Research Article

Safe City Concept in Smart City Planning

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Rapid urbanization and smart city development have heightened the importance of prioritizing safety and security for residents, businesses, and visitors. This research analyses the integration of safe city concepts into Indian smart city planning, focusing on major safety issues, strategies, and international case studies. Recognizing safety's significance, the study aligns with the Smart Cities Mission's goal of enhancing urban life quality and competitiveness. The paper defines safe cities as technologically-driven communities minimizing crime for a secure environment. It underscores the necessity of seamlessly integrating safety into smart city planning, guided by the 2030 Agenda for Sustainable Development.

Key smart city outcomes encompass livability, economic vitality, and sustainability, reinforced by principles such as citizen-centricity and responsible technology. The study scrutinizes safety measures' practical implementation, dissecting case studies of Indian smart cities. Addressing safety and security challenges, the paper advocates a unified approach, referencing international exemplars recognized by the Economic Intelligence Unit. The study formulates recommendations derived from the analysis to enhance safety in Indian smart cities.

Emphasizing the need for coordinated efforts, the paper underscores the potential of integrated safety measures in smart city planning. This approach positions India to create cities that not only excel technologically but also offer secure living spaces for its citizens.

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1. Introduction

The smart cities mission states that the quality of life and economic competitiveness of a city is determined by the ability of the city to provide security as well as safety to its residents, businesses and

visitors. Safety and feeling of security of citizens are affected by crimes as well as other issues such as pollution, cybercrimes, accidents, insecure living conditions, cybercrimes such as data thefts. Therefore, smart cities have to embed solutions through social innovation with the help of technology to improve safety in these cities.

The study aims to analyse the ways in which the concept of safe city has been used in planning for smart cities in India. This paper intends to study the concepts and guiding principles of safe city and smart cities as well as to comprehend the importance of safety and security in planning of smart cities in India.

1.1. Purpose of Study

The rapid global urbanization strains civic infrastructure and resources, impacting citizens' safety and security. This underscores the urgency of safe city initiatives. The 'Safe Cities Index 2021' by The Economic Intelligence Unit emphasizes integrating security into smart cities holistically. Maslow's hierarchy asserts safety's pivotal role in urban life. Smart cities must prioritize safety for enhanced living standards. Understanding safety's incorporation in smart city planning is imperative.

1.2. Methodology

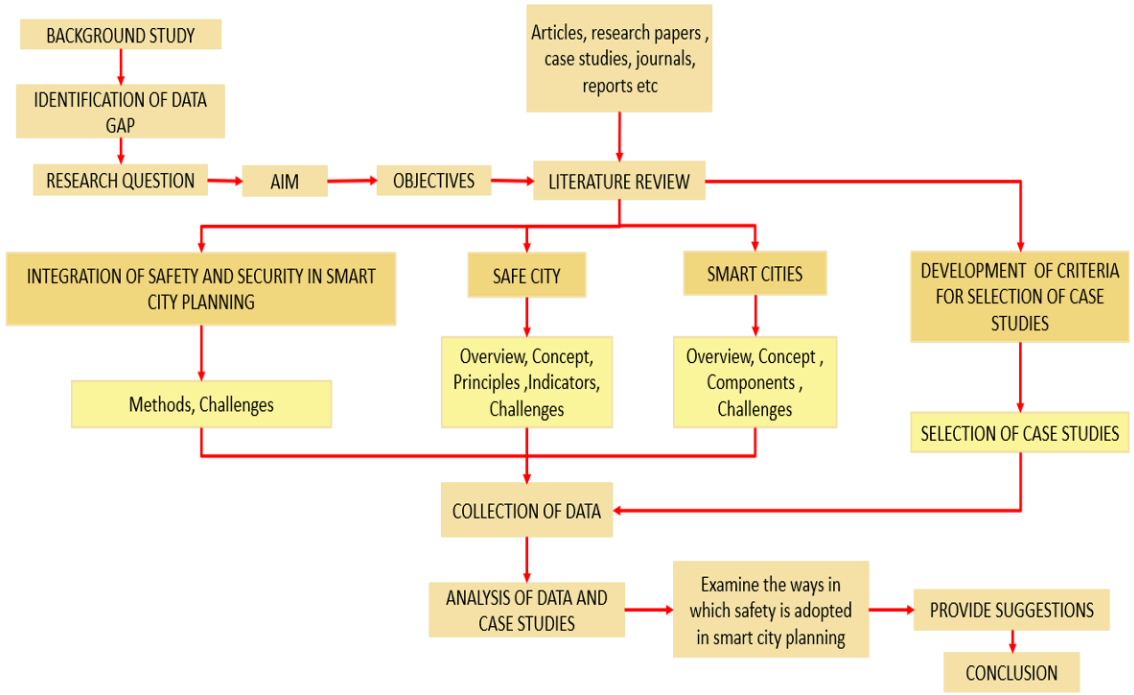

Figure 1.1. Methodology of research

Source: generated by Aysha, 2023

The study begins by comprehending the definitions of safe city and smart city. The research further proceeds by comparing different smart cities within India to understand the elements of safety and security adopted as per the definition of safe cities. Suggestions are provided at the end to improve safety in Indian smart cities by adopting elements from best-case examples around the globe.

2. Safe City Concept

The 'Safe cities index 2017' report from The Economic Intelligence Unit (EIU) defines Safe city as, "an idea in a community that uses technology to help governments, communities and businesses reduce the possibility of crime and provide an environment where people can feel safe and comfortable".

Goal 16 of 2030 Agenda for sustainable development recognizes that reducing crime, conflict, discrimination, violence and ensuring rule of law, good governance and inclusion are necessary for the

wellbeing of citizens and for achieving sustainable development. Also goal 11 of the 2030 Agenda focuses attention on the promotion of safe, inclusive and resilient cities.

2.1. Urban Safety and Security

Urban safety and security deals with both Physical threats as well as Intangible threats. Physical threats include violence, traffic accidents, robberies etc whereas Intangible threats include terrorist attacks, wars, disasters etc.

'Safety' can be defined as the condition of being safe from any risk or danger while 'Security' is associated with guaranteeing freedom from anxiety or danger.

2.2. Role of Urban Planning in Safe Cities

Urban planning prioritizes citizens' safety by fostering social integration through strategies like enhancing walkability and mixed-use spaces, ensuring proximity of vital services, promoting social diversity, and integrating varied transportation options. Maintenance and regeneration of public spaces are emphasized, along with secure public transport for vulnerable groups. Geographic Information Systems aid in identifying unsafe areas via participatory planning, ensuring holistic urban security.

2.3. Need for Safe Cities in India

India is a developing nation, with its urban population growing at a phenomenal rate, as in 2019, there were more than 600 cities with a population of more than one lakh. The rapid population increase is due to the migration of citizens from rural areas into the urban areas as a result of the push and pull factors of cities that provide better opportunities, quality of living, health facilities etc. This sudden population insurge creates challenges to a city's infrastructure, security procedures, emergency response systems and it's resources. It can further lead to competition over scarce resources thus affecting the safety of Indian citizens.

2.4. Safe City Indicators

Digital security safeguards various types of data, from personal information to intellectual property and industry systems, against theft and harm. Health security aims to mitigate the impact of global health crises, including pandemics and weak health systems that jeopardize lives and economies. Infrastructure security is compromised by inadequate amenities, housing, disaster management, and transportation,

leading to congestion, pollution, and accidents. Personal security is at risk due to terrorism, natural disasters, conflicts, and violence. Safe city programs can deploy communication systems and advanced information to reduce economic losses and casualties. Environmental security assesses cities' adherence to environmental policies and addresses threats to energy resources, resource contamination, and failing infrastructure, which endanger citizens' safety.

3. Smart Cities

UNCSTD (United Nations Commission on science and Technology) defines smart city as “A smart city is an innovative city that uses ICT’s and other means to improve quality of life, efficiency of Urban operation, services and competitiveness.” According to Andrea Caragliu, “ the city becomes smart when investments in human and social capital and traditional and modern Information and Communication Technology (ICT) fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.”

3.1. Key Outcomes that Define a Smart City

Liveability encompasses essential services, safe streets, public transport, health, education, recreation, and cultural sites, enhancing citizens' quality of life. Economic ability involves a thriving business environment, diverse jobs, sustainable economic activities, and resource-conscious development. Sustainability focuses on preserving the harmony between natural and built environments, tackling climate impacts, air quality, floods, and biodiversity decline.

3.2. Guiding Principles of Smart Cities

Ensuring equitable access to public goods without biases, Smart Cities must engage in diverse community participation. Strengthening citywide resilience against shocks and stresses, adaptive evolution of infrastructure, and fostering health and wellness are essential. Leveraging reusable resources, optimizing global connectivity, and prioritizing safety enhances economic competitiveness and quality of life. Responsible technology use drives innovation, evidence-based decision-making, collaboration, and efficient resource utilization. The goal is achieving significant impact with fewer resources.

4. Case Studies of Smart Cities

4.1. New Delhi Smart City

4.1.1. Major issues of safety and security in New Delhi smart city includes:

Rising sexual assault cases, air pollution (smog), earthquake vulnerability (zone 4), pandemic risk (covid-19), no standards, traffic strain on infrastructure.

4.1.2. Strategies Undertaken to achieve safety and security:

4.1.2.1. Digital security:

- Hierarchical Command and Control Centre for integrated Urban management & Public Safety/Security
- Health security
- Integrate all public medical facilities through Cloud-based e-healthcare system

4.1.2.2. Infrastructure security:

- Enhancement of para-transit including crossing facilities for differently abled and senior-citizens.
- Pedestrianization of inner circle Connaught Place, free from unauthorized hawkers
- E-surveillance including e-challan for enforcing traffic discipline

4.1.2.3. Personal security:

- Safety and crisis management through monitoring of public spaces using surveillance cameras

4.1.2.4. Environmental security:

- Mobile app-integrated cycle tracks in designated routes
- Expansion of door-to-door waste management for businesses and institutions, with bin geo-tagging
- Smart Poles from electric poles, featuring LEDs, incident-responsive controllers, communication infrastructure, Wi-Fi access, air and noise sensors
- Revamped public toilets at strategic locations.24x7 water supply is planned for NDMC

4.2. Chennai Smart City

4.2.1. Major issues of safety and security in Chennai smart city includes:

Chennai faces unregulated parking, traffic congestion, aging infrastructure, and vulnerability to disasters like floods. Pollution, pedestrian conflicts, and pandemic risks compound these challenges.

4.2.2. Strategies Undertaken to achieve safety and security

4.2.2.1. Digital security:

- Integration of all utilities using GIS
- Website for e-Governance features

4.2.2.2. Infrastructure security:

- The safety of road users will be improved through the creation of complete streets that meet the needs of all road users – Intelligent traffic management
- Differently-abled friendly pedestrian footpaths

4.2.2.3. Personal security:

- CCTV cameras along main streets and in public parks and plazas.
- One central emergency phone number for direct response 24*7.
- LED street lighting monitoring

4.2.2.4. Environmental security:

Adequate & Reliable Water Supply, including wastewater recycling and rainwater reuse

4.3. Kohima Smart City

4.3.1. Major issues of safety and security in Kohima smart city includes:

Kohima faces frequent car thefts and lacks proper street lighting, endangering pedestrians. Inadequate housing and untreated wastewater contaminate groundwater. Vulnerability to earthquakes and landslides threatens the city. Insufficient medical technology and infrastructure raise the risk of pandemics due to the growing population.

4.3.2. Strategies Undertaken to achieve safety and security

4.3.2.1. Digital security:

- Central Command Centre for controlling centralized facilities, a common portal for utilization of open data approach
- Web-based incident reporting system.

4.3.2.2. Infrastructure security:

- Electric vehicles, ropeways for city movement. Seamless integration.
- Pedestrian pathways and 10% renewable electricity supply.
- Urban resilience project: evacuation, emergency services data.
- Sensor-based surveillance for real-time traffic management.

4.3.2.3. Personal security:

- Community policing through volunteers and neighborhood watch initiatives.
- CCTV surveillance cameras at junctions
- Safety through Urban Design brings inclusive public spaces for all age groups.
- Way finder project for tourists, and children for safe access and movement.
- Introduce blue-coloured taxis for women, children, and differently-abled citizens

4.3.2.4. Environmental security:

- Install solar-powered street lights. ii) Audit existing lights for LED upgrade.
- Sensor-based bins, app reporting, GPS-tracked waste management.
- Ensure water supply, wastewater, and stormwater reuse for all.

4.4. Ahmedabad Smart City

4.4.1. Issues of Safety and security in Ahmedabad smart city

Public areas lack pedestrian-friendly paths and essential infrastructure. Sub-optimal block sizes cause road congestion. Services like water supply need efficient quantification. Unsanitary slums lead to disease outbreaks. Ahmedabad's climate poses threats, worsened by pollution and pandemic risks.

4.4.2. Strategies Undertaken to achieve safety and security

4.4.2.1. Digital security:

- City Wide OFC & Command & Control Centre

4.4.2.2. Infrastructure security:

- 24X7 Power Supply to be provided
- Non-Motorized transport facilities shall be developed at appropriate sections
- Safe designated leisure areas.

4.4.2.3. Personal security:

- Surveillance cameras will be installed at important locations such as public spaces, commercial areas, etc.
- Eyes on the street" urban design + well-planned street lighting - reduction in blind spots; higher safety
- 100% accessible zones for wheelchairs and prams - accessible across the township.

4.4.2.4. Environmental security:

- Creation of trunk infrastructure in the city, including water supply, sewage system, and drainage network.

4.5. Indore Smart City

4.5.1. Issues of Safety and security in Indore smart city

Inadequate pedestrian facilities and road safety issues persist. Slums make urban service delivery challenging. Lack of essential infrastructure, weak environmental resilience, and limited public spaces contribute to problems. Traffic congestion and pandemic risks further jeopardize citizen safety.

4.5.2. Strategies Undertaken to achieve safety and security

4.5.2.1. Digital security:

- Central Command & Control Centre

4.5.2.2. Health security:

- Improvement in access to health Facilities

4.5.2.3. Infrastructure security:

- Provision of Fire Hydrant System
- Improvement of roads, vehicular intersections & pedestrian crossings through geometric design as per SDG
- Creation of no-vehicle/pedestrian zone on traditional market streets with the provision of smart parking at walkable distances

4.5.2.4. Personal security:

- Sensor-enabled energy-efficient street-lighting system for vehicular streets, pedestrian paths & public open spaces to improve safety & security on streets & public spaces.
- Installation of multi-use CCTV cameras for security surveillance & traffic monitoring

4.5.2.5. Environmental security:

- 24/7 water supply systems
- 100% door-door collection & segregation of waste, storage dust-bins & transportation of organic waste to decentralized bio-digesters

5. Case Studies of Safe Cities

5.1. Tokyo: Safe City. Diverse City. Smart City

Ranked as the world's safest city in 2019 by the 'Economic Intelligence Unit report, Tokyo exemplifies a multifaceted approach to safety and security.

5.1.1. Major Issues of Safety & Security:

- Vulnerability to natural disasters
- Risk of pandemics like COVID-19
- Violence against women

5.1.2. Strategies Undertaken:

5.1.2.1. Digital Security:

Collaborate for cyber threat sharing and response. Promote user security.

5.1.2.2. Health Security:

Improve emergency care for aging populations. Enhance disaster medical relief.

5.1.2.3. Infrastructure Security:

Advance earthquake resilience and fire-resistant housing.

5.1.2.4. Personal Security:

Boost disaster management capabilities. Enhance flood disaster readiness.

5.1.2.5. Environmental Security:

Promote energy savings, non-CO2 tech, and eco-friendly buildings.

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5.2. Sydney Community Safety Action Plan

Ranked the safest city in Australia and fifth globally in 2019, Sydney's safety action plan encompasses various dimensions of security.

5.2.1. Major Issues of Safety & Security:

- Local crime
- Domestic and family violence
- Sexual assault
- Safety of visitors

5.2.2. Strategies Undertaken:

5.2.2.1. Digital Security:

Expand public Wi-Fi access, protect digital infrastructure, and promote cyber safety. 5.2.2.2 Health Security: Raise drug awareness, and support rough sleepers with housing and health services.

5.2.2.2. Infrastructure Security:

Enhance road, transport, and pedestrian safety through design and education.

5.2.2.3. Personal Security:

Improve public lighting, and promote vibrant nightlife for safety.

5.2.2.4. Environmental Security:

Tokyo and Sydney's cases highlight strategies for smart and safe cities, addressing climate, footprints, and well-being.

6. Analysis

SAFETY INDICATORS	1. DELHI SAFETY ISSUES	2. CHENNAI SAFETY ISSUES	3. KOHIMA SAFETY ISSUES	4. AHMEDABAD SAFETY ISSUES	5. INDORE SAFETY ISSUES
1. DIGITAL					
2. HEALTH	Risk of pandemics	Risk of pandemics	Risk of pandemics	Risk of pandemics	Risk of pandemics
3. INFRASTRUCTURE	Traffic congestion	Traffic congestion	Lack of Pedestrian facilities	Road congestion	Lack of Pedestrian facilities
		Unorganized parking	Housing demand	Lack of Pedestrian facilities	Traffic congestion
		Aging infrastructure		Increasing slums	Increase in slums-
		Pedestrian-vehicular conflict		infrastructure facilities	Lack of Public/social Infrastructure
4. PERSONAL	Higher security threats due to high value targets	Vulnerability to floods	Inadequate street lights in the city	Disasters like floods and drought	
	Violence against women		Car thefts		
	Vulnerability to earthquakes		Natural disasters : landslide & earthquake		
5. ENVIRONMENTAL	Environmental pollution	Improper solid waste management	Water pollution	Inefficient resource utilization	Environmental degradation
	No environmental standards	No waste water recycling		Increase in pollution	Poor waste management
		Pollution			
		No use of renewable energy			

Table 6.1. Comparative analysis of safety in Indian smart cities

Source: generated by Aysha, 2023

The issues of safety and security is analysed under each indicator to observe the issues that have been addressed and those that have not been addressed while planning for smart cities in India through case studies of 5 major cities.

It is observed that more than half of the existing issues of safety and security have not been addressed through strategies in smart city plans in India.

7. Findings

The study highlights that safety and security issues remain largely unaddressed in the planning of Indian smart cities. The inadequacy of health infrastructure to tackle pandemics like COVID-19 underscores a failure in health security. Neglecting threats such as natural disasters pose risks to personal security. Major smart cities lack strategies for such challenges. Environmental security, including resource pollution and monitoring, demands attention. Smart city planning must encompass these aspects to ensure safer urban environments.

8. Recommendations

CASE STUDIES	OBSERVATIONS
1. NEW DELHI SMART CITY	Majority of the safety issues have not been addressed in Delhi smart city plan. Delhi being highly vulnerable to earthquakes as it lies in seismic zone 4, have not incorporated any measures for disaster resilience.
2. CHENNAI SMART CITY	Issues of health security, personal security and environmental security have not been properly addressed in Chennai smart city planning. Chennai is vulnerable to floods, but no measures have been adopted to address the issue.
3. KOHIMA SMART CITY	Safety and security are given better consideration in Kohima smart city plan when compared to other smart cities in India. But Planning measures to cope with pandemics and to address the issues of housing demand are not taken into consideration.
4. AHMEDABAD SMART CITY	Overall, only few strategies have been adopted for creating a safe and secure city in Ahmedabad smart city planning. Health, personal and environmental security issues are not addressed properly. No action is taken to overcome the major security issues such as disasters, reduce pollution, reduce growth of slums. Planning measures to cope with pandemics are also not taken into consideration.
5. INDORE SMART CITY	Most issues of Infrastructure security are addressed in Indore smart city plan. Issues of Health security and environmental security must be given more priority while planning.
INTERNATIONAL CASE STUDIES	
1. TOKYO SAFE AND SMART CITY PLAN	Most of the indicators of safety and security have been considered and given importance while adopting strategies and actions while planning for smart and safe city of Tokyo. Disaster preparedness and mitigation is given high importance in planning (use of risk maps: risk informed development). Planning measures to cope with pandemics are also not taken into consideration.
2. SYDNEY SAFE CITY PLAN	Most of the indicators of safety and security have been considered and given importance while adopting strategies and actions while planning for Safe city of Sydney. Use of CPTED helps in creating a safer and more secure city. Planning measures to cope with pandemics are also not taken into consideration.

Source: generated by Aysha,2023

Safety in smart cities can be improved by use of CPTED principles, planning for better disaster resilience, adopting measures for reduction of pollution and improving health infrastructure facilities so as to meet the security needs of growing population.

8.1. Disaster Resilience Through Risk Informed Development

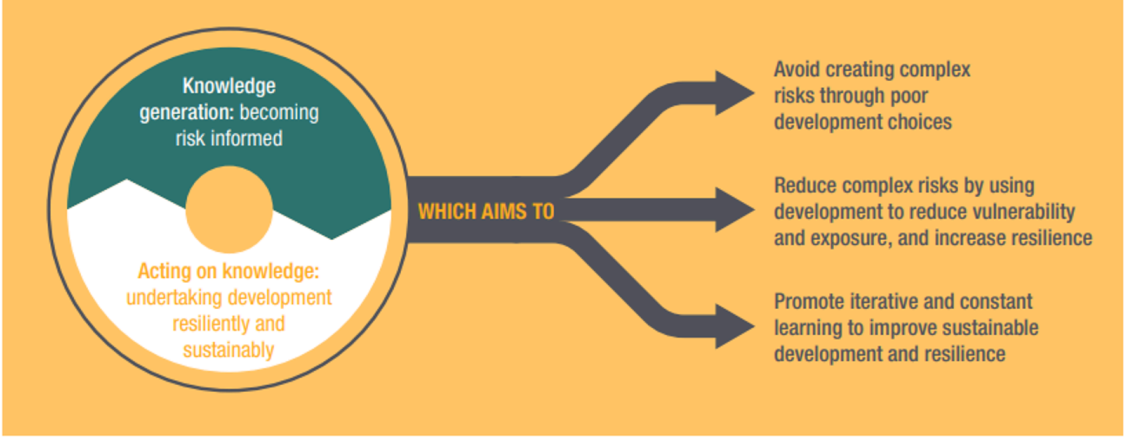

Figure 8.1. Risk Informed Development and its core aims

Source: S. Opitz-Stapleton, 2019

Better disaster resilience can be achieved through risk informed development strategies.

Risk-informed development is a risk-based decision process that enables development to become more sustainable and resilient. Move away from single hazard risk analysis to an explicit acknowledgement of the interactions between multiple threats, including economic and financial instability, geopolitical volatility, natural hazards and climate change.

8.2. 'Crime Prevention Through Environmental Design' (CPTED)

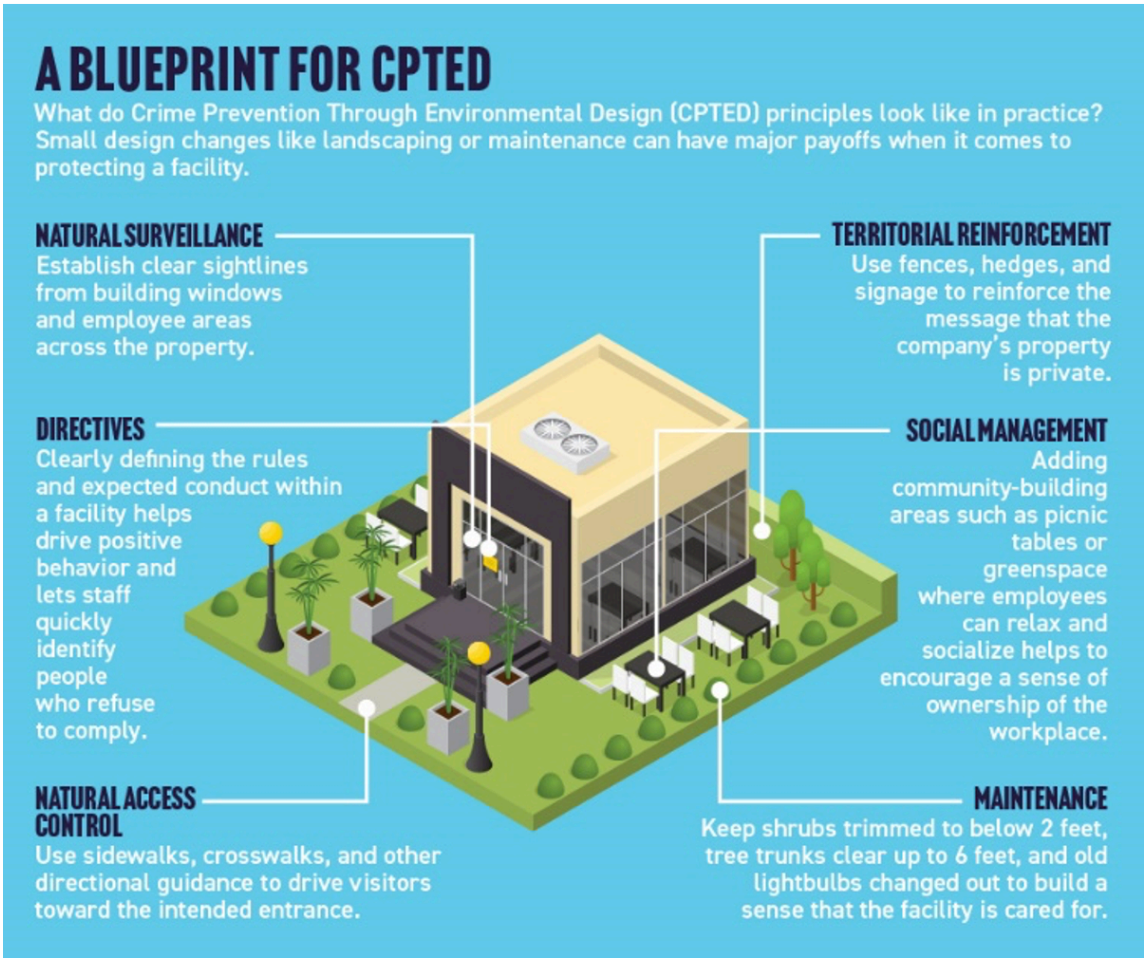

Figure 8.2. Principles of CPTED

Source: Meyer, 2022

CPTED is a crime prevention theory focusing on tactical design and the effective use of the built environment, which when applied, reduces both crime and the fear of crime. A main objective of CPTED is to reduce/remove the opportunity for crime to occur in an environment, and promote positive interaction with the space by legitimate users.

9. Conclusion

This study investigates the integration of safe city concepts into smart city planning in India, utilizing safe city indicators. Case studies within India analyze strategies for enhancing safety and security across

Digital, Health, Infrastructure, Personal, and Environmental domains. Examination reveals limited emphasis on safety and security in Indian smart city planning, indicating most smart cities are not safe. This deficiency impacts quality of life. Prioritizing safe city principles is essential to enhance urban living. Notably, health security, including pandemic preparedness like Covid-19, must hold a central role in future smart city planning.

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