different age cohorts, enabling comparative insights.
    - Mix of range of close and open-ended questions
- Weaknesses:
    - No question to determine if the respondent is part of the target group.
    - Age groups are not evenly distributed
    - Vague and subjective terms with different persons having different standards to what is "..." and "...". This can create inaccuracy in data collection.
    - Double-barrelled questions but only allows for one answer. [1]
    - No option for "None of the above", which reduces clarity for respondents who have not participated in or heard of any of the listed initiatives.
    - No "others" option so may not fully capture all possible drivers of [...]

<u>3) Accuracy and reliability of data collected</u>

a) *How to improve accuracy of data:*

- Explain to the elderly what the investigation is about first so they will understand the purpose and give better responses
- Terms should be specific and not subjective in questionnaire

        - The phrases “strong influence” and “some influence” tend to be ambiguous and subjective. Such phrases may be interpreted differently by different participants
    - substantiate the quantitative data shown with qualitative data obtained from the interviews / open ended questions.
    - More follow-up questions to have more comprehensive understanding (see context)
    - For counting, make sure students have a clear view of <XXX>

b) *How to improve reliability of data:*

- Determine good sample size / frequency of data collection
- better to have open-ended interview questions
    - Only having close-ended questions usually means there are some assumptions and the provision of prepared/pre-filled options may inadvertently influence the respondents’ eventual thoughts and responses. Respondents may select these options out of convenience instead of sharing their real reasons
    - Without open-ended questions, students do not have any avenue to contextualise their responses and provide further information that might be helpful in the interpretation of the results
- Do not request for respondents’ names on the forms as respondents may become more conscious about how their responses may be interpreted. Since respondents know that their responses can be ‘traced’ back to them, they may refrain from indicating <XXX>
- For elderly specifically:
    - Sampling method should be stratified to get a good range of elderly across age groups, sex, ethnicity
        - On top of knowing the proportion of different age groups within the elderly sample, should also know the actual proportion of elderly in the various age groups in the population
    - Collect more identity markers instead of just age / race / gender is so as to be able to do more in-depth analysis
    - Try to think about whether there is understanding of elderly’s physical, psychological and social needs and factors which affect whether those are met

<u>4) Data Presentation Methods</u>

- In general, bar graphs pie chart and radial graphs allow for Easy visualisation; Allows for comparison across the various categories
    - A comparative bar graph or compound bar graph helps to present multiple data sets in 1 graph sharing

- Compared to a pie chart, the bar chart avoids clutter from too many categories and highlights contrasts more effectively.

- When drawing, must include **Title**, **Axis** and Legend / Key

5) Risk and Ethics

a) *How to Minimise Risk*

- Should always go in groups of 2 or 3 for safety reasons especially if approaching strangers!
- [for outdoor investigation]: Students should be alert to safety concerns like finding shelter should there be a downpour or lightning and should not go after dark
- [for homeless] should also be alert to being a target of unruly behaviour / the students could wear masks to prevent transfer of diseases or viruses in the course of their investigations as not all homeless have access to healthcare and some of them might be unwell

b) *How to Minimise Impact / Ethics*

- Don't litter
- Don't be a public nuisance
    - Don't crowd
    - Don't be noisy
    - Don't block the way
- Do pilot to test for sensitivity
    - How to pilot?
        - check for clarity of the questions & terms
        - check whether the sequence of questions made sense.
        - age range and occupational profile could be similar to the sample to ensure similarity with the test group
- Always ask for permission whether to the individual participating or mall security
- Allow individual to withdraw from research at any point in time
- Make sure results are confidential and anonymous

6) Evaluation

1 paragraph on why conclusion is valid + another paragraph on why conclusion is invalid

When determining something is valid, consider:

- Methodology
    - Is the sample representative of the population?
    - Is the questionnaire worded clearly and precisely?
    - Mix of close-ended and open-ended questions in the questionnaire?
- Data Collected
    - Does it support the conclusion?
    - Does it corroborate with secondary data?