# PSYCHOLOGICAL DIMENSIONS OF URBAN RESILIENCE: EVALUATING SMART SPATIAL PLANNING IN THE CONTEXT OF PANDEMICS

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**Abstract** - Many countries have adopted smart city applications, and the COVID-19 pandemic has accelerated this trend, highlighting the benefits of smart urban planning. The role of human psychology has become crucial amidst this technological shift, as it significantly influences how individuals perceive, interact with, and respond to their environment, particularly during disruptive events such as pandemics. This paper aims to explore the relationship between smart spatial planning and human psychology, emphasizing the impact of smart urban planning on community behavior and mental health, by integrating technology with psychological insights, the goal is to enhance urban living.

**Keywords** - Psychological dimensions, Smart City, Human behavior, pandemics.

## I. INTRODUCTION

The COVID-19 pandemic outbreak led to a set of practical issues. During this crucial time, many countries' governments, committed to transparent joint mobilizations to tackle and control the pandemic. People globally worked together and overcame many challenges caused by the virus. However, the pandemic also revealed flaws in urban spatial planning. Spatial planning refers to the long-term planning and arrangement of territorial space, resources, and layout. It aims to achieve effective control and scientific governance of territorial space and promote a balance between development and protection. Besides ecological protection, spatial planning requires a consideration of the "multiple-gauge fusion" mode of planning, implementation, management, and supervision mechanisms[1].

Resilient cities are cities that can absorb, recover, and prepare for future shocks (economic, environmental, social, and institutional), as well as favoring sustainable development, well-being, and inclusive growth. Starting with the factors associated with current smart city components, it became obvious that it is necessary to redefine “community recovery”[2].

Thus, our paper aims to (a) analyze the resilience of smart cities in terms of the effects of the pandemic on work and life in cities, identify the extent to which changes are needed and areas of activity that have practically been redefined; (b) determine the connection between urban resilience and urban smartness and identify whether smart cities are the main drivers in achieving community resilience; (d)investigate the psychological aspects of urban resilience, with a specific focus on how smart spatial planning can alleviate the impacts of pandemics on human psychology.

## II. CONCEPT OF SMART AND RESILIENCE CITIES

### A. Smart City Aspects

The smart city concept, which has been gaining popularity in recent years, is considered an answer to their needs.The smart city is an urban region utilizing information and communication technology (ICT) to integrate and manage all sectors of the economy, social sciences, transportation, infrastructure, and transportation to improve quality of life and attain sustainability.

The main advantage of this concept is its environmental, economic, social, and institutional benefits[3].There is a related concept of a smart city that can be categorized into three dimensions: technology, human, and community. These dimensions are not independent of each other and are mutually connected, which can lead to confusion in definitions and usage[4].

1) **Technology Dimension:** Technologies can be used in a variety of ways. It stems from the idea of a digital and information city promoted using information and communication technologies (ICT) to develop cities. Throughthe installation of ICT, municipalities obtain large sets of data which are then transformed into effective urban policies[5].

2) **Human Dimension:** A smart city is a humane city that has multiple opportunities to exploit its human potential and lead a creative life. A smart city is the residence of many highly educated people and institutions of higher learning. The focus on human infrastructure brings attention to education and social learning. To create more progressive smart cities, human capital should be prioritized first[6].

### B. Resilience Cities

In exploring urban resilience, comprehending the facets involved in characterizing and assessing resilience is crucial. The analysis of urban resilience is deeply tied to understanding the threats and risks posed by natural disasters[7].It is important to understand urban resilience dimensions,the best characterized urban resilience are the dimensions adopted by[8].In a systematic review of evaluation models for social resilience in communities, Ostadtaghizadehet al. (2015) summarized 10 models that attempt to assess social resilience and recommended that this idea be examined in the context of five dimensions:1) Natural; 2) Physical; 3) Economic; 4) Institutional; and5) Social[8].

### C. Integration of smart and Resilience cities

Integrating the resilience concept provides a strategic direction for Smart Cities and there is a significant positive relationship between the two concepts, Smart Cities, and urban resilience[5]. There remains the challenge to build resilience within the Smart City context as resilience-building demands a long-term strategy that takes demographic changes and all other city contextual changes into account. Accordingly, below are the six dimensions that can holistically be seen through the lenses of both the Smart City and the urban resilience city (hereinafter called as Smart City dimension/urban (city) resilience dimension)[9]:

1. Smart environment/ecosystem (natural environment).
2. Smart people/people.
3. Smart governance/leadership and strategy (knowledge).
4. Smart economy/economy.
5. Smart living and smart mobility (transportation)/infrastructure, spatiality, society, and living (organization).
6. ICT infrastructure.

These six aspects will be the areas through which disaster resilience in a Smart City needs to be understood and disaster resilience efforts/strategies/plans in a Smart City need to be operationalized.

## III. SMART SPATIAL PLANNING AND HUMAN PSYCHOLOGY

### A. Smart spatial planning

Spatial planning involves a process of understanding a place and identifying its strengths, weaknesses, opportunities, and threats so that a planning vision expressed in goals and objectives can be set up to guide the generation of responses and options. These will then be evaluated, with the impacts mapped before decisions are taken to allow implementations and monitoring to unfold, providing feedback to the whole process[10].

In recent years, with the rapid development of information technology, new techniques including geospatial information, cloud computing, IOT, and artificial intelligence provide technical support for more intelligent governance of cities and natural resources. Making spatial planning ‘smart’ is therefore much broader than limiting it only to technological advancements. It is therefore important to focus not only on the design of technological innovations but also on the impacts and requirements on spatial planning processes and the degrees to which the technical changes also affect societal and planning necessities[11].

### B. Human Psychology

Human psychology is defined as an intricate web of emotional and mental processes that show human behavior and shape individual responses to related environments. It includes feelings, thoughts, cognitive functions, and perceptions that people employ while interacting with spatial arrangements, like neighborhoods, the design of buildings, and cities. Specifically, the human mind's internal mechanisms and emotional traces assist individual interactions with the world around them[12].

Three important elements of emotion includeSubjective experience[13], physiological response[13], andbehavioral response[12].

1) **Indicators of Human Psychology:** Based on human psychology from the perspective of spatial planning, there is a requirement to develop measurement indicators or criteria that can assist individuals in finding its impact efficiently. These indicators are efficient tools for finding how psychological aspects enhance the planning process and lived experiences of communities and individuals [15].There are various indicators of human psychology, however, the most significant are:(1) human well-being[16],(2)human behavior[17],(3)culture[18],(4)built environment[19], and (5)accessibility[20].

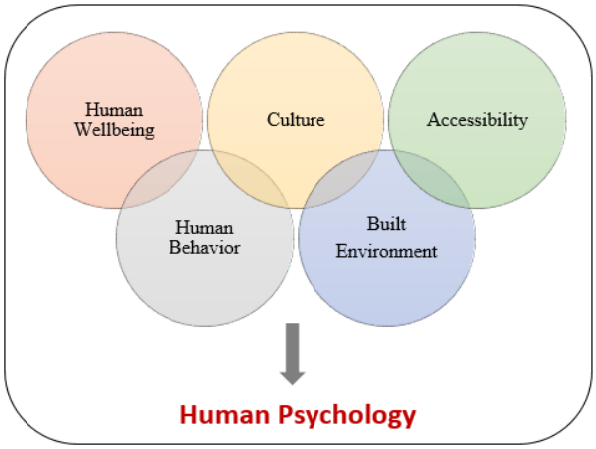



**Figure 1: Indicators of Human Psychology, (by the author)**

### C. Relation between smart spatial planning and human psychology

Smart spatial planning is the most significant approach that focuses strategic and efficient design of rural and urban spaces to increase human well-being and quality of life. These planning approaches, when well-planned, have a major effect on human psychology, as they influence how people perceive, respond to, and interact with environments [21].According to the previous references table (2) illustrates the major components of smart spatial planning and smart citizens.

| smart spatial planing "smart city " | | Smart and Digital Citizens | |
|---|---|---|---|
| Indicators of smart city | Factors | Indicators of citizens | Factors |
| Sustainable and Eco-frendily enviroment | Air Quality | Human Psycology | Human Well Being |
| | Pollution and waste treatment | | Culture |
| | Green spaces | | Built enviroment |
| | Smart urban planning | | Accessibility |
| | Waste, reuse,recycle | | |
| Inclusive and society | Education | Human Awarness | Education |
| | Health | | Inclusive society |
| | Living | | Disaster Management |
| | Safety | | Embrace creativity |
| | Culture | | community interaction |
| Innovative Economy | Innovation | | |
| | Entrepreneurship | | |
| | Employment | | |
| | Life cycle management | | |
| Efficient and Green physical infrastructure | Mobility | | |
| | Energy | | |
| | Public Utilities | | |
| | Recreation | | |
| | IT Infrastructure | | |

**Table (1) Composite Indicators of Smart Human Environmental Behavior Cities.**

The positive repercussions include improved well-being[21], community cohesion, sustainability awareness[22], safety and security[23]. On the other hand, negative repercussions include displacementand gentrification[24], social exclusion[25], overdevelopment and congestion, and loss of cultural identity[18], as identified in Fig 2.

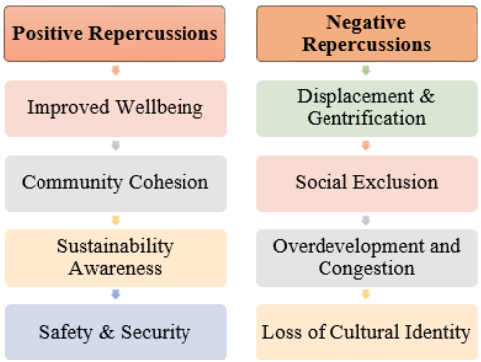



**Fig 2: Positive & Negative Repercussions (Source: By Author, 2023)**

## IV. FEATURES OF THE ERA OF PANDEMICS

### A. Smart spatial planning in the era of pandemics

Effective spatial planning is crucial for promoting behavioral change, improving well-being, and creating a resilient city capable of responding to the challenges posed by the COVID-19 pandemic[1].The outbreak of COVID-19 caused a sudden change in working behavior and lifestyle. People had to switch to working from home and practice social distancing. This will influence the development of spatial planning, with well-being being a major consideration. The construction of a resilient city can support future spatial planning and enhance people's living standards and well-being[26].

New and existing digital technologies were suggested to complement traditional measures in response to the first pandemic of the decade. During this time, AI-based digital technologies quickly became an essential part of both personal and professional life. Smart cities have different roles to play in the various stages of the pandemic - before, during, and after the crisis. They also have a vital role to play in disaster planning for the "new normal" post-COVID-19. The use of smart city platforms for intelligent prevention, epidemic management, information screening, and medical resource matching has caught the attention of policymakers and scholars during the pandemic. Researchers from various disciplines relevant to city planning and design are studying the intellectual implications of using the latest technologies that have evolved to address environmental hazards like the coronavirus pandemic[27].




**Fig 3: spatial planning in the era of pandemics (Source:[1])**

### B. COVID-19 lockdown and cities

The advancement of the COVID-19 pandemic enhanced the unprecedented and complex global response, resulting in the adoption of enhanced lockdowns as a measure to control the spread of the virus. The following research identifies the major effect of lockdowns on urban environments. It includes complex challenges that cities face during pandemic-induced lockdowns and determines huge implications for urban resilience and planning[28].

There was a need for decisive and quick action in response to COVID-19 as it was creating different problems. Therefore, there was prompt introduction of

certain emergency measures throughout the world. The cities implemented emergency measures to protect their populations. The measures included a range of approaches, varying from strict lockdowns and travel restrictions to enhanced deployment of health infrastructure[28].

There are various examples and case studies of cities that successfully adapted their efficient governance structures to meetthe exigencies of the moment, giving important information about efficient crisis management. The major example include the early testing and contact tracing strategy implemented by South Korea for the management of the COVID-19 pandemic situation[29]. The research showed that Seoul adopted the efficient testing as well as contact tracing strategy, with mobile apps and drive-through testing centers for monitoring and finding citizens of potential exposure. Mayor Park Won-soon plays a major role in this response. It was identified from this case study that widespread and rapid testing with open communication assisted in improving the curve and controlling the spread of the virus[30].

### C. Human Psychology in the Era of Pandemics

The process of identifying how people adapt to these new cases gives information about the malleability of human behavior which is needed for the development of a better community efficiently. The pandemic era demonstrated that certain psychological stressors, including anxiety, fear, and uncertainty. These emotional factors majorly influence behavior, impacting decisions related to consumption, travel, and social interactions. Individual as well as collective risk perception plays a major role during the COVID-19 pandemic. Perceived risks and problems influence choices related to travel, exposure, and health-related behaviors[1].

### D. Technology Versus Human

Significance of technology that enables the collection of behavioral information, allowing planners to get information about how people use urban spaces. This information can inform decisions regarding design, infrastructure improvements, and resource allocation. The relationship between technology and human behavior, particularly in urban environments, is a complex topic. Technologies such as smart infrastructure, GPS navigation, and smartphones have revolutionized how we interact with our cities, influencing our daily behaviors and decisions[31].

1) **Smart Infrastructure:** Integrating technology into city planning (like efficient waste management systems, smart lighting, and energy systems) has not only made urban environments more sustainable and efficient but also impacted how residents perceive and engage with their surroundings[5].

2) **Smartphones and Social Interaction:** The ubiquitous presence of smartphones has reshaped social interactions and daily decision-making. With constant access to information and communication tools, individuals' social behaviors and routines have evolved. Smartphones enable immediate connectivity and access to services, which can lead to both increased efficiency in daily tasks and potential over-reliance on technology for social engagement[32].

3) **GPS Navigation:** The advent of GPS technology has transformed urban mobility. By providing real-time data, easing congestion, and improving route optimization, GPS navigation has made commuting less stressful and more efficient. This convenience has altered transportation choices, as people now have more information to make informed decisions about their travel routes, potentially reducing the psychological burden of commuting[31].

Thus the relationship between technology and humans in modern urban settings is complex and evolving. While technology has brought about significant improvements in urban living and efficiency, it also challenges traditional human behaviors and social norms, necessitating a balanced approach to its integration into daily life[11].

## V. POST PANDEMICS CHANGES

### A. Changes in the smart spatial planning system

The COVID-19 pandemic has had a major impact on smart spatial planning systems in cities worldwide. It has accelerated the adoption of digital tools for remote work, data-driven decision-making, and virtual meetings. Cities are now focusing on public health concerns by implementing health data, planning for healthcare infrastructure expansion, and monitoring COVID-19 hotspots. There is also a greater emphasis on developing healthier urban environments with better air quality and green spaces[31].

COVID-19 has motivated cities to rethink mobility systems and transportation, with a focus on making streets safer for cyclists and pedestrians and encouraging micro-mobility solutions. Urban planners are now including resilience measures to manage future crises, such as efficient healthcare systems and repurposing infrastructure promptly. Smart spatial planning systems are also prioritizing public engagement through virtual town hall meetings, digital platforms, and crowdsourcing initiatives[32].

Effective spatial planning during the COVID-19 pandemic needs certain guidelines that prioritize public safety, health, and adaptability. Some major principles for smart spatial planning during this continuous crisis are:

1. Social distancing.
2. Outdoor spaces.
3. Flexible workspaces.

It is important for spatial planning to encourage social distancing measures in workplaces, public spaces, and commercial establishments. It can include developing one-way traffic flows, rearranging seating, and decreasing the number of people allowed in the enclosed spaces[33].

### B. Post Pandemics smart- resilience cities

The development of smart technologies and solutions in cities has played an important role in responding to problems posed by the COVID-19 pandemic. There are different methods in which these approaches or technologies have been used. The study showed that IoT sensors have been implemented efficiently to monitor different elements of urban life, from temperature and air quality to crowd density. Data analytics assist in managing resource allocation, and predicting outbreaks. Different cities have significantly introduced contact tracing applications to track virus spread. These applications use Bluetooth technology to notify people who may have been in close contact with an individual infected, enabling quick testing as well as isolation[34].

#### 1) Technical dimensions for the post-pandemic smart-resilience cities:

These cities depend on IoT technology to efficiently manage a vast network of sensors that can be integrated into various structures such as buildings, roads, vehicles, devices, and even human bodies. By doing so, it is possible to transform these physical entities into digitally connected objects. Due to the immense number of IoT sensors deployed, a significant amount of real-time data is generated, often geotagged. Processing this data necessitates significant time and resources to fully harness the advantages of smart city technologies. All of these factors combine to create a comprehensive smart city system [27].

### C. Post pandemics human behavior

Public health awareness has become enhanced, resulting in major concentration on physical fitness, outdoor spaces, and cleaner air. It is important for smart spatial planning to give importance to green spaces, enhanced air quality, and pedestrian-friendly streets. Fear of the crowded public transportation has resulted in decrease in ridership. Smart cities should reassure commuters with better safety measures and should invest high budget in more sustainable and flexible transportation options. Lastly, COVID-19 pandemic has increased the requirement for resilience as well as preparedness in urban planning[30].

It is essential for cities to integrate pandemic response plans into infrastructure development and long-term approaches. Therefore, it can be said that COVID-19 has significantly changed smart spatial planning systems, increased the implementation of technology in cities, and enhanced human behavior in different manners. Managing these changes and adopting technology for long term urban resilience will be important for developing sustainable and smart cities in the post-pandemic world[15].

## VI. GUIDELINES FOR FUTURE CITIES

It is important to consider smart cities as key contributors to the development of inclusive urbanization and resilience (SDG 11) to attain a sustainable future. The resilience attitudes of smart cities can significantly mitigate the adverse effects of the COVID-19 pandemic. These smart, sustainable, and resilient entities should possess various skills during the different stages of the pandemic such as preparedness (pre-disaster), response (in-disaster), recovery (post-disaster), and adaptation (new normal). The preparedness stage refers to the control procedures and prevention measures implemented before the pandemic to improve the overall system response, which can also be extended to procedures taken to get ready for the succeeding waves of the pandemic[27].

The response stage includes the procedures taken during the disaster to absorb the shock and reduce its damage. The recovery stage pertains to returning to the normal pre-disaster phase. The adaptation stage promotes further recoverability, as it aims to improve overall performance to ensure better planning and preparation against future pandemics and crises[34].

## VII. CONCLUSION

The importance of digital infrastructure in light of the COVID-19 pandemic has become more apparent. The smart city concept offers a comprehensive approach to integrating data from various organizations, environments, and technologies. This paper provides a multidisciplinary perspective on how modern technology has been utilized at different levels to combat the COVID-19 pandemic.

Out of all the ICT concepts used in urban environments, the smart city paradigm is particularly noteworthy due to its all-encompassing vision. By incorporating IoT and smart connected technologies, along with data-driven applications, they can play a pivotal role not only in prevention, mitigation, or recovery but also in enforcing guidelines, rules, and administrative orders to contain future outbreaks.

Traditional cities should adopt smart technologies and digital approaches, along with a resilient mindset, to support communities in the face of future challenges and disasters. From a theoretical standpoint, the COVID-19 crisis seems to have pushed smart cities to

include resilience thinking in their recovery strategies. If design, implementation, and operation challenges are addressed in the future, the implementation of smart cities can be beneficial.

Effective solutions must provide secure access, and manage smart city data, communication, and infrastructure. If smart cities are developed in a structured manner with proper planning and analysis, they can create an antivirus-built environment to combat future pandemics.

However, as we are still amid the COVID-19 pandemic, we cannot be certain when or how it will end. This crisis is a test of collective intelligence, adaptability, resilience, and human collaboration.

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