**An-Najah National University**

**Faculty of Graduate Studies**

# STRATEGIC PLANNING FOR SMART MOBILITY FOR NEW CITIES IN DEVELOPING COUNTRIES: A CASE STUDY FROM PALESTINE

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This Thesis was Defended Successfully on 03/03/2024 and approved by

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# Dedication

To myself.

To my mother and father.

To my sisters and brother.

To my friends Shefa and Raghad.

# Acknowledgement

I would like to express my deepest gratitude to all those who have contributed to the completion of this thesis. This journey has been challenging and rewarding, and I am thankful for the support and encouragement I have received along the way.

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Lastly, I express my appreciation to all those unnamed individuals who, directly or indirectly, have contributed to this work. Your influence has left an indelible mark on the completion of this thesis.

Thank you all for being part of this significant milestone in my academic journey.

## Declaration

I, the undersigned, declare that I submitted the thesis entitled:

**STRATEGIC PLANNING FOR SMART MOBILITY FOR NEW CITIES IN DEVELOPING COUNTRIES: A CASE STUDY FROM PALESTINE**

I declare that the work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

**Student's Name:** Raya Fadel Mohammed Sawafta

**Signature:** [signature]

**Date:** 3 - 3 - 2024

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# STRATEGIC PLANNING FOR SMART MOBILITY FOR NEW CITIES IN DEVELOPING COUNTRIES: A CASE STUDY FROM PALESTINE

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## Abstract

**Background:** As developing countries undergo rapid urbanization, the establishment of new cities presents a unique opportunity to integrate innovative smart mobility solutions that can address emerging challenges and create sustainable urban environments. This thesis proposes a comprehensive strategic planning framework for achieving smart mobility systems in new cities within developing countries, considering Palestine as the case study.

**Aims:** The objectives of the thesis is to leverage technology and data-driven approaches to enhance transportation efficiency, reduce environmental impact, and improve overall quality of life. Objectives include developing a strategic planning framework that encompasses various dimensions, including infrastructure development, policy formulation, technological integration, and community engagement. Another key objective of the thesis, utilizing successful case studies from both developed and developing regions, is outlining key considerations for designing and implementing smart mobility initiatives tailored to the specific needs and contexts of new cities in developing countries.

**Methodology:** In order to propose the strategic planning framework for smart mobility for new cities in Palestine, a comprehensive literature review was first conducted, including examining regional and international experiences in the field. This culminated in defining the concept, requirements and components of smart mobility, as well as in comparing how transforming of existing communities towards having smart transportation with planning new cities smart transportation, whether in developed countries or developing countries. The second phase involved the identification of the key

factors to be include in the strategic planning process towards smart mobility, using cross impact balance (CIB) method through the analysis phase. This phase concluded with the issuance of recommendations and results, serving as guidelines for local authorities and relevant entities in each study area. Additionally, a general strategic planning framework for smart mobility for new cities was provided.

**Main results:** The thesis provides strategic planning for smart mobility for new cities in Palestine that can guide decision-makers, urban planners, and stakeholders in Palestine as they embark on the creation of new smart cities. The thesis presents the approach and outcome of the application of the CIB method, allowing for a comprehensive analysis of the interconnected factors and their potential impacts on the strategic planning process. This includes identifying the goals and objectives, as well as the broad strategies, to achieve the vision of establishing a new city that could be characterized to have smart and integrated mobility system. The main goals include enhancing transportation infrastructure, supporting economic growth, integrating sustainable mobility, implementing smart security infrastructure, and fostering good governance.

**Conclusions of the study:** The strategic planning for smart mobility in new cities in Palestine focuses on the main sectors such as transportation and mobility, social, economy, security, governance, technology, and the citizens. The research emphasizes the use of tools such as Geographic Information Systems (GIS), simulation software, big data analytics, urban planning software, Intelligent Traffic Management Systems, and internet of things (IoT) Sensors. It also highlights the importance of citizen engagement and digital literacy, as well as the need for a regulatory framework and collaboration with local and international entities to achieve successful smart mobility strategies.

**Keywords:** New Smart Cities, Smart Mobility, Strategic Planning, Cross Impact Balance (CIB), Developing Countries, Palestine.

# Chapter One
# Introduction

## 1.1 Background

Cities in developing countries are facing several urban problems including traffic congestion, high population density, poverty, lack of affordable housing, inadequate infrastructures, economic downturn, urban sprawl, and urban decay. Such problems have a significant impact on urban mobility systems.

Smart mobility systems use emerging technologies to arrive at solutions to many of these problems by creating connected and sustainable transportation systems that can move people more efficiently and safely. Existing communities can be transformed, as well as new communities can be established, considering smart mobility, making vehicles and transportation infrastructure technology-enabled. Globally, many countries have been actively looking for solutions for mobility challenges; however, new cities being planned in developing countries have an opportunity to benefit from the global experience in this regard.

In this thesis, a novel framework and thinking approach is presented, taking into account the connections among the various relevant components, to achieve planning strategically for smart mobility for new cities in a developing country. The interaction among the infrastructure, vehicular, and institutional components is to be considered as well.

The thesis presents the strategic planning framework, based on the strategic analysis that will be considered in the fields relevant to the smart and integrated mobility. This includes identifying the goals and objectives as well as the broad strategies to achieve the vision of establishing new cities that could be characterized to have smart and integrated mobility systems.

## 1.2 Significance of Study

Changes and alteration in urban areas is an irresistible fact, and various forces including social, cultural, economic, population, technological and environmental forces affect the process and the intensity of changes [1].

Due to the negative impact of the daily activities on the environment, including those

related to transportation, there is a trend to more consider technology in all sectors of the cities such as those related to transportation, energy, water, land, and waste. At the same time, transportation and mobility development efforts must address a complex system of individual, social, economic, and environmental factors in order to promote more diverse, inclusive communities and improve the sustainability of cities.

Due to the inexistence of smart mobility systems in Palestine, despite the claim of the developers to have Rawabi as a smart city with operations of green cars, there is a need to start planning strategically for smart mobility systems in the Palestinian cities. Smart mobility solutions are needed to achieve sustainable cities, addressing the environmental pollution resulting from transportation, and dealing with traffic safety and congestion, the space consumed for parking and the related challenges, as well as public transportation inadequacy and difficulties facing non-motorized transportation. Therefore, there is a need to identify a clear strategy that addresses a suggested framework for smart mobility in Palestine. Such strategy is envisaged to be the basis for new smart cities.

This subject has not been previously tackled, either within the scope of locally implemented general policies and strategies or through comprehensive studies and research on Strategic Planning for Smart Mobility in new Palestinian cities. Consequently, this research stands as the inaugural comprehensive study aiming to elucidate the meaning and mechanisms involved in implementing smart mobility in these new urban areas. Moreover, it endeavors to pinpoint and apply overarching strategies and policies that align with the current local context in Palestine, using new Palestinian cities as a specific case study.

The study's focus on strategic planning implies a direct connection to policy formulation and implementation. The thesis offers practical insights for policymakers in developing countries to create policies that facilitate the integration of smart mobility solutions. This relevance contributes to the effective implementation of plans and strategies on the ground.

## 1.3 Objectives of Study

This section indicates the key issues that were focused on in the research. The specific objectives of this research could be summarized in the following points:

1. Analyze and understand the criteria of smart mobility in new cities internationally and regionally.
2. Identify smart mobility concept, as well as its requirements and components (the infrastructure, vehicular, and governance components), and the interaction among them.
3. Compare transforming existing communities to smart transportation with planning new cities.
4. Formulate the framework for strategic planning for smart mobility in Palestine include vision, mission, goals, and the strategies for the mobility in the new Palestinian cities.

## 1.4 Study Area

The study area encompasses various urban development and intelligent transportation system initiatives in Palestine, examining case studies such as Rawabi City and Sama Qruntol City.

Rawabi City, conceived in 2007, is Palestine's first planned city in the West Bank. The city states that it aims to be green and smart, providing digital services to enhance urban living. These include advanced water control systems, smart meters, and a SCADA system for water management. Rawabi focuses on sustainability, safety, and a proactive approach to maintenance. Despite having digital services, the plan did not prioritize smart mobility, potentially due to infrastructure limitations and low population density [2].

Sama Qruntol City, still in the planning stage which is located to the west of Jericho City, is intended to be a model Palestinian smart city. Challenges include securing funding and part of the city being in Area C under Israeli control. The proposed master plan outlines housing for low-income individuals, villas, tourist cottages, green spaces, lakes, a public park, commercial centers, and areas for crafts and industries. The project's progress is hindered by political and economic conditions [3].

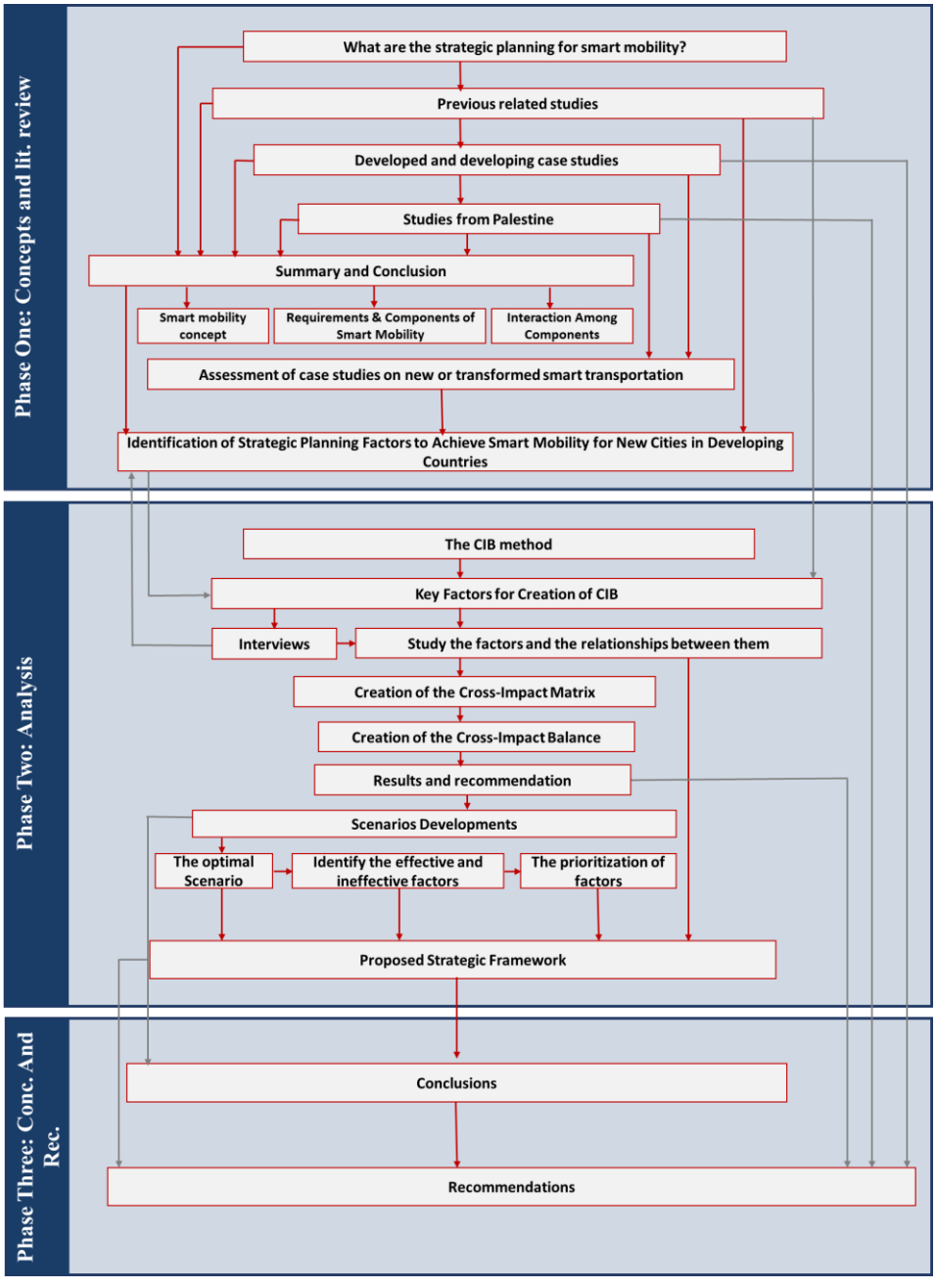
## 1.5 Methodology of Study

### 1.5.1 Introduction

The methodology of this study is structured across three comprehensive phases as illustrated in Figure 1.1. In phase one, an overview of strategic planning and smart mobility, is presented, along with literature review, analyzing publications and previous experiences from both developed and developing countries pertaining to strategic

**Figure 1.1**

*A flow chart illustrating the methodology phases*



planning and smart mobility. This phase explores the conceptual framework, requirements, and components of smart mobility, while drawing comparisons between the transformation of existing communities to smart transportation and the planning of new cities in both developing and developed nations. Phase two outlines the methodology employed in this research, relying on the Cross-Impact Balances (CIB) method in order to identify the relationships between the factors that could contribute to strategic planning for smart mobility. In this phase, a strategic planning proposal for smart mobility in new cities in Palestine is put forth, encapsulating the culmination of the study's findings and analyses. Finally, in phase three, the conclusions and recommendations are identified.

### 1.5.2 Literature review

The literature review explores a number of case studies from various global locations, examining concepts associated with smart mobility strategic planning applicable to cities in both developed and developing countries. It delves into smart mobility aspects within two specific case studies and introduces the Strategic Framework for the Intelligent Transportation System in Palestine.

### 1.5.3 Study Area

The study investigates two urban development and intelligent transportation system initiatives in Palestine, focusing on the case studies of the two new cities of Rawabi City and Sama Qruntol City. As indicated above, Rawabi City was intended to be a city that prioritizes green and smart features, however, its plan lacks a clear focus on smart mobility. Sama Qruntol City was planned to be a model Palestinian smart city, but was not developed yet.

### 1.5.4 Data collection

The data for analyzing the situation of the case studies was collected through various sources, primarily through online research and data extraction, specifically from the website of the Ministry of Local Government's Geographic Information System (GeoMoLG) and the geographic information website of Rawabi City. In addition, additional information were obtained from the municipality of Rawabi.

Furthermore, numerous interviews and discussions were conducted with relevant stakeholders for the three study sites and the Ministry of Local Government (MoLG),

including municipalities, planners, and engineers. This approach ensured a comprehensive understanding of the context and enriched the study with insights from those directly involved in or affected by urban development in the areas under consideration.

### 1.5.5 Analysis

The analysis of the current situation for the three case studies and identification of the main factors for the smart mobility in the new cites has been conducted based on the interviews and literature review using the Cross Impact Balance (CIB) method. The CIB method is a valuable tool for decision-makers engaged in scenario planning. It aids in the identification of influential factors and potential vulnerabilities within a system. By interpreting these balances, key insights are gained, allowing the development of scenarios that explore different plausible futures based on changes in key factors and their interdependencies. Sensitivity analyses are also conducted to assess scenario stability under varying conditions. Essentially, the CIB facilitates a comprehensive understanding of system dynamics, enabling decision-makers to navigate uncertainties and prepare for a range of possible outcomes by considering the interconnected nature of key factors. The analysis focuses on identifying central or influential descriptors in the system, with those exhibiting high positive balances regarded as drivers positively influencing other factors, while high negative balances may indicate vulnerabilities or challenges.

## 1.6 Thesis Structures

This thesis is composed of four chapters, Chapter One includes the background, overview of strategic planning and smart mobility, significance of study, objectives of study, the research methodology, study area, and thesis structure. Chapter Two presents literature review on previous experiences in developed and developing countries related to strategic planning and smart mobility, including the concept, requirements and components smart mobility as well as comparison transforming existing communities to smart transportation with planning new cities in developing countries and in developed countries. Chapter Three presents the approach followed in this research is based on the CIB and proposes a strategic planning framework for smart mobility for new cities in Palestine. Finally, Chapter Four presents recommendations, conclusion and limitations.

# Chapter Two
# Literature Review

## 2.1 Chapter Overview

This Chapter presents definition of key concepts in strategic planning and smart cities as well as a number of case studies in different places worldwide that have concepts related to smart mobility strategic planning, whether for cities in developed or developing countries. Smart mobility aspects in case studies and the Strategic Framework for the Intelligent Transportation System in Palestine are then presented.

## 2.2 Definition of key concepts in strategic planning and smart cities

### 2.2.1 Urban Strategic Planning

Urban strategic planning has many definitions. One of these states that it is "creating a state of opinion, motivating institutions and introducing reflections oriented in the long term towards having more developed cities, taking in consideration sustainability as a base for planning" [4].

Based on UN-Habitat strategic planning is "a management tool that determines the direction in which an organization is moving, and how it will achieve that. Urban strategic planning determines the direction of development of a city or an urban area, in the context of its current profile and SWOT analysis. This approach helps the city to respond to fast-moving events, to manage change and to improve the quality of life. It is not a static process; it must change to reflect the changing situation in existing cities and the proposed situation in new cities" [5].

Canadian Urban Institute [6] states that "Strategic planning seeks the answers to three fundamental questions:

- Where are we now? (What is the present status, situation or condition of the city?)
- Where do we want to go? (Where would the city like to go or what direction it is taking?)
- How do we get there? (How would the city like to get there?)"

### 2.2.2 Smart Cities

Marsal-Llacuna et al. indicates that smart cities initiatives "try to improve urban performance by using information, data, and information technologies (IT) to provide more efficient services to citizens, monitor and optimize existing infrastructure, increase collaboration among different economic actors, and encourage innovative business models in both the private and public sectors" [7].

Arora states that a smart city "uses electronic and technology-based infrastructure, such as information and communication technology (ICT), to collect real-time data and insights, provide certain important services, and solve city problems" [8].

### 2.2.3 Smart Transportation

"Smart transportation, by definition, is an approach that incorporates modern technologies into transportation systems. This includes cloud computing, wireless communication, location-based services, computer vision, and other tools to enhance mobility. Intelligent transportation systems must work as a whole to achieve the best results. However, each of the building blocks of any smart transportation network is vital for its overall success and has a massive impact on road conditions" [9].

"Smart transportation systems worldwide are working towards enhancing the safety and quality of life for everyone in urban areas. Overall, intelligent mobility's main benefits include better safety, accessibility, and sustainability of transportation systems" [9].

### 2.2.4 Smart and Integrated Mobility

United Nations illustrates that smart mobility "is a new and revolutionary way of thinking about how we get around; one that is cleaner, safer, and more efficient", as Neckermann calls this new vision "Zero Emissions, Zero Accidents, Zero Ownership" [10]. The concept of smart mobility involves the various transportation modes, such as bicycles (including electric), scooters, buses, light rail, subways, trams, taxis, autonomous vehicles, and walking" [10].

### 2.2.5 Internet of Things (IoT)

"IoT refers to the rapidly growing number of digital devices, which can communicate and interact with others over the network/internet worldwide and they can be remotely monitored and controlled. The IoT include smart sensors and other devices. On the

operational level of IoT, for example, vehicles data are collected. IoT offers new opportunities for cities to use data to manage traffic, cut pollution, make better use of infrastructure, and keep citizens safe and clean" [11].

"The future of IoT is unlimited. It provides solutions in all sectors ranging from manufacturing, healthcare, education, infrastructure, etc. Smart cities can share a common smart city platform, which makes sense especially for small cities. The cloud-based nature of IoT solutions for smart cities is appropriate by sharing a platform based on open data. Small cities can form a common urban ecosystem. In this way, solutions of small and large smart cities are networked and controlled via the central cloud platform. However, the size of a city is not an obstacle on the way to becoming "smart". Cities in each group can benefit from intelligent technologies" [11].

### 2.3 Sustainable cities and communities - Indicators for smart cities

ISO 37122 is a standard developed by the International Organization for Standardization (ISO) titled "Sustainable cities and communities - Indicators for smart cities" [12]. It provides a framework for defining and measuring indicators related to smart cities, helping cities and stakeholders assess their progress towards becoming smarter, more sustainable, and more livable urban environments. The standard encompasses various dimensions of smart cities, including governance, economy, environment, and quality of life.

1. **Economy:** Key indicators include the city's unemployment rate, assessed value of commercial and industrial properties, and the percentage of the population living in poverty. Supporting indicators cover employment rates, youth unemployment, business density, and innovation through patents.
2. **Education:** Core indicators encompass enrollment rates for both male and female school-aged populations, survival rates in primary and secondary education, and student-to-teacher ratios. Additional indicators include higher education degrees per capita.
3. **Energy:** Indicators include per capita electrical energy consumption, renewable energy adoption, energy consumption in public buildings, and reliability measures such as electrical interruptions.
4. **Environment:** Core indicators cover air quality (PM2.5, PM10), greenhouse gas emissions, and noise pollution. Supporting indicators include concentrations of

pollutants like $NO_2$ and $SO_2$, ozone levels, and biodiversity trends.

5. **Governance:** Indicators include voter participation, representation of women in elected offices and city government jobs, corruption convictions, and voter registration rates.
6. **Health:** Core indicators encompass life expectancy, healthcare infrastructure (hospital beds, physicians), child mortality rates, and mental health resources. Supporting indicators include nursing personnel, suicide rates, and overall healthcare access.
7. **Safety:** Core indicators include police presence, homicide rates, and crimes against property. Supporting indicators cover response times, violent crime rates, and overall public safety perceptions.
8. **Telecommunication and Innovation:** Core indicators include internet and cell phone connections per capita. Supporting indicators cover landline connections and innovation metrics.
9. **Transportation:** Core indicators cover public transport infrastructure, usage rates, personal vehicle ownership, and transportation fatalities. Supporting indicators include alternative commuting modes, such as bicycles and public air connectivity.
10. **Urban Planning:** Core indicators include green space per capita, tree planting rates, and informal settlement areas as a percentage of the city. Supporting indicators encompass job-housing ratios and urban development trends.

These indicators collectively provide a holistic view of a city's progress in smart mobility, sustainability, inclusivity, and overall livability, aiding in informed decision-making and targeted interventions for continuous improvement.

### 2.4 Strategic planning for the development of smart cities

This research on strategic planning for the development of smart cities delves into the intricacies of urban development in the context of emerging technologies and digitalization [13]. The study explores the various components that contribute to making a city "smart," such as ICT, data analytics, sustainability measures, and citizen engagement strategies. The study investigates existing frameworks and models for smart city development, evaluates their effectiveness, and proposes novel strategic planning approaches tailored to the unique needs and challenges of modern urban environments. The thesis emphasizes the importance of interdisciplinary collaboration, stakeholder

engagement, and long-term sustainability in the pursuit of building smarter and more livable cities for the future.

The study aims to address the growing need for effective frameworks and strategies in urban development, particularly in the context of digital transformation and smart technologies. The purpose is to investigate how cities can harness the power of ICT, data analytics, and innovative approaches to improve efficiency, sustainability, and quality of life for residents.

The methodology of the study is supplemented by qualitative and quantitative research methods such as case studies, interviews with experts and stakeholders, surveys, and data analysis. The research approach is interdisciplinary, drawing insights from urban planning, technology, governance, and sustainability fields.

The inputs for the study include data and information gathered from various sources such as academic publications, reports from governmental and non-governmental organizations, case studies of existing and proposed smart cities initiatives worldwide, interviews with key stakeholders including city officials, industry experts, and community representatives, as well as surveys to gather public opinion and feedback.

After extensive desk research, it was decided that 15 smart city strategies around the world and serves as a reference basis for the analyses, the cases to be studied would be the following:

- In Europe: Amsterdam smart city (the Netherlands), Barcelona Smart City (Spain), London (UK), PlanlT Valley (Portugal), Stockholm (Sweden),
- In Asia: Cyberjaya (Malaysia), Intelligent Nation 2015' (iN2015) (Singapore), King Abdullah Economic City (Saudi Arabia), Masdar City (United Arab Emirates), Skolkovo (Russia), Songdo International Business District (South Korea),
- In the Americas: Chicago Smart City (U.S.A.), New York Digital Roadmap (U.S.A.), Rio de Janeiro (Brazil) and
- In Africa: Konza Technology City (Kenya).

For each city was gathered information about its economic, social and technology background, about its smart city strategy, its ability to capitalize on the smart city critical success factors, and finally about the implementation weaknesses. All this information was broken down in 84 factors (variables) characterizing each smart city strategy.

Based on the findings and analysis, the study identifies these factors as necessary for successful implementation strategies in smart city initiatives:

1. **Technological Emphasis:** Highlighting the significance of technological infrastructure and artificial intelligence as crucial components of smart cities.
2. **Capital Attraction:** Sustainability in smart city projects often hinges on attracting private investments.
3. **Human and Social Capital:** Prioritizing knowledge sharing, social innovation, and digital inclusion to empower individuals and foster smart communities.
4. **Localization Strategy:** Tailoring strategies to suit local characteristics, address specific challenges, and leverage local opportunities.
5. **Bottom-Up Engagement:** Involving stakeholders in planning and execution, fostering innovation ecosystems, and meeting diverse societal needs for sustainable smart city development.
6. **Top-Down Coordination:** Establishing visionary leadership grounded in solid foundations to inspire collaboration among stakeholders and ensure long-term smart city goals.
7. **Political Balance:** Balancing public sector strategies between community long-term interests (like social and environmental well-being) and short-term political concerns.
8. **Selective Prioritization:** Strategically identifying and prioritizing smart city initiatives for cost-effectiveness, scalability, ease of implementation, and reduced investment risks.
9. **Multi-disciplinary Expertise:** Leveraging expertise from various fields to design and implement comprehensive smart city strategies that encompass diverse developmental aspects.
10. **Collaboration and Networking:** Partnering with institutions and cities for knowledge exchange, resource coordination, economies of scale, and access to international best practices.
11. **Privacy and Security Focus:** Incorporating robust security measures, customizable privacy options, and personalized features to address privacy and security concerns effectively.

## 2.5 Determining Strategic Priorities for Smart City Development

This study explores the strategic priorities necessary for the successful development of smart cities [14]. It specifically examines case studies from South Korean smart cities and compares them with international counterparts to derive insights and recommendations for smart city planning and implementation.

The study aims to identify and prioritize strategic initiatives essential for the development of smart cities. By analyzing case studies from South Korean smart cities and international examples, the researchers intend to understand commonalities, challenges, and best practices that can inform strategic decision-making in smart city development.

The methodology involves a comparative case study approach, where multiple smart cities in South Korea and international locations are analyzed. Data collection methods may include interviews with key stakeholders such as city officials, technology providers, and community representatives, as well as document analysis of smart city plans, policies, and initiatives. The study also employs qualitative and quantitative analysis techniques to identify common themes and strategic priorities.

The study include data gathered from case studies of smart cities in South Korea (Sejong, Busan, Daegu and Siheung) and international smart cities (like Amsterdam, Barcelona, New York, and Vienna). Inputs also include interviews, surveys, policy documents, and relevant literature on smart city development strategies, technologies, and governance frameworks.

Based on the analysis and findings, the study provides recommendations in several areas: Theoretical Implications:

1. **Holistic Approach:** The study proposes a strategic framework that integrates diverse stakeholder goals and resolves conflicts in smart city planning.
2. **Hierarchical Structure:** Utilizes a tiered approach (Tier 1: vision and mission, Tier 2: core values, Tier 3: strategic goals) to systematize mission, vision, values, and goals.
3. **Comprehensive Coverage:** Addresses a wide range of smart city issues such as citizen quality of life, environmental sustainability, industry innovation, and city competitiveness.

4. **Relevance to Emerging Economies:** Suitable for rapidly growing Asian mega-cities facing challenges like population growth, pollution, and limited resources, offering a practical roadmap for smart city implementation.

Practical Implications:

1. **Consensus Building:** Helps diverse stakeholder groups align and prioritize goals in smart city projects, leading to quicker policy decisions and efficient resource allocation.
2. **Efficiency Improvement:** Facilitates collaborative work among cross-functional teams early in the development process, fostering a shared vision and mission for smart city development.
3. **Resource Optimization:** Enables more effective achievement of social benefit goals and resource allocation efficiency in smart city projects.

Overall, the study's strategic framework offers a structured approach to smart city development, balancing theoretical with practical applications for stakeholders involved in shaping the cities of the future.

### 2.6 Developed Countries Case Studies

In this section, a number of case studies in different places in developed counties that have concepts related to smart mobility are presented. These include cases considering planning for existing cities (Barcelona, London, and Chicago), as well as new cities (Skolkovo Innovation Center (Russian Federation) and Songdo International Business District (South Korea)). It is to be noted that that South Korea has been recognized as a developed country, as indicated by the UN Conference on Trade and Development (UNCTAD), which reclassified South Korea as a developed economy in 2021. [15].

#### 2.6.1 Existing Cities

- **Barcelona, Spain**

  Barcelona has implemented the 2019-2024 Urban Mobility Plan as a roadmap to guide urban mobility initiatives [16]. This plan serves as a strategic vision aimed at progressing towards a collective mobility model that is more sustainable, efficient, safe, healthy, and equitable.

  The plan outlines objectives and strategies to facilitate harmonious coexistence among various modes of transportation, prioritizing the safety and protection of

pedestrians and cyclists on public roads. It emphasizes the promotion of public transportation while reducing reliance on private vehicles. Additionally, it seeks to regulate commercial and tourist mobility and ensure the overall efficiency of the mobility network. Ultimately, the plan aims to “encourage travel by foot, bicycle, and public transportation”.

The main areas of strategies are

- Enhancing safety in mobility to decrease accident rates associated with transportation.
- Promoting healthy mobility by encouraging active modes of transportation, mitigating atmospheric and acoustic pollution stemming from transportation activities.
- Fostering sustainable mobility through facilitating a shift to more sustainable transportation modes, reducing energy consumption in transportation, mitigating contributions to climate change, and increasing the utilization of renewable and "clean" energy sources.
- Promoting equitable mobility by diversifying the use of public roads, ensuring accessibility to the mobility system for all individuals regardless of age, physical ability, gender, income, or neighborhood, and enhancing conditions for labor mobility and daily life.
- Advancing smart mobility by enhancing the efficiency of transportation systems, promoting the utilization of shared-use vehicles, integrating new technologies into mobility management, and enhancing mobility services through the adoption of mobility as a service technologies.

- **London Smart City (UK)**

  The city has begun to delve into smart city applications with a more focused approach, primarily motivated by the necessity to enhance the management of public transportation [17]. In 2013, a decision was made to adopt a more strategic approach to addressing smart city challenges. This led to the establishment of the Smart London Board, comprising academics, entrepreneurs, and businesses engaged in the smart city sector.

The vision of London's strategy is to harness the creative potential of new technologies to benefit the city and enhance the lives of its residents [18]. The strategy's objectives include:

- Establishing London as a world-class city in terms of both commerce and culture.
- Addressing the challenges posed by population growth, which will necessitate improvements in infrastructure.
- Embracing innovation and leveraging new technologies to become a smarter city.
- Implementing the vision with a focus on transparency, collaboration, and innovation.
- Evaluating success based on predefined milestones and indicators.
- Measure success on the basis of milestones and indicators.

London is leveraging data-driven technology to manage transportation and traffic [19]. This approach involves utilizing data from the situation center to oversee transportation services and automatically adjusting traffic signals based on congestion data collected by sensors integrated into traffic lights. London's transportation technology is evolving towards real-time management automation, including smart traffic lights, smart parking systems, and automatic traffic alerts. Additionally, as part of the Smart London Plan, the city aims to demonstrate how technology can mitigate traffic collisions and explore new technologies to reduce the risk of accidents involving cyclists and other vulnerable road users.

- **Chicago Smart City**

  Chicago, a large city boasting approximately 2.7 million residents, is currently grappling with various challenges including economic development, education, crime, and transportation issues [20]. Despite being a prominent transportation hub, the city is plagued by traffic congestion, road accidents, and delays in both freight and passenger travel. To address these issues, Chicago's strategy focuses on three key pillars: investment in open broadband infrastructure, fostering community engagement and inclusion, and driving technology innovation. These efforts collectively aim to establish a 'City-as-a-Platform' model in Chicago [21].

  The Smart Chicago initiative, co-founded by the City of Chicago, is driven by the mission to ensure that all residents of Chicago excel in digital proficiency and capitalize on the social and economic opportunities stemming from widespread adoption of digital technology. Presently, Smart Chicago plays a pivotal role in fostering collaboration and securing corporate investments in civic innovation. It oversees projects aimed at enhancing internet access, refining digital skills, and

generating impactful products from data, all of which contribute significantly to the well-being of Chicago's residents. The city places a priority on smart city and open data initiatives, particularly in the areas of infrastructure investment, economic development, and community engagement [22].

### 2.6.2 Planning New Cities

- **Skolkovo Innovation Center (Russian Federation)**

  The Skolkovo Innovation Center (2010-2020) is a planned city located just outside Moscow, Russia. Initiated in 2010 under state leadership, the project aimed to modernize the Russian economy by diversifying away from reliance on oil and gas. It envisioned harnessing local human capital towards a sustainable, knowledge-based economy, fostering collaboration between industry and academia.

  According to the official website of Skolkovo Innovation City (2014), the vision for Skolkovo extends beyond being a mere science or technology park; it aspires to be a fully developed city where creativity thrives, serving as a prototype for the cities of the future.

  Spanning a 400-hectare site on the outskirts of Moscow, approximately 15 km from the city center, Skolkovo is designed to accommodate 20,000-25,000 residents and a workforce totaling 31,000 individuals, including commuters from Moscow and the surrounding region. It will be seamlessly connected to the capital through a new highway and a rapid rail link, with similar connectivity planned for Vnukovo International Airport.

  As depicted in Figure 2.1, the master planner for Skolkovo aimed to achieve several key objectives:

  Maximize the utilization of the site's natural features and landscape.

  Foster collaboration among individuals, academic bodies, research projects, and business institutions.

  Ensure a high quality of life rooted in sustainable development, making the site exceptionally appealing [23].

**Figure 2.1**

*Planning Principles of Skolkovo Innovation Center*


Source: (Skolkovo Innovation Center website, 2014)

"The transportation system prioritizes walking and cycling. The use of vehicles with internal combustion engines is prohibited in the city. In addition, it provides high speed public transportation connected to railway transportation by interchange terminals, pedestrian and bicycle zones, and carpooling" as illustrated in Figure 2.2.

**Figure 2.2**

*Skolkovo Innovation Center public Transportation Plan*


Source: (Skolkovo Innovation Center website, 2022)

- **Songdo International Business District (South Korea)**

Developed between 2001 and 2018, Songdo International Business District (IBD) stands as a modern smart city situated in South Korea. Part of the larger planned city known as New Songdo City (NSC), it is adjacent to Incheon, the country's fourth-largest city with a population of 2.5 million. Songdo IBD, located just 65 km from Seoul, occupies 1,500 acres (610 ha) of reclaimed land along Incheon's waterfront. It serves as a pioneering model for sustainable urban development and innovation, aspiring to become a key business hub in Northeast Asia [24].

Songdo boasts a diverse array of public transit options, ensuring accessibility from neighboring cities. Initially integrated into the existing Incheon subway system, the city's public transit network will eventually connect to most of northern South Korea. Furthermore, it links to the Seoul Metropolitan Rapid Transit (SMRT) system and the

National Railroad network. Songdo will introduce its own bus system, with strategically located stops within a quarter-mile of all commercial and residential areas. Adding to its charm, the city will feature water taxis navigating its canal system [24].

Songdo's public transit system enhances South Korea's impressive transportation infrastructure, facilitating convenient travel within the city, to neighboring cities, and even to the airport without the need for a car. Designed with pedestrians and bicyclists in mind, Songdo's above-ground spaces prioritize their safety and convenience. The city adopts a 'complete streets' approach, ensuring separate lanes for cars, bikes, and pedestrians to coexist harmoniously. Additionally, most parking structures are located underground, minimizing surface space occupation and preserving it for pedestrian use [24].

Songdo offers a delightful experience for pedestrians and cyclists, underscoring its functionality, aesthetics, and people-centric focus. By prioritizing non-motorized transportation while maintaining connectivity to the wider region, Songdo epitomizes the potential of smart cities. It signifies a progressive stride for South Korea and serves as a global exemplar for urban development.

## 2.7 Developing Countries Case Studies

In this section, a number of case studies in different places in developing counties that have concepts related to smart mobility considering planning for both existing cities and new cities are presented. These include cases considering planning for an existing city (Dubai), as well as new cities (Masdar, (U.A.E), and XZERO (Kuwait)

### 2.7.1 Existing Communities

- **Smart Dubai, United Arab Emirates**

The U.A.E. has fully embraced the vast potential of smart mobility and cutting-edge transportation technologies. The Prime Minister of the U.A.E. and Ruler of Dubai has set an ambitious goal of achieving 25% of journeys in the Emirate of Dubai through driverless transportation by 2030. To achieve this vision, the Dubai Future Foundation, in collaboration with the Dubai Roads and Transportation Authority (RTA), has launched the "Dubai Autonomous Transportation Strategy [25].

Numerous forms of smart transportation can help realize this goal. These technologies include smart pods, autonomous vehicles, SkyWay, hyperloop, delivery drones, and flying taxis [25].

- **Autonomous Vehicles**

The U.A.E. boasts a robust market for autonomous vehicles, making Dubai an attractive launchpad for manufacturers. Nearly half of U.A.E. residents expressed interest in owning a self-driving car within the next five years if available. To further entice autonomous driving firms, the Emirati government plans to provide data to startups, facilitating technology development.

- **SkyWay**

SkyWay Dubai is an innovative transportation system under development, designed to transport passengers and freight on elevated string-rail overpasses between skyscrapers. With a capacity of 8,400 passengers per hour in each direction, SkyWay will significantly increase Dubai's transportation capacity, connecting key buildings like the Dubai International Financial Center with downtown Dubai.

- **Sky Pods**

Another smart transportation system in development for Dubai is the sky pods, designed by UK-based BeemCar. This system will link residential and business areas with the metro network. Expected to launch in the next 3-4 years, these pods are designed for dense urban environments, with speeds up to 50 kilometers per hour and powered by solar panels.

- **Hyperloop**

The hyperloop system, capable of speeds up to 1,220 kilometers per hour, is nearing reality. This technology could reduce travel time between Abu Dhabi and Dubai to 10 minutes, or from Dubai to Riyadh to 48 minutes.

- **Smart Pods**

Dubai is also developing a system of autonomous "smart pods" powered by electricity. These pods, capable of safely transporting passengers at approximately 20 kilometers per hour, will be showcased at Expo 2020 Dubai. Multiple pods can be linked together to

allow passengers to move freely between them**.**

- **Delivery Drones/Autonomous Delivery**

The U.A.E. recognizes the potential of drones, especially in response to the Covid-19 pandemic. Drones have been used for police monitoring and disinfection efforts. Projects like the Sky Dome pave the way for commercial drone applications including deliveries and flying taxis.

- **Flying Taxis**

Flying taxis represent another advancement in air transportation. Volocopter, a German company, has partnered with the Dubai Roads and Transport Authority to launch its two-passenger flying taxi in Dubai once the technology is ready [25].

### 2.7.2 Planning New Cities

- **Smart City Abu Dhabi - Masdar City Abu Dhabi, United Arab Emirates**

  Masdar City stands as one of the globe's most sustainable urban communities, characterized by its low-carbon approach. It encompasses a swiftly expanding clean-tech cluster, a business free zone, and residential areas complete with amenities like restaurants, shops, and public green spaces. Guided by the principles of economic, social, and environmental sustainability, Masdar's urban development philosophy rests on these three pillars. Serving as a blueprint for sustainable city development, Masdar City focuses on implementing practical solutions in energy and water efficiency, mobility, and waste reduction [26].

  Masdar City's transportation strategy prioritizes pedestrians, focusing on sustainable public transportation supplemented by clean point-to-point services, with personal vehicles as a final consideration. However, this strategy is just one aspect of the city's overall sustainability approach. Neighborhoods are designed to provide essential services within walking distance, promoting walking over vehicle usage. Enhanced service levels at key city locations like schools and hotels encourage biking or the use of Masdar City transportation. This neighborhood design facilitates the success of the transportation strategy.

- **Eco-Bus**

Unveiled at Abu Dhabi Sustainability Week 2018, the Eco-Bus is a collaborative effort between Masdar, Abu Dhabi-based Hafilat Industry, and the Masdar Institute, with Siemens providing the bus's engine. With a range of 150 kilometers per charge, the Eco-Bus features a lightweight aluminum body and temperature-resistant, water-cooled batteries. Advanced air-conditioning and electrochromic windows enhance comfort, while a low-entry floor ensures easy access. The Eco-Bus, integrated into the Department of Transport’s fleet in Abu Dhabi, has a seated capacity of 27 along with additional standing room.

- **EV Rapid Charger Station**

Masdar City installed the Middle East's first rapid charging station for electric vehicles (EV), aiming to evaluate the technology's efficiency in the region's harsh climate conditions. This rapid charger enables EV batteries to reach 80% charge in approximately 30 minutes.

- **NAVYA**

NAVYA's Autonom Shuttle vehicle, a pioneer in the autonomous vehicle market, is designed to manage all safety-critical driving functions and monitor roadway conditions throughout a trip. Passenger input is required for destination or navigation, but drivers are not expected to control the vehicle at any point during the journey. After a pilot project to assess battery efficiency in Abu Dhabi's summer climate, NAVYA's route at Masdar City runs from the North Car Park to the Knowledge Centre, primarily along pedestrian-focused pathways without interaction with public roads.

- **PRT Station**

Masdar City's Personal Rapid Transit (PRT) system has transported over two million passengers since its 2010 launch. These electric-powered, automated vehicles combine the privacy and comfort of taxis with the environmental performance of public transportation. Operated via touch screens, PRT vehicles travel along dedicated corridors beneath the Masdar Institute campus. Controlled by computers and guided by ground-embedded magnets, PRT vehicles ensure safe navigation. Overhead leaky coaxial cable antennae provide wireless communication between vehicles and the PRT system computer.

- **XZERO City | Kuwait**

  XZERO is an upcoming sustainable community, designed to accommodate 100,000 residents with a net zero carbon lifestyle in harmony with nature. This city aims to "ensure food and energy security while fostering a green circular economy, creating an eco-friendly destination for living, working, and visiting" [27].

  The masterplan depicted in Figure 2.3 employs passive design strategies alongside green and blue infrastructure to foster sustainable development, aiming for maximal environmental benefits with minimal financial investment. Active strategies and cutting-edge technologies are seamlessly integrated into the city's infrastructure to ensure the highest standards of living within its smart city grid. Sustainability features within the cityscape serve as educational tools, enhancing awareness and understanding.

  XZERO incorporates sensor technology into its infrastructure, linked to the Internet of Things (IoTs) for real-time communication across various city components. For instance, waste collection can be automatically triggered upon sensors detecting full bins. Real-time user data analysis enables accurate estimation of future waste collection schedules.

  City planning prioritizes pedestrian-friendly design, limiting vehicular access to maximize landscape area and foster a walkable environment. Increased green spaces promote social activities, biodiversity, and microclimate optimization, mitigating rising temperatures and urban heat islands. Well-shaded walking networks seamlessly connect with other green transportation modes, ensuring safe, convenient, and enjoyable travel throughout the city. Primary and secondary walking networks are meticulously planned to optimize walkability.

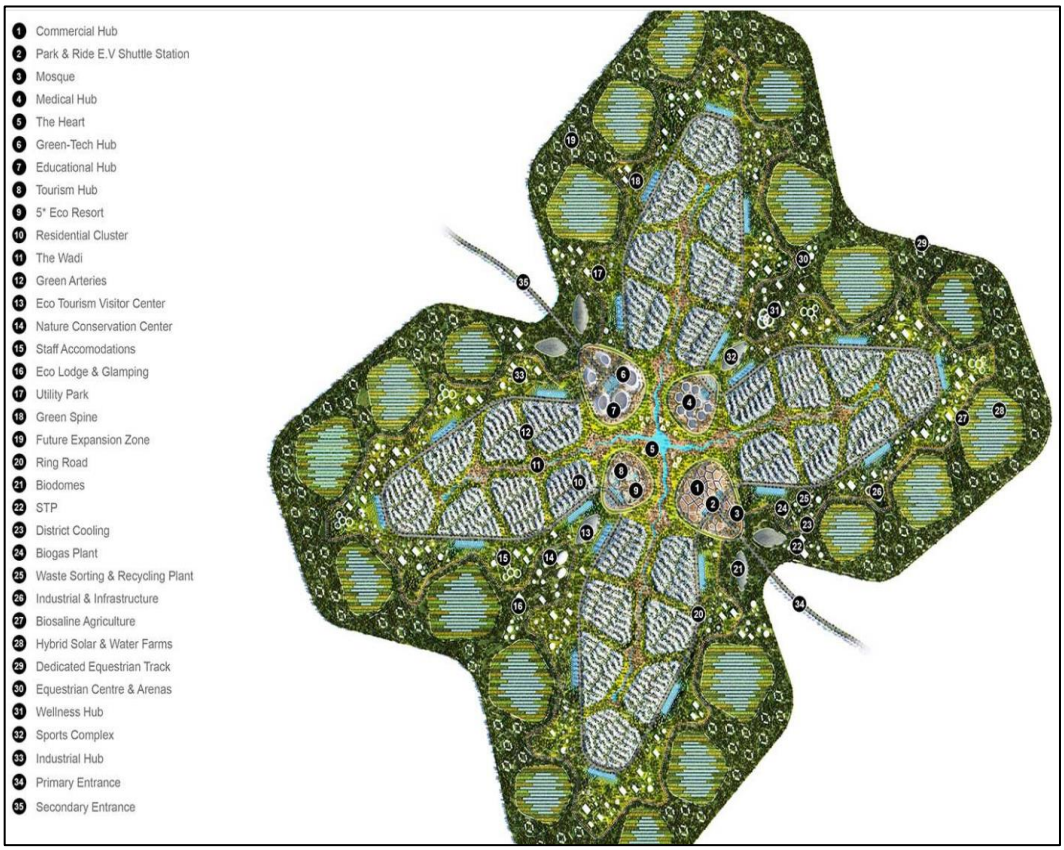
  The ring road and solar car park farms minimize vehicular access, reducing walking distances for residents. Electric charging stations and reduced energy costs incentivize the use of electric vehicles. Cycling and electric buggy paths form primary and secondary transportation networks, offering residents carbon-emissions-free transportation options.

  An autonomous EV shuttle system provides convenient transportation, connecting residents and visitors to city hubs and facilities. Each EV shuttle stop is conveniently located adjacent to cycling and buggy stations. Additionally, the city features an

electric park-and-ride system for visitors. A continuous 35 km network of dedicated running and cycling tracks, integrated into the landscape design, offers recreational opportunities. Moreover, a dedicated 9 km equestrian track loop connects to the equestrian center.

**Figure 2.3**

*XZERO Master Plan*




Source:(URB. XZERO City, 2022)

## 2.7 Studies from Palestine

- **Rawabi City, Palestine**

  Rawabi is the first planned city built for and by Palestinians in the West Bank. The idea of Rawabi was conceived in 2007, excavation started in 2010, and construction started in 2012. Rawabi is a high-tech city with 6,000 housing units on the project area of about 6,300 donums, housing a population of between 25,000 and 40,000 people spread across six neighborhoods [28].

  The Master plan as shown in Figure 2.4 “provides direction for the way the new city will grow and flourish and how future land use decisions will contribute to the achievement of social, economic, and environmental goals” [29].

**Figure 2.4**

*Rawabi City Master Plan*


Source:(Rawabi City, 2023)

Rawabi is poised to become Palestine's inaugural green and smart city, aspiring to establish a replicable model for future urban centers that will elevate the quality of life for both current residents and future generations [2]. In pursuit of this goal, Rawabi offers a suite of smart digital services designed to enhance urban living. This includes the implementation of Computerized Aid Facility Management Aid software and the Rawabi application for the city, which incorporates smart meters to efficiently control water usage and a SCADA system to mitigate water wastage. The city fosters direct communication between owners and residents through a dedicated phone application.

To promote sustainability and efficiency, Rawabi prioritizes optimized energy consumption through the deployment of energy-saving systems and lighting schedules. The city is committed to creating a safe and healthy environment by leveraging advanced technology, including CCTV for crime reduction and robust security monitoring. An advanced fiber optic network and high-speed WiFi infrastructure ensure seamless connectivity throughout the city.

Rawabi implements access control measures for buildings, offices, and facilities, enhancing overall security. The city embraces a proactive approach to maintenance, utilizing smart and innovative techniques for preventive maintenance to reduce damages and extend the lifespan of assets and properties. Demonstrating environmental responsibility, Rawabi intends to incorporate green cars for its operations, employs solar technology, and implements smart irrigation systems [28]. Through these comprehensive initiatives, Rawabi endeavors to set a precedent as a sustainable, technologically advanced, and resident-centric smart city in the Palestinian context.

Despite indicating that one of the smart digital services to its residents include green cars for the operations, the plan of Rawabi city did not focus on the aspect of smart mobility and transportation, but rather focused on the application of sustainability standards in the city more than the requirements of smart mobility. This may be due to the lack of smart mobility related infrastructure and the low population density in the city.

- **Sama Qruntol City**

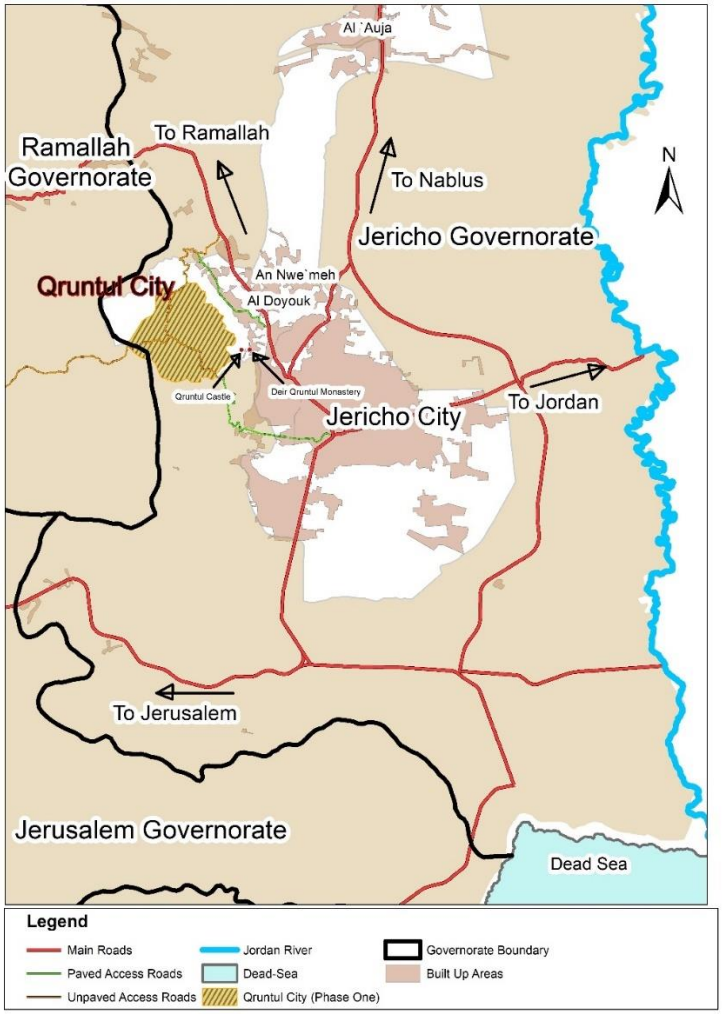
  The proposed city of Sama Qruntol is located close to Jericho near Deir Qruntol as presented in Figure 2.5. The city is still in the planning stage and preparing designs and studies. A developer will be contracted by the Palestinian Government to develop the new city. The project area is about 4,400 donums and is expected to accommodate around 15-20 thousand residents. as a first stage [3].

  The idea of the project was announced in 2021, but the project faces several challenges, which is the difficulty of securing the necessary funding for the project, in addition to the presence of part of it in Area C, which is controlled by the Israeli occupation.

  The city is intended to be a model for the Palestinian smart cities to catch up with advanced societies through a combine the Palestinian heritage with the aesthetics of modernity, with a developed tourist and technological nature that expresses the government's vision and strikes the depth of history and contributes to economic and social development [3].

**Figure 2.5**

*The location of the project site of Sama Qruntul City*




There is a proposed master plan for the land use and the roads network of Sama Qruntul City as shown in Figure 2.6 [3]. The plan indicates that the city will offer housing for low-income individuals, as well as villas, tourist cottages, and tourist trails. The city includes open spaces with green areas and lakes covering an area of 150 dunums, a public park covering 122 dunums, and features a commercial center and areas designated for crafts and industries, in addition to integrated community infrastructure.

The completion of the city's infrastructure was expected within three years, with the commencement of purchasing and construction activities afterward. The estimated cost for the first phase of infrastructure implementation is approximately 300 million shekels, with funding expected to come either through a partnership with the private sector or full government financing.

The government planned to establish a special council for the city, comprising several

ministries, operating under a special system allowing it greater autonomy due to the unique nature of the city compared to other local authorities. Once constructed, the city would have a regular local council.

It is important to note that all the mentioned plans have been frozen, and none of them has been implemented to date. This is due to the political and economic conditions faced by the Palestinian government in recent years.

- **Strategic Framework for the Intelligent Transportation System in Palestine**

  The Palestinian Government launched the Strategic Framework for the Intelligent Transportation System in Palestine in 2019 for the period up to 2029 [29]. The strategic framework aims to adapt the intelligent transportation systems (ITS) and integrate them within the transportation systems in Palestine. This strategic framework represents the backbone of the next phase of transportation systems in Palestine as it encompasses the outlines and the major issues of most concern. This framework can be considered as a base for initiating actions and projects to develop and advance the transportation sector.

**Figure 2.6**

*The proposed master plan for the land use and the roads network of Sama Qruntul City*


Source: (Ramallah News, 2021)

A road map to establish ITS in Palestine is established to attain the previously mentioned strategies and objectives. An implementation phased plan is proposed that addresses the issues, objectives, proposed projects, and priority interventions. It is divided into three phases: short term plan of 5 years, intermediate and long term plans of 3 years for each. However, despite having the strategic framework in 2019, none of its output has been applied yet.

The successful implementation of Intelligent Transportation Systems (ITS) necessitates a thorough understanding of the technical, institutional, and management requirements, along with adherence to the relevant legislations. These requirements are meticulously defined and expounded upon to establish a comprehensive foundation for the deployment of ITS. The overarching objectives and requisite strategies for the ITS initiative are delineated as follows:

- The first set of objectives focuses on creating an enabling institutional environment and establishing a robust database, facilitating the seamless integration of ITS components. Furthermore, the initiative aims to provide an efficient communication system for these components, thus ensuring their optimal functionality.
- Addressing urban congestion, the strategy seeks to reduce traffic congestion and enhance traffic control and management. Simultaneously, efforts are directed towards curbing vehicle emissions, promoting sustainability, and improving the efficiency and level of service of public transportation. Ensuring the safety of public transportation and minimizing delays and travel times are integral components of the strategic plan, with the ultimate goal of increasing public transportation ridership.
- Additionally, the initiative strives to offer integrated information for travelers, guiding them towards viable alternatives. This holistic approach extends to commercial vehicles, aiming to enhance safety, expedite custom operations, improve delivery times, exercise control over truck loads, and facilitate pedestrian mobility. The plan also emphasizes pedestrian safety, overall traffic safety, and the reduction of road accidents. Through these multifaceted objectives and strategies, the ITS initiative aims to revolutionize transportation systems, fostering efficiency, safety, and sustainability in urban environments.

Having a strategic framework for ITS in Palestine can form the basis for developing strategic planning framework for smart mobility for the Palestinian cities, whether for transforming existing cities mobility systems or for developing such for new cities.

## 2.8 Summary and Conclusions

### 2.8.1 Smart Mobility Concept

Smart mobility refers to an intelligent, efficient, and sustainable approach to transportation that leverages advanced technologies and data-driven solutions to enhance the overall transportation ecosystem. The primary goal is to provide seamless, accessible, and environmentally friendly transportation options while optimizing infrastructure use and improving the quality of transportation services [10].

### 2.8.2 Requirements of Smart Mobility

1. **Connectivity**

   High-speed, reliable connectivity is essential for smart mobility systems to facilitate real-time communication between vehicles, infrastructure, and centralized control systems.

2. **Data Infrastructure**

   Robust data infrastructure, including sensors, IoT devices, and communication networks, is required to collect, process, and disseminate information relevant to traffic conditions, vehicle status, and user preferences.

3. **Interoperability**

   Standardized protocols and interoperable systems are crucial to ensure seamless integration among various smart mobility components, allowing for efficient communication and data exchange.

4. **User Engagement**

   User-friendly interfaces and applications are necessary to engage and empower users, providing them with real-time information, route planning, and the ability to make informed decisions.

5. **Regulatory Framework**

   Clear and adaptable regulatory frameworks are needed to govern smart mobility solutions, ensuring compliance with safety standards, privacy protection, and fair competition.

### 2.8.3 Components of Smart Mobility

1. **Infrastructure Components**
   - **Sensors and IoT Devices:** Deployed in roads, traffic lights, and public spaces to collect real-time data on traffic flow, environmental conditions, and infrastructure usage.
   - **Communication Networks:** Enable data exchange between vehicles, infrastructure, and control centers, supporting real-time decision-making.
   - **Electric Charging Stations:** For electric vehicles, a network of charging stations is crucial to promote sustainable transportation.

2. **Vehicular Components**
    - **Connected Vehicles:** Equipped with communication technology to interact with vehicles, infrastructure, and centralized control systems.
    - **Electric and Autonomous Vehicles:** Promoting sustainability and efficiency by reducing emissions and enhancing safety.
    - **Sensors and Actuators:** Embedded in vehicles to gather data on surroundings and enable automated responses.
3. **Governance Components**
    - **Centralized Control Centers:** Monitor and manage the smart mobility ecosystem, analyzing data to optimize traffic flow, reduce congestion, and improve overall system efficiency.
    - **Data Analytics and AI Systems:** Analyze vast amounts of data to derive insights, predict traffic patterns, and optimize transportation services.
    - **Policy and Regulation Authorities:** Develop and enforce regulations, ensuring the responsible and deployment of smart mobility solutions.

#### 2.8.3.1 Interaction Among Components

1. **Data Exchange**

    Sensors in infrastructure and vehicles collect data, which is transmitted through communication networks to centralized control centers. These centers analyze the data and disseminate relevant information to users and vehicles.

2. **Real-time Decision-Making**

    Centralized control centers use data analytics and AI systems to make real-time decisions, such as adjusting traffic signals, rerouting vehicles, or optimizing public transportation schedules.

3. **User Engagement**

    Users interact with smart mobility systems through applications, receiving real-time information, personalized route suggestions, and updates on transportation services.

4. **Regulatory Compliance**

    Governance components ensure that smart mobility systems adhere to established regulations, addressing safety, privacy, and environmental concerns. Regulatory authorities also facilitate fair competition and innovation within smart mobility.

5. **Infrastructure Optimization**

   The interaction among infrastructure components and centralized control centers enables the optimization of infrastructure use, promoting efficient traffic flow, reducing congestion, and enhancing overall system performance.

   In summary, smart mobility is a holistic approach that involves interconnected components, including infrastructure, vehicular technologies, and governance mechanisms. The seamless interaction among these components is essential to realizing the benefits of intelligent, efficient, and sustainable transportation systems.

### 2.8.4 Assessment of case studies on new or transformed smart transportation

Transforming existing communities to smart transportation and planning new cities, whether in developing or developed countries, present distinct challenges and opportunities [30]. The processes comparison according to the previous case studies is presented in Table 2.1.

**Table 2.1**

*Comparison transforming existing communities to smart transportation with planning new cities in developing countries and in developed countries*

| | | Developing Countries | Developed Countries |
|---|---|---|---|
| Transforming Existing Communities to Smart Transportation | Infrastructure Challenges | Existing infrastructure may be outdated and lack the necessary foundation for smart transportation. Upgrading infrastructure poses a considerable challenge due to budget constraints and existing structures. | May have more advanced infrastructure, the challenge lies in retrofitting existing systems with smart technologies. This requires significant investment and may face resistance from established communities. |
| | Community Adaptation | Difficulties in terms of technological literacy. Cultural factors and varying levels of socioeconomic development may also influence community acceptance. | May resist change due to familiarity with existing transportation systems. The process requires effective community engagement and communication to gain acceptance. |
| | Cost Considerations | May limit the scale and speed of transformation. Funding sources, domestic play a crucial role in implementing smart transportation initiatives. | Generally more abundant, the cost of retrofitting existing infrastructure and managing the transition can be substantial. |
| | Regulatory Framework | May need to establish or enhance regulatory frameworks to support smart transportation. This requires cooperation between government agencies, private sector entities, and regulatory bodies. | May have existing regulations that need to be updated to accommodate smart transportation technologies. Striking a balance between innovation and regulation is essential. |
| Planning New Cities | Greenfield Advantage | Offers a greenfield advantage, allowing for the integration of smart transportation solutions from the inception. This facilitates seamless implementation without the need for extensive retrofitting. | Provides an opportunity to apply the latest technologies and urban planning principles. The challenge lies in balancing innovation with established practices. |
| | Technological Leapfrogging | Can leapfrog traditional transportation systems and directly implement cutting-edge technologies, potentially avoiding the challenges faced by established cities. | Can use new city planning as an opportunity for technological experimentation and innovation, serving as a model for future urban development. |
| | Community Engagement | Crucial to ensure cultural acceptance and participation. Community-driven planning may lead to more inclusive and sustainable outcomes. | The challenge may involve balancing the interests of diverse stakeholders and ensuring representation in decision-making. |
| | Sustainability Focus | Have the advantage of incorporating sustainability principles from the start, addressing issues such as energy efficiency, environmental impact, and social equity. | Remains a priority in new city planning, focusing on energy-efficient infrastructure, green spaces, and smart transportation options. |

Navigating challenges and seizing opportunities in smart transportation involves strategic retrofitting of existing communities and planning new cities with advanced technologies. Success depends on collaboration among governments, communities, and private sector.

### 2.8.5 Identification of Strategic Planning Factors to Achieve Smart Mobility for New Cities in Developing Countries

The identified factors, considering the outcome of the previous case studies, represent those factors that can be considered to have impact on the overall success and sustainability of smart mobility initiatives, which could be included in the comprehensive framework influencing the implementation of smart mobility in urban settings. Chapter three will delve into the examination of these factors, exploring their interplay and assessing their respective degrees of influence on one another, whether positive or negative, based on the interviews with transportation experts, planners, and official stakeholders.

- **Location**
  - The city is strategically positioned in a key region.
  - The overall area of the city is a significant factor in its development.
- **Population**
  - Consideration of the total population is essential.
  - Understanding the employed population is crucial for economic planning.
  - Analyzing population density provides insights into urban dynamics.
- **Social**
  - Examining average income levels within the population.
  - Evaluating the percentage of the population with higher education.
  - Assessing the ratio of cars per capita.
  - Identifying the presence and number of colleges and universities.
- **Economy**
  - Reviewing the municipal budget for economic planning.
  - Identifying the number of shopping centers as an economic indicator.
  - Assessing the variety of services, including construction, industry, transportation, services, finance, and health.
- **Mobility**
  - Studying the city's Sustainable Mobility Urban Plan.
  - Evaluating the efficiency of the multimodal transport system.
  - Assessing the integration of Information and Communication Technology (ICT) in traffic control.
- **Security**
  - Considering the current political situation for overall security assessment.

    - Evaluating measures in place for the city's security.

- **Organization/Municipality**
    - Analyzing the organizational structure of the municipality.
    - Assessing the skill set of municipal staff.

- **Governance**
    - Examining existing legislation and policies governing the city.
    - Reviewing regulations related to IT security and privacy.
    - Identifying partnerships that contribute to city governance.
    - Exploring the existence of an official smart city strategy.

- **Technology**
    - Evaluating the quality of existing IT infrastructures in the city.

- **Citizen**
    - Assessing the IT skills of the citizens.
    - Exploring citizen engagement initiatives.
    - Promoting digital literacy among the population.

# Chapter Three

# Methodology and Analysis

## 3.1 Chapter Overview

This chapter presents the approach followed in this research is based on the CIB method. It is a scenario analysis technique, which systematically explores the intricate relationships among various potential factors or events within a system, providing a nuanced understanding of potential future scenarios [31]. The process involves identifying key factors, establishing relationships between them, and creating a cross-impact matrix to visually represent the interactions. By assigning values to quantify the strength and direction of these relationships, cross-impact balances are calculated to assess the net impact of each factor on others. The outcome of the analysis will form the basis for identifying the strategic planning framework for the smart mobility in new cities in Palestine.

## 3.2 The CIB method

The CIB is a method employed in scenario analysis for examining the connections and interrelationships among different factors or events within a system. This approach facilitates the evaluation of how alterations in one variable could affect others, providing a more nuanced comprehension of potential future scenarios. The CIB method was developed by Weimer-Jehle in 2006 [31]. The CIB method has been used in strategic planning in several fields such as the economic, social, political, and management fields, as well as in the field of transportation [32].

Many papers delve into either the methodological intricacies of CIB analysis or present applications within the transportation domain. Examples include studies exploring scenario planning as a framework to structure the development of transport planning alternatives [33]. Scenario planning was utilized to investigate scenarios for network configuration and organization of automated public transit, using Aachen as a case study [34]. Additionally, research has been conducted on building scenarios for urban mobility in 2030 for five cities across Europe by combining cross-impact balance analysis with participatory stakeholder workshops [35]. Other works explore explorative scenarios of future urban mobility in Brussels, as well as city-specific future urban mobility

scenarios, aiming to determine the impacts of emerging urban mobility environments [36].

Despite the numerous scientific papers in the field of smart mobility that employ various analysis methods, there has been no study found in the literature concerning the use of CIB method in strategic planning for smart mobility for new cities in developing countries using.

Using the CIB method in strategic planning for smart mobility in new cities in developing countries encapsulates the central theme of employing a sophisticated methodology to navigate the complexities of introducing intelligent transportation systems. This research explores the unique dynamics, challenges, and opportunities associated with deploying smart mobility in the context of developing urban landscapes. The ScenarioWizard software, developed to perform CIB analysis, has been used, tested and further developed in numerous application projects and method experiments. The application of the CIB utilizing ScenarioWizard software, typically followed in scenario analysis, is illustrated hereafter.

- **Identify Key Factors**
  Begin by identifying the potential key factors or variables that could significantly influence the future outcomes of interest. These factors may include economic indicators, technological advancements, social trends, political developments, etc.

- **Establish Relationships:**
  Determine the relationships and interactions between the identified key factors. Consider how changes in one factor may influence or be influenced by changes in another. These relationships can be expressed using qualitative terms such as "positively influences," "negatively influences," or "is independent of." This can be done by the researcher or through a focus group.

- **Create a Cross-Impact Matrix:**
  Develop a cross-impact matrix that systematically captures the relationships between pairs of factors. This matrix is a visual representation of the interactions, with rows and columns representing the identified factors, and the cells indicating the nature and strength of the relationships.

- **Assign Cross-Impact Values:**
  Assign values to the cells of the matrix to quantify the strength and direction of the relationships. Common values include +1, +2, +3 for a strong positive influence, 0 for no influence, and -1,-2, -3 for a strong negative influence. Intermediate values can be used to represent moderate influences.

- **Calculate Cross-Impact Balances:**
  Calculate the cross-impact balances by summing the values in each row and each column. The row sums represent the net impact of a factor on other factors, while the column sums represent the net impact of other factors on a specific factor.

- **Interpret Cross-Impact Balances:**
  Analyze the cross-impact balances to identify factors that play a central or influential role in the system. Factors with high positive balances are considered drivers that positively influence other factors, while those with high negative balances may indicate vulnerabilities or challenges.

- **Scenario Development:**
  Use the insights gained from the cross-impact balances to develop scenarios. Explore how changes in key factors, considering their interdependencies, could lead to different plausible futures. This helps in understanding the dynamics of the system and preparing for a range of possible outcomes.

- **Sensitivity Analysis:**
  Conduct sensitivity analyses to explore the robustness of the scenarios to changes in the strength and nature of the relationships between factors. This helps to assess the stability of the scenarios under different conditions.

Cross-impact Balances provide a structured approach to understanding the complexity of systems and exploring potential future states. The technique is particularly useful in strategic planning, risk assessment, and decision-making processes where a comprehensive understanding of interdependencies is crucial.

Using the CIB method in strategic planning for smart mobility for emerging cities in developing countries embodies the core idea of employing an advanced methodology to address the intricacies of introducing smart mobility solutions. This study delves into

the distinctive dynamics, obstacles, and prospects linked to the implementation of intelligent mobility within the framework of developing urban environments..

Against the backdrop of limited resources, diverse socio-economic conditions, and evolving infrastructures, the CIB method emerges as a strategic compass. This method, renowned for its ability to assess interdependencies and uncertainties within complex systems, is proposed to be instrumental in guiding the formulation of effective smart mobility strategies tailored to the specific needs of new cities in developing nations.

In the subsequent sections, this study will delve into the key factors influencing smart mobility success in developing cities, assess the readiness of existing infrastructures, navigate regulatory landscapes, and consider technological aspects. Through a comprehensive analysis facilitated by the CIB method, the research aims to contribute valuable insights that will inform strategic decision-makers for the successful integration of smart mobility solutions. Ultimately, the goal is to pave the way for sustainable, efficient, and inclusive transportation systems in new cities that align with the unique challenges and opportunities present in developing countries.

### 3.3 Analysis Methodology

Interpreting these balances helps in identifying the influential factors and potential vulnerabilities in the system. The insights gained from the CIB are then utilized to develop scenarios that explore different plausible futures based on changes in key factors and their interdependencies. Additionally, sensitivity analyses are conducted to assess the stability of scenarios under varying conditions.

In essence, the CIB serves as a powerful tool for decision-makers in scenario planning, allowing them to navigate uncertainties, understand system dynamics, and prepare for a range of possible outcomes by considering the interconnected nature of key factors.

Analysis is conducted to the cross-impact balances in order to identify the descriptors that play a central or influential role in the system. Descriptors with high positive balances are considered drivers that positively influence other factors, while those with high negative balances may indicate vulnerabilities or challenges.

### 3.4 Key Factors for Creation of CIB

In this section, the factors that were mentioned in Section 2.4.5 will be studied and analyzed in order to determine the degree of influence each one has on the others, whether positively or negatively in the next step. Here's an overview of how each factor can influence the integration of smart mobility solutions [37].

#### 3.4.1 Location

The following are believed to be key considerations when selecting a location for smart mobility success in new cities:

- **Strategic Region**

  Implementing smart mobility in new cities is complex, relying on factors like location selection, considering urban density, transportation hubs, and proximity to essential institutions. Prioritizing areas with tourism, environmental sustainability, and government districts further aids seamless integration. Infrastructure readiness, regulatory support, and community engagement are crucial, demanding thorough evaluation. Collaborating with local authorities and garnering community support become instrumental, highlighting the need for active involvement from both public and private sectors.

- **Area**

  Moving beyond geographical considerations, the size of a city also becomes a factor in determining the success of smart mobility. Large cities, with their complex transportation networks and high daily commuters, may focus on optimizing public transportation and addressing diverse needs. In contrast, medium-sized cities may emphasize enhancing existing systems, while smaller cities and towns might prioritize cost-effective and sustainable transportation options. In essence, the success of smart mobility is not solely contingent on the size of a city but on a holistic understanding of its unique characteristics, challenges, and goals. By tailoring solutions to the specific needs, scale, and objectives of each city, smart mobility strategies can be effectively implemented.

### 3.4.2 Population

The impact of population on smart mobility in new cities is multifaceted and can be categorized into three key aspects: population size, employed population characteristics, and population density [13].

1. **Population Size**

   Population size is a pivotal factor influencing the dynamics and effectiveness of smart mobility initiatives in new cities. Planners need to consider various aspects of population size when designing and implementing smart mobility solutions. Key considerations include:

   - Traffic Congestion: Larger populations lead to increased congestion, necessitating congestion management solutions, while smaller populations allow for more flexible and tailored options.
   - Demand for Transportation Services: Larger populations require scalable solutions, emphasizing robust public transit and efficient traffic management, while smaller cities may opt for cost-effective options.
   - Data Availability and Management: Larger populations generate more data, requiring advanced management for effective smart mobility solutions, whereas smaller populations necessitate simpler data management with a focus on privacy.
   - Economic Considerations: Larger populations offer economies of scale for significant investments in smart mobility infrastructure, while smaller populations may face resource constraints, necessitating prioritization of cost-effective solutions.
   - Cultural and Behavioral Factors: Larger populations demand solutions accommodating diverse demographics and preferences, whereas smaller populations allow for more intimate community engagement in decision-making.

2. **Employed Population**

   Employed population can have an influence on smart mobility as follows:

   - Commute Patterns: Commuting distances and last-mile connectivity influence the effectiveness of smart mobility solutions, especially in diverse employment locations.
   - Transportation Preferences: Diverse preferences require a mix of options, with solutions offering flexibility to adapt to various commuting patterns and lifestyles.
   - Technology Adoption: The tech-savviness of the workforce influences the adoption

of technology-driven solutions, emphasizing the need for user-friendly interfaces.

- Employer Engagement: Corporate initiatives and partnerships play a role in promoting and implementing various transportation modes, influencing economic considerations and benefits.
- Urban Planning and Land Use: Integrating smart mobility with urban planning, considering workplace proximity and zoning regulations, encourages sustainable commuting.

**3. Density of Population**

The density of population can have an influence on smart mobility as follows:

- Public Transit Viability: High-density areas favor economically thriving public transit, while low-density areas may benefit from alternative solutions like para- or micro-transit.
- Ridesharing and Carpooling: High-density areas see widespread adoption of ridesharing, while low-density areas may have less widespread but relevant usage.
- Micro-Mobility Solutions: High-density areas are conducive to the success of micro-mobility solutions, with adaptations necessary for less densely populated regions.
- Traffic Management: High-density areas require advanced traffic management systems, while low-density areas benefit from simpler solutions.
- Last-Mile Connectivity: High-density areas emphasize effective last-mile solutions, whereas low-density areas prioritize enhancing accessibility in suburban regions.
- Infrastructure Investment: High-density areas justify larger investments in transportation infrastructure, while low-density areas focus on optimizing existing networks.
- Community Engagement: High-density areas require targeted communication for diverse urban populations, while low-density areas necessitate intimate engagement with a personalized approach.
- Economic Considerations: High-density areas with a large customer base offset implementation costs, while low-density areas require cost-effective solutions tailored to community needs.

### 3.4.3 Social

Social factors such as average income, educational attainment, car ownership rates, and the presence of colleges and universities play crucial roles in shaping the development and success of smart mobility initiatives in new cities [38].

1. **Average Income**

   The average of income can have an influence on smart mobility as follows:

   - Affordability of Transportation: High-income areas support premium services, while low-income areas prioritize cost-effective options.
   - Modal Preferences: Diverse preferences in high-income areas require various smart mobility options, whereas low-income areas emphasize public transit and shared mobility.
   - Access to Technology: High-income areas leverage advanced technologies, while low-income areas require alternative communication channels.
   - Employer-Based Initiatives: Corporate support is common in high-income areas, while public-sector initiatives are vital in low-income areas.
   - Shared Mobility Programs: High-income areas embrace shared mobility for convenience, while low-income areas focus on affordability.
   - Public Transit Subsidies: Wealthier communities may sustain public transit without subsidies, but subsidies are crucial in lower-income areas.

2. **Population with Higher Education**

   The population with higher education can have an influence on smart mobility as follows:

   - Technology Adoption: Higher-educated individuals exhibit higher digital literacy and early adoption of new technologies.
   - Use of Mobile Apps: Solutions relying on mobile applications are widely accepted among the educated population.
   - Data-Driven Decision-Making: Higher-educated individuals are comfortable with data-driven decision-making.
   - Sustainability Awareness: The educated population prioritizes eco-friendly choices.
   - Innovative Commuting Habits: They engage in flexible work arrangements and multi-modal commuting.
   - Community Engagement: The educated population actively participates in

community discussions and supports research and innovation.

- Affordability Considerations: Despite higher income, variations within the demographic require consideration for affordability.

**3. Cars per Capita**

The cars per capita can have an influence on smart mobility as follows:

- Congestion and Traffic Management: High car ownership leads to congestion, while low car ownership emphasizes optimization of existing road networks.
- Public Transit Utilization: Public transit is crucial in high car ownership areas and plays a central role in low car ownership areas.
- Last-Mile Connectivity: Last-mile challenges are vital in high car ownership areas, focusing on convenience in low car ownership areas.
- Economic Considerations: Economic considerations drive interest in cost-effective solutions in high car ownership areas, while affordability and accessibility are key in low car ownership areas.
- Environmental Impact: High car ownership areas face increased emissions, while promoting sustainable options remains important in low car ownership areas.
- Parking Challenges: Parking solutions are crucial in high car ownership areas, with a focus on shared mobility in low car ownership areas.
- Cultural Shifts and Behavioral Changes: Changing cultural attitudes requires education in high car ownership areas, while openness to alternative transportation modes facilitates shifts in low car ownership areas.

**4. Colleges and Universities**

The colleges and universities can have an influence on smart mobility as follows:

- Diverse Demographics: Consideration of various commuting patterns and preferences is necessary due to diverse student backgrounds.
- Technology Adoption: Campus communities foster a tech-savvy population.
- Research and Innovation: Collaborations lead to innovative projects, and universities serve as living labs for testing smart mobility solutions.
- Commute Patterns: Smart mobility solutions need to adapt to flexible academic schedules and efficient on-campus transportation.
- Last-Mile Connectivity: Enhanced last-mile connectivity and micromobility options are vital for universities as transit hubs.

- Community Engagement: Engaging with universities ensures consideration of unique academic community needs.
- Economic Impact: Universities contribute to the local economy, impacting affordability and adoption of smart mobility solutions.
- Activities and Events: Efficient and sustainable commuting options are required for events, and integrating smart mobility into programs promotes awareness.
- Accessibility for All: Prioritizing inclusivity ensures accessibility to the diverse academic community.

### 3.4.4 Economy

The success of smart mobility initiatives in new cities is intricately linked to various factors, each playing a vital role in shaping transportation landscapes. Three key factors Municipal Budget, Number of Shopping Centers, and Number of Companies hold significant influence over the planning, implementation, and sustainability of smart mobility solutions [39].

**1. Municipal Budget**

The municipal budget can have an influence on smart mobility as follows:

- Infrastructure Investment: Higher budgets enable substantial investments in smart mobility infrastructure, while limited budgets necessitate prioritization and cost-effective solutions.
- Public Transit: Adequate funding facilitates enhancement and expansion, while constrained budgets require optimization and exploration of partnerships.
- Technology Implementation: Robust budgets allow for comprehensive smart technology adoption, whereas limited budgets may lead to phased implementations.
- Affordability: Cities with higher budgets can invest in diverse, premium services, while those with lower budgets prioritize cost-effective solutions.
- Innovation Programs: Generous budgets support extensive pilot programs and innovation initiatives, while limited budgets may lead to smaller-scale projects and collaborations.
- Sustainability Initiatives: Generous budgets support various sustainable initiatives, while budget limitations lead to prioritization within constraints.
- Maintenance: Sufficient funds ensure long-term sustainability, but budget constraints may require prioritized maintenance efforts.

- Community Engagement: Adequate funds enable comprehensive engagement, while creative strategies are employed with limited budgets.
- Public-Private Partnerships: Larger budgets facilitate substantial partnerships, while smaller budgets allow exploration on a more limited scale.

**2. Number of Shopping Centers**

The number of shopping centers can have an influence on smart mobility as follows:

- Traffic Congestion: More shopping centers contribute to congestion, necessitating traffic management, while fewer centers require efficient traffic flow planning.
- Last-Mile Connectivity: Numerous shopping centers demand focus on last-mile solutions, while even fewer centers necessitate flexible options for residents.
- Parking Demand: High demand in shopping areas requires smart parking solutions; fewer centers still benefit from enhanced parking efficiency.
- Public Transit Integration: Integration is crucial in shopping-rich areas, while optimization is required in areas with fewer centers.
- E-commerce and Delivery Services: Shopping centers drive demand for delivery services, influencing overall mobility strategies.
- Pedestrian and Cyclist Safety: Concentrated shopping centers demand safety measures, while fewer centers still require attention to pedestrian and cyclist safety.
- Demand for Shared Mobility: Extensive shopping centers boost shared mobility demand, whereas even in fewer centers, shared services can be viable.
- Community Engagement: More centers demand extensive engagement, while fewer centers require targeted community involvement.

**3. Number of Companies**

The number of companies can have an influence on smart mobility as follows:

- Modal Diversity: More services offer a range of transportation choices, promoting a multimodal approach, while limited services optimize available options.
- User Convenience: A higher number of services enhances user convenience; limited services require user-friendly interfaces and streamlined processes.
- Last-Mile Connectivity: Diverse services address last-mile challenges; limited services focus on effective solutions for accessibility.
- Technology Integration: More services encourage increased technological integration; limited services benefit from simple and effective technology solutions.

- Competition and Innovation: Intense competition fosters innovation in areas with more services; innovation remains crucial in areas with fewer services.
- Affordability and Accessibility: More services offer pricing flexibility and accessibility; limited services prioritize affordability and accessibility.
- Community Engagement: Extensive services demand community engagement; limited services necessitate tailored solutions based on residents input.
- Sustainability Considerations: Cities with more services explore comprehensive sustainability initiatives; limited services focus on introducing environmentally friendly practices.

### 3.4.5 Mobility

Developing a comprehensive urban plan for smart mobility in new cities involves a strategic approach that integrates various elements to foster efficiency, sustainability, and user-friendly transportation. The key components of this framework include [40]:

1. **Integrated Transportation Networks**
   - Multimodal Integration: Seamless integration of various transportation modes.
   - Real-time Information: Implementation of real-time information systems for transit schedules, traffic conditions, and shared mobility.

2. **Smart Infrastructure**
   - Connected Infrastructure: Utilization of sensors, IoT devices, and communication technologies for data-driven decision-making.
   - Traffic Management Systems: Implementation of intelligent traffic management systems.

3. **Transit-Oriented Development (TOD)**
   - Strategic Zoning: Adoption of TOD principles to strategically plan around transit hubs.
   - Affordable Housing: Integration of affordable housing within TODs for a diverse population with accessible transportation.

4. **Pedestrian-Friendly Design**
    - Walkable Streets: Prioritization of walkability with safe crosswalks and traffic-calming measures.
    - Plazas and Public Spaces: Design of spaces encouraging pedestrian activity and community engagement.

5. **Cycling Infrastructure**
    - Dedicated Cycling Lanes: Development of dedicated lanes and bike-sharing programs.
    - Bike Parking Facilities: Implementation of secure and convenient bike parking at key locations.

6. **Smart Parking Solutions**
    - Dynamic Parking Management: Introduction of dynamic pricing and efficient parking management systems.
    - Multimodal Hubs: Design of hubs with integrated parking facilities for smooth transitions between modes.

7. **Community Engagement**
    - Inclusive Planning: Community engagement through surveys, town hall meetings, and digital platforms.
    - User-Centric Design: Prioritization of user-centric design principles considering accessibility and lifestyle choices.

8. **Technology Integration**
    - Digital Platforms: Development of platforms providing access to smart mobility services.
    - IoT for Transportation: Exploration of IoT devices for data collection on traffic patterns.

9. **Regulatory Framework**
    - Supportive Policies: Establishment of policies supporting smart mobility deployment.
    - Flexible Regulations: Development of a flexible regulatory framework adapting to technological advancements.

10. **Sustainability Initiatives**
    - Green Transportation: Promotion of sustainable options, such as electric vehicles and shared mobility.
    - Emission Reduction Programs: Implementation of programs to reduce emissions and enhance air quality.

11. **Public-Private Partnerships (PPPs)**
    - Collaborative Initiatives: Partnerships with private entities for innovative solutions.
    - Funding Models: Explore innovative funding models through public-private partnerships to finance and operate smart mobility projects, ensuring a sustainable and economically viable approach.

12. **Accessibility and Inclusivity**
    - Universal Design: Prioritization of universal design principles for accessible infrastructure.
    - Affordable Solutions: Implementation of affordable smart mobility solutions.

13. **Continuous Monitoring and Adaptation**
    - Performance Metrics: Establishment of KPIs for monitoring and evaluating smart mobility initiatives.
    - Adaptive Planning: Continuous adaptation to changing demographics, technological advancements, and transportation trends.

### 3.4.6 Security and Political Situation

The success of smart mobility initiatives in new cities is influenced by both the political situation and security considerations [41]:

1. **Political Situation**

   The political situation can have an influence on smart mobility as follows:

- Policy and Regulation: Supportive policies encourage innovation, while regulatory barriers can hinder progress.
- Funding and Investment: Political commitment influences financial support, while instability may lead to budget constraints.
- Public-Private Partnerships (PPPs): Positive political climates foster public-private

collaboration, while instability may hinder such partnerships.

- Decision-Making Processes: Stability is crucial for consistent long-term planning, and bureaucratic efficiency expedites project approval.
- Community Engagement: Positive government-citizen relations and transparent communication build community support.
- National and Regional Policies: Political support positively influences smart mobility prioritization, while conflicting priorities can impede implementation.
- Emergency Preparedness: Resilience planning and emergency response policies are shaped by political situations.
- Innovation Ecosystem: Political support for entrepreneurship fosters innovation, and leaders can initiate programs supporting the sector.
- Global Collaboration: Leaders prioritizing global collaboration seek partnerships for knowledge sharing, while political isolation may limit access to international expertise.

2. **Security**

- Data Privacy and Protection: Robust measures for handling sensitive information and compliance with regulations are crucial.
- Cybersecurity Threats: Protection against cyber threats and regular audits enhance system resilience.
- Integrity of Communication Networks: Secure communication protocols and resilience to network failures are essential.
- Vehicle and Infrastructure Security: Cybersecurity measures for connected vehicles and physical security measures for infrastructure are necessary.
- Emergency Response Preparedness: Security protocols for emergencies and infrastructure resilience to disruptions are crucial.
- Public Safety: Security awareness campaigns and reliable emergency communication systems empower users and ensure safety.
- Interagency Collaboration: Collaboration with security agencies and cross-sector cooperation create a holistic security framework.
- User Authentication and Authorization: Robust access controls, biometric, and multi-factor authentication enhance overall security.
- Supply Chain Security: Ensuring the security of the supply chain and establishing vendor security standards are crucial.

- Incident Response Planning: Developing response plans and collaborating with law enforcement agencies minimize the impact of security breaches.

### 3.4.7 Organization/Municipality

The success of smart mobility initiatives in new cities is heavily influenced by the organization, governance, and decision-making processes of the city. Key aspects include [42]:

1. **Organization/Municipality Structure**
   - Interdepartmental Collaboration: Collaboration between municipal departments is crucial, requiring mechanisms to overcome silos and fragmentation.
   - Decision-Making Authority: The distribution of decision-making authority influences project streamlining and agility, crucial for adapting to dynamic technologies.
   - Public-Private Partnerships (PPPs): The municipal structure's ability to facilitate PPPs and efficient procurement processes impact collaboration with private firms.
   - Budget Allocation and Prioritization: Reflecting the city's commitment, budget allocation requires prioritization and flexibility for emerging technologies.
   - Department of Transportation Integration: The involvement and autonomy of transportation departments influence project success, promoting holistic transportation planning.
   - Digital Innovation Offices: Dedicated offices drive innovation, fostering smart mobility initiatives through cross-functional teams.
   - Community Engagement: Dedicated departments and transparent communication enhance community involvement in smart mobility planning.
   - Technology Adoption and Adaptation: Cities with a Chief Information Officer (CIO) and flexible structures are more likely to succeed in technology adoption.
   - Regulatory Framework Development: Regulatory departments shape policies, and agility in regulatory processes supports innovation.
   - Resilience Planning: Integration of resilience departments and collaboration with emergency services prepare the city for challenges.

2. **Staff Skills**

The skills of municipal staff are pivotal for the success of smart mobility initiatives, requiring a diverse set of skills due to the interdisciplinary nature of projects. Key considerations include:

- Technical Proficiency: Skills in data analysis, IT, software development, and GIS are essential for informed decision-making and optimization of transportation services.
- Urban Planning and Design: Skills in transportation planning and urban design contribute to developing comprehensive and sustainable smart mobility strategies.
- Engineering and Infrastructure Management: Traffic engineering and infrastructure management are necessary for the efficient operation of smart mobility systems.
- Policy Development and Regulatory Compliance: Legal and regulatory expertise ensures compliance and facilitates the development of frameworks that encourage innovation.
- Public Engagement and Communication: Skills in community outreach and communication strategy are crucial for effectively communicating smart mobility benefits.
- Project Management: Project planning, execution, and risk management skills are essential for successful smart mobility project implementation.
- Cybersecurity Awareness: Training in cybersecurity ensures staff can safeguard smart mobility systems against cyber threats and understand data privacy principles.
- Sustainability and Environmental Planning: Environmental expertise contributes to the development of sustainable and eco-friendly smart mobility strategies.
- Financial Acumen: Budgeting, financial planning, grant writing, and funding acquisition skills are essential for managing funds and securing external funding.
- Training and Capacity Building: Training programs and capacity-building initiatives empower staff to operate and maintain smart mobility systems.
- Cross-Disciplinary Collaboration: Interdisciplinary collaboration facilitates integration of diverse perspectives for comprehensive smart mobility solutions.
- Public Safety and Emergency Response: Skills in emergency preparedness and collaboration with emergency services ensure safety and resilience of smart mobility systems during crises.

### 3.4.8 Governance Official Smart City Strategy

The success of smart mobility initiatives in new cities is significantly influenced by the smart city strategy devised by governance officials. The strategy covers key aspects that shape the integration of technology into urban infrastructure [42]:

- Policy Framework: Officials design supportive policies incentivizing smart mobility, covering areas like electric vehicles and ridesharing, along with a robust regulatory framework.
- Collaboration with Stakeholders: Collaboration with private entities and technology providers enhances innovation and efficiency in implementing smart mobility initiatives.
- Urban Planning and Design: Officials influence urban planning by integrating smart mobility into master plans and promoting TOD to reduce reliance on traditional vehicles.
- Budget Allocation and Funding: Prioritizing smart mobility in budget allocation ensures resources for digital infrastructure and transportation networks, with active seeking of external funding.
- Technology Adoption and Innovation: Leading digital transformation initiatives and establishing innovation hubs and testbeds allow experimentation with smart mobility solutions, fostering innovation.
- Community Engagement and Inclusivity: Community outreach, education programs, and prioritizing accessibility ensure inclusivity in the planning process and address residents' concerns.
- Data Governance and Privacy: Establishing a data governance framework and ensuring public trust through transparent communication maintain privacy compliance.
- Sustainability and Environmental Goals: Aligning smart mobility with sustainability goals involves promoting green transportation and initiatives to reduce the carbon footprint.
- Emergency Preparedness and Resilience: Incorporating smart mobility into resilience plans and collaborating with emergency services ensure operational transportation systems during emergencies.
- Performance Measurement and Evaluation: Establishing Key Performance Indicators (KPIs) and regular evaluation mechanisms measure the success and impact of smart

mobility initiatives.

- Regulatory Flexibility and Agility: Agile regulatory approaches, pilot programs, and experimentation zones allow officials to adapt quickly to technological advancements while ensuring safety and security.
- Education and Training: Investing in training programs for municipal staff and public awareness campaigns ensure the skills and active participation needed for smart mobility planning and implementation.

### 3.4.9 Technology and Information Technology Infrastructures for Smart Mobility

Smart infrastructure and Information Technology (IT) are pivotal in revolutionizing smart mobility in new cities, contributing to sustainability, efficiency, and user-friendly transportation solutions. Key areas where these technologies influence smart mobility include [43]:

1. **Connected Transportation Systems**
   - Intelligent Traffic Management optimizes traffic flow through sensor-driven dynamic adjustments to traffic signals.
   - Vehicle-to-Infrastructure (V2I) Communication enhances safety and reduces congestion by enabling real-time information exchange between vehicles and infrastructure.

2. **Data Collection and Analytics**
   - Real-time Data Monitoring from embedded sensors offers insights into traffic patterns and usage trends for optimized transportation planning.
   - Predictive Analytics enables proactive measures to manage congestion and enhance overall transportation efficiency.

3. **Intelligent Transportation Systems (ITS)**
   - ITS Deployment, incorporating technologies like sensors and cameras, enhances safety, reduces travel times, and improves transportation network efficiency.
   - Dynamic Message Signs convey real-time information, contributing to a more informed and responsive driving experience.

4. **Smart Parking Solutions**
    - Parking Management Systems, aided by mobile applications, help locate available spaces, reducing traffic congestion.
    - Payment and Reservation Systems streamline the parking process and encourage shared mobility options.

5. **Electric Vehicle (EV) Charging Infrastructure**
    - Smart Charging Stations with IT support enhance accessibility and convenience through features like remote monitoring and payment processing.
    - Integration with Navigation Systems facilitates locating and navigating to the nearest charging stations, promoting EV adoption.

6. **Mobility as a Service (MaaS)**
    - Digital Platforms for MaaS, where information technology plays a crucial role in the development and operation of digital platforms that offer MaaS. These platforms integrate various modes of transportation, providing users with seamless, on-demand mobility options.
    - Payment Integration within MaaS platforms allows users to pay for multiple transportation modes through a unified digital payment system.

7. **Autonomous Vehicles and Infrastructure Readiness**
    - Sensor-equipped Infrastructure supports autonomous vehicles by enabling interaction with the surrounding environment.
    - High-precision Mapping, facilitated by IT systems, is crucial for the navigation and operation of autonomous vehicles.

8. **Digital Platforms for Ride-Sharing and Carpooling**
    - Ride-Sharing Applications, driven by smart infrastructure and IT, optimize vehicle occupancy and enhance transportation efficiency.
    - Dynamic Routing Algorithms, powered by IT, determine optimal routes for shared mobility services based on real-time conditions.

9. **Cybersecurity and Data Privacy**
    - Security Measures implemented by IT systems protect smart mobility infrastructure from cyber threats.
    - Data Privacy Policies ensure compliance with regulations, and transparent data

governance builds trust among users.

10. **Real-time Communication Networks**
    - 5G and Low-latency Networks support real-time data exchange, critical for responsive and secure smart mobility operations.
    - Vehicle-to-Everything (V2X) Communication, facilitated by IT infrastructure, enhances safety and coordination among vehicles and transportation elements.

11. **Smart Street Lighting**
    - Energy-efficient Lighting responds to real-time conditions, contributing to energy savings and road safety.
    - Integrated Sensor Networks monitor environmental conditions, traffic flow, and air quality, providing valuable data for urban planning.

12. **Public Transportation Enhancements**
    - Digital Ticketing Systems, supported by IT, make public transportation more convenient.
    - Real-time Transit Information from smart infrastructure improves the overall user experience and encourages public transit use.

### 3.4.10 Citizens

Citizens literacy, particularly in digital and technological aspects, significantly influences the successful adoption and comprehension of smart mobility initiatives in new cities. The impact of citizens literacy on smart mobility encompasses several key areas [43]:

1. **Adoption and Awareness**
    - Literate citizens are more likely to adopt and embrace smart mobility solutions, contributing to the success of these initiatives.
    - Digital literacy empowers citizens to access information about available smart mobility services, enabling informed choices based on their mobility needs.

2. **Usage of Mobile Applications**
    - Digital literacy enables effective use of mobile applications for planning routes, making payments, and accessing real-time transportation information.
    - Citizens with digital literacy can seamlessly integrate various mobility services into digital platforms, facilitating the use of integrated transportation options.

3. **Digital Payments and Transactions**
    - Digital literacy is crucial for citizens to engage in cashless transactions for mobility services, enhancing the convenience of using smart mobility services.
    - Familiarity with digital payment methods supports a frictionless payment experience.

4. **Access to Information**
    - Digital literacy enables citizens to access real-time information about transportation options, traffic conditions, and service updates.
    - Understanding communication from transportation authorities fosters reliability and trust in smart mobility systems.

5. **Participation in Sustainable Practices**
    - Digital literacy contributes to citizens' understanding of the environmental benefits of sustainable mobility practices.
    - Enables tracking and understanding of the carbon footprint associated with transportation choices.

6. **Feedback and Community Engagement**
    - Citizens with digital literacy actively engage with smart mobility services, providing feedback for service improvement.
    - Digital literacy enables citizens to contribute ideas and concerns related to smart mobility planning in the city.

7. **Safety and Security Awareness**
    - Understanding and utilizing safety features in smart mobility applications enhance personal safety during transit.
    - Digital literacy contributes to citizens' understanding and addressing of privacy concerns, fostering trust and security.

8. **Accessibility for Diverse User Groups**
    - Digital literacy supports citizens in using inclusive design features in smart mobility applications, ensuring accessibility for diverse user groups.
    - Efforts to improve digital literacy must address potential digital divides, ensuring equitable access to smart mobility solutions.

9. **Education and Training Programs**
    - Digital literacy enables citizens to actively engage in education and training programs, fostering responsible use of smart mobility services.
    - Promotes a culture of continuous learning, allowing citizens to adapt to evolving smart mobility technologies.

10. **Equitable Access and Social Inclusion**
    - Digital literacy supports citizens in understanding the importance of inclusive transportation solutions.
    - Contributes to digital inclusion, ensuring a broader segment of the population can benefit from smart mobility initiatives.

## 3.5 Interviews

During the interview process with governmental entities such as the MoLG, MoT, and Rawabi Municipality, in addition to private entities and developers, important conclusions were reached regarding the key factors that concern each entity, as well as how these factors intersect and relate to each other. The interviews help in defining the relationships between the relevant factors and creating the CIB matrix.

### 3.5.1 Governmental Entities' Concerns

- Site Selection and Environmental Preservation: The MoLG and the MoT sought to ensure that the selection of new cities sites is done carefully, with a focus on minimizing negative impacts on the environment and historical sites.
- Defining the City's Character and Identity: There was an interest in defining a unique character and identity for the new city to make it attractive to residents and meet their needs.
- Public-Private Partnerships: There was a focus on enhancing collaboration between the public and private sectors to achieve optimal results in the development and operation of cities.

### 3.5.2 Private Firms and Developers' Concerns

- Focus on Partnership: Private firms and developers emphasized the importance of collaboration between the public and private sectors, recognizing that partnership is key to the success of urban development projects.
- Connecting New Cities: There was a particular interest in connecting new cities effectively with their surroundings, whether through transportation networks or other means of communication.
- City Design and Increased Population Density: The firms focused on designing cities effectively, with an emphasis on increasing population density to make them more economically viable.

There is a close relationship between site selection and defining the city's character, as sites need to reflect the desired identity to ensure the city's attractiveness. Public-private partnership is a vital factor in achieving common goals for both the government and private firms. Increasing population density enhances the effectiveness and sustainability of new cities, closely linked to smart city design and the adoption of compact city systems. In conclusion, the interviews demonstrate a consensus on common concerns between governmental and private entities and developers. This highlights the importance of comprehensive collaboration to ensure the development of effective and sustainable new cities that meet the needs and aspirations of the community.

### 3.6 Creation of the Cross-Impact Matrix

The next step to identifying descriptors is establishing relationships between them. Only direct influences are to be indicated. The resulting indirect influences are constructed by the CIB automatically during the evaluation. Subsequently, a cross-impact matrix is created to visually represent the interactions where each row and column that corresponds to a different descriptor. The relationships between descriptors identified based on interviews with transportation/planning experts, official stakeholders from MoLG and MoT, and developers from private sectors, as well as the understanding of the statues of the new cities and the smart mobility in developing countries, and literature reviews. By assigning values to quantify the strength and direction of these relationships, cross-impact balances are calculated to assess the net impact of each factor on others by summing the rows and columns.

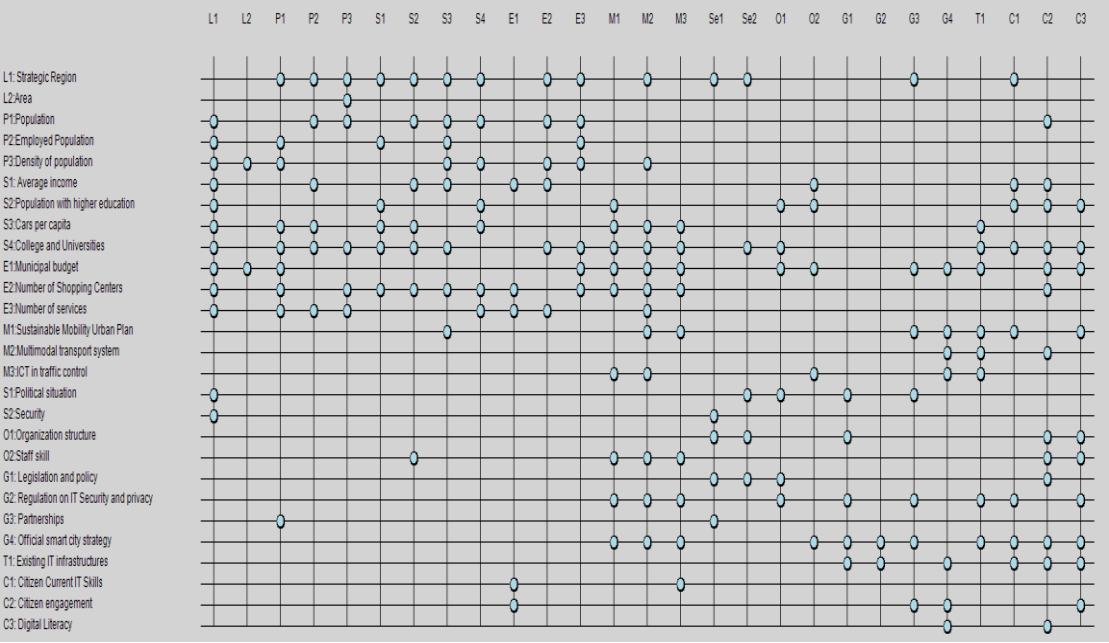
To operationalize the process effectively, it becomes necessary to assign values to the cells of the matrix, quantifying the strength and direction of these relationships using a scale that ranges from +2 (strongly promoting influence) to -2 (strongly restricting influence) as follows:

+2: strongly promoting influence
+1: weakly promoting influence
0: no influence
-1: weakly restricting influence
-2: strongly restricting influence

Next, the cross-impact matrix that systematically captures the relationships between pairs of factors is developed as shown in Appendix A. This matrix is a visual representation of the interactions, with rows and columns representing the identified factors, and the cells indicating the nature and strength of the relationships as shown in Figure 3.1 considering the key factors identified in Section 3.4 and the interviews indicated in Section 3.5. Accordingly, and benefiting from others case studies, the blue points have been assigned to indicate that there is a direct relationship between one factor and the other factors. The strength and nature of this relationship, whether positive or negative, have been clarified in the matrix in Appendix A.

**Figure 3.1**

*The direct relationship between one factor and the other factors*




## 3.7 Analysis Results

Analysis is conducted to the cross-impact balances in order to identify the descriptors that play a central or influential role in the system. Descriptors with high positive balances considered as drivers that positively influence other factors, while those with high negative balances may indicate vulnerabilities or challenges. Appendix B shows the result of the cross-impact balances descriptors for the smart mobility in new cities in developing countries.

This is followed by developing scenarios from the insights gained from the cross-impact balances. Exploring how changes in key factors, considering their interdependencies, could lead to different plausible futures. This helps in understanding the dynamics of the system and preparing for a range of possible outcomes. Appendix C illustrates the scenarios development from the impact balance descriptors for the smart mobility for new cities in developing countries. As Appendix C shows, there are 13 scenarios. The optimal scenario is shown in Figure 3.2.

The optimal scenario indicates that all factors are important and significantly influence each other, except for the factor of the area of new city. The success of smart mobility in new cities is not solely determined by size; rather, it depends on a combination of factors that align with the unique characteristics, goals, and needs of the city.

Arranging the factors based on their impact strength, from the most influential to the least, is shown in Figure 3.3, therefore, allowing to categorize them into three priority classifications. Prioritization is based on evaluating the intensity of each factor's impact on the intended goal. High-priority factors (with score more than 16) are considered to have a significant and vital impact on the expected outcomes, while medium-priority factors (with score from 11 to 15) reflect a moderate and average impact. Simultaneously, low-priority factors (with score less than 11) are deemed to have a minor or less significant impact on achieving the targeted goals. This classification aids in directing efforts and efficiently allocating resources to ensure a focus on crucial factors for the success of the project or specified goal.

**Figure 3.2**

*The optimal scenario*

| Descriptor | Value |
|---|---|
| Strategic Region | high |
| Area | low |
| Population | high |
| Employed Population | high |
| Density of Population | high |
| Average Income | high |
| Population with Higher Education | high |
| Cars per Capita | high |
| Colleges and Universities Impact | high |
| Municipal Budget | high |
| Number of Services | high |
| Sustainable Mobility Urban Plan | high |
| Political Situation and Security | high |
| Municipality Budget and Staff Skill | high |
| Official Smart City Strategy and Legislation and Policy | high |
| Partnerships | high |
| IT Infrastructures | high |
| Citizens Engagement | high |
| Digital literacy | high |

**Figure 3.3**

*Arranging the factors based on their impact strength*

| Descriptor | Value | Consistency Value | Category |
|---|---|---|---|
| Citizens Engagement | high | 26 | High priority |
| Strategic Region | high | 24 | |
| Sustainable Mobility Urban Plan | high | 24 | |
| Digital literacy | high | 20 | |
| Population | high | 18 | |
| IT Infrastructures | high | 15 | Med priority |
| Colleges and Universities | high | 14 | |
| Number of Services | high | 14 | |
| Partnerships | high | 14 | |
| Official Smart City Strategy and Legislation and Policy | high | 12 | |
| Population with Higher Education | high | 12 | |
| Density of Population | high | 11 | Low priority |
| Cars per Capita | high | 11 | |
| Employed Population | high | 10 | |
| Average Income | high | 10 | |
| Municipal Budget and Municipal skills | high | 10 | |
| Political Situation and Security | high | 9 | |
| Area | low | 2 | |

* The values result from the ScenarioWizard software based on the relationships between factors

Factors with high priority include citizen engagement, strategic region, sustainable mobility urban plan, digital literacy, and population. Factors with medium priority encompass IT infrastructures, college and universities, number of services, partnerships, smart city strategy, legislation and policy, population with higher education, density of population, and cars per capita. Factors with low priority consist of employed population, average income, municipal budget and municipal skills, political situation and security, and area.

### 3.8 Recommendation

It is recommended to consider only the high- and medium-priority factors, which are believed to have considerable impact on the successful implementation of smart mobility initiatives. This nuanced understanding derived from the CIB method can guide decision-makers in allocating resources effectively and developing tailored strategies for the successful integration of smart mobility in new cities in developing countries.

Accordingly, it is recommended to consider the above indicated priority factors in the strategic planning process to arrive at the strategic planning framework, with the aim of establishing a new city that could be characterized to have a smart mobility system.

### 3.9 Proposed Strategic Framework

In this section, a general strategic planning framework for smart mobility for new cities in developing countries is proposed. The main components of this framework are presented as following:

1. **Vision:** based on the previous diagnostic factors, a vision for the future of smart mobility in new cities is reached and summarized as:

   **"Innovative smart mobility driving sustainable development in the Palestinian new cities"**
2. **Goals, objectives and strategies:** based on the previous diagnostic factors, the goals, objectives, strategies, main projects, tools and the Monitoring and Evaluation have been conducted and clarified in Table 3.1 in appendix d. The strategies have been arranged based on priorities and the outcomes of the CIB method as follows:
   1. Prioritizing citizen-centric solutions
   2. Emphasizing connectivity in strategically located areas
   3. Establishing a comprehensive sustainable mobility plan
   4. Foster a balanced sustainable population
   5. Embracing cutting-edge technologies
   6. Promoting social inclusion through mobility
   7. Driving economic growth through smart mobility
   8. Fostering collaborative governance
   9. Building responsive municipality
   10. Enhancing smart security infrastructure

# Chapter Four
# Conclusions and Recommendations

## 4.1 Introduction

This research has been prepared with the aim of understanding the principles and elements of smart mobility for the preparation of a general strategy for the new Palestinian cities, adopting it as a planning direction for new Palestinian cities as an effective step towards sustainable urban growth. The fundamental principles and factors of smart mobility were identified by reviewing numerous literary studies in this field. Based on this, the identification of strategic planning factors for achieving smart mobility in new cities of developing countries involves a comprehensive analysis across multiple dimensions. The main key considerations include location, population, social, economy, mobility, security, organization/municipality, governance, technology, and citizens.

After identifying the strategic planning factors for achieving smart mobility in new cities of developing countries, CIB method was used in order to identify the key factors (descriptors) that play a central or influential role in the system. Arranging the factors based on their impact strength, from the most influential to the least, has allowed to categorize them into three priority classifications. Prioritization is based on evaluating the intensity of each factor's impact on the intended goal.

The study and analysis of global and local case studies also helped in realizing and understanding the strategies for achieving smart mobility. Consequently, a general strategy for the new Palestinian cities has been formulated, which planners can adopt as a first step in developing new smart cities in Palestine.

## 4.2 Conclusions

The conclusions from the results of the study are summarized hereafter.

1. The crucial importance of strategic planning for smart mobility in new cities, particularly in developing countries such as Palestine and the adoption of smart mobility solutions is imperative for addressing urbanization challenges, ensuring sustainable development, and enhancing the overall quality of life in these emerging urban centers.

2. The case study from Palestine, including Rawabi City and Sama Qruntol City, highlights the significance of integrating advanced technologies, infrastructure development, and community engagement in the planning process.
3. The CIB method categorizes the key factors influencing smart mobility success into high-priority (citizen engagement, strategic location, sustainable mobility urban plan, digital literacy, and population), medium-priority (IT infrastructures, service variety, partnerships, smart city strategy, legislation, education levels, population density, and car ownership), and low-priority (employed population, average income, and political situation).
4. The nuanced understanding from the CIB method aids decision-makers in resource allocation and strategy development for effective integration of smart mobility in developing countries.
5. The study recommended focus on high- and medium-priority factors in the strategic planning process that aim to establish a new city characterized by a well-integrated smart mobility system.
6. The study emphasizes that successful strategic planning for smart mobility involves a multi-dimensional approach, encompassing transportation, social, economic, security, governance, and technological aspects.
7. The proposed strategic planning framework not only provides guidelines for decision-makers and urban planners in Palestine, but also serves as a valuable model for other developing countries facing similar urbanization issues.
8. Prioritize effective strategic planning as a catalyst for fostering sustainable, technologically advanced, and citizen-centric smart mobility in existing cities of developing nations.
9. Consideration of the proper strategies applicable to existing cities and adopting them as part of the proposed strategic planning framework for transforming the existing cities in developing countries towards smart mobility.

### 4.3 Recommendations

Based on the thesis outcome, including the constituents of the strategic planning framework, the recommendations are presented hereafter.

- Develop and implement transportation plans that are integrated with urban plans for enhanced accessibility, reduced commute times, and strategic business attraction.
- Focus on urban planning initiatives supporting sustainable population growth, economic development, and social inclusion, with proper consideration of smart mobility aspects.
- Drive economic growth through smart mobility by prioritizing sustainable and alternative transportation modes.
- Establish sustainable mobility plans for urban areas encompassing various modes of sustainable transportation.
- Enhance security infrastructure to ensure safety in smart mobility systems.
- Foster stakeholder engagement to garner support and collaboration.
- Improve organizational efficiency for effective implementation of smart mobility initiatives.
- Embrace cutting-edge technologies to stay at the forefront of smart mobility advancements.
- Prioritize citizen-centric solutions for greater public acceptance and usage.
- Promote digital literacy to ensure widespread understanding and utilization of smart technologies.
- Integrate diverse focus areas, including technology, governance, economy, population, security, and transportation, into a cohesive plan for smart mobility in developing cities.
- For Rawabi City, as an existing new city with low population density, is recommended to follow the previous strategies with focusing on achieving balanced sustainable population and prioritizing citizen-centric solutions.
- For Sama Quruntol city, as a new city in the planning phase, is recommended to follow the previous strategies with focusing on the main strategy of location as its important to ensure that the proposed site is suitable for the new city and does not

impact the environmental aspects and achieving the previous strategies, especially the security and safety strategy, as part of the city is located in area C.

### 4.4 Limitations

The limitations of this study can be summarized as follows:

- Limited availability and quality of data related to smart mobility infrastructure, urban planning, and socioeconomic factors in the context of developing countries, specifically in Palestine. Outdated or incomplete data can hinder the accuracy of the analysis and recommendations.
- Limited number of previous local studies in the field of smart mobility in new smart cites in developing countries, especially in Palestine.
- The significant gap that exists between what developed countries have achieved in planning for smart mobility systems and the reality in the Palestinian cities.
- The CIB method, while considered as a valuable tool for scenario analysis, it involves expert judgment and subjective assessments, making it susceptible to biases and differing opinions among experts.
- The complexity of analyzing and interpreting cross-impact balances may result in variations in outcomes based on individual perspectives. It is possible that factors with lower impact should be taken into consideration, but they might be overlooked due to a lack of awareness or vision.
- When using the CIB method, as the number of factors or projections increases, the complexity of the analysis grows exponentially. Handling a large set of factors may become impractical, and the method may lose its efficiency and effectiveness.

# List of Abbreviations

| Abbreviation | Meaning |
|---|---|
| AR | Augmented Reality |
| CIB | Cross Impact Balance Method System |
| CIO | Chief Information Officer |
| EV | Electric Vehicle |
| GeoMoLG | Geographic Information System of the Ministry of Local Government |
| GIS | Geographic Information Systems |
| IBD | International Business District |
| ICT | Information and Communication Technology |
| IoT | Internet of Things |
| IT | Information Technology |
| ITS | Intelligent Transportation Systems |
| KPIs | Key Performance Indicators |
| MaaS | Mobility as a Service |
| MoLG | Ministry of Local Government |
| MoT | Ministry of Transportation |
| NSC | New Songdo City |
| PPPs | Public-Private Partnerships |
| PRT | The Personal Rapid Transit |
| RTA | Roads and Transportation Authority |
| SMRT | Seoul Metropolitan Rapid Transit |
| TOD | Transit-Oriented Development |
| UNCTAD | UN Conference on Trade and Development |
| V2I | Vehicle-to-Infrastructure |
| V2X | Vehicle-to-Everything |
| VR | Virtual Reality |

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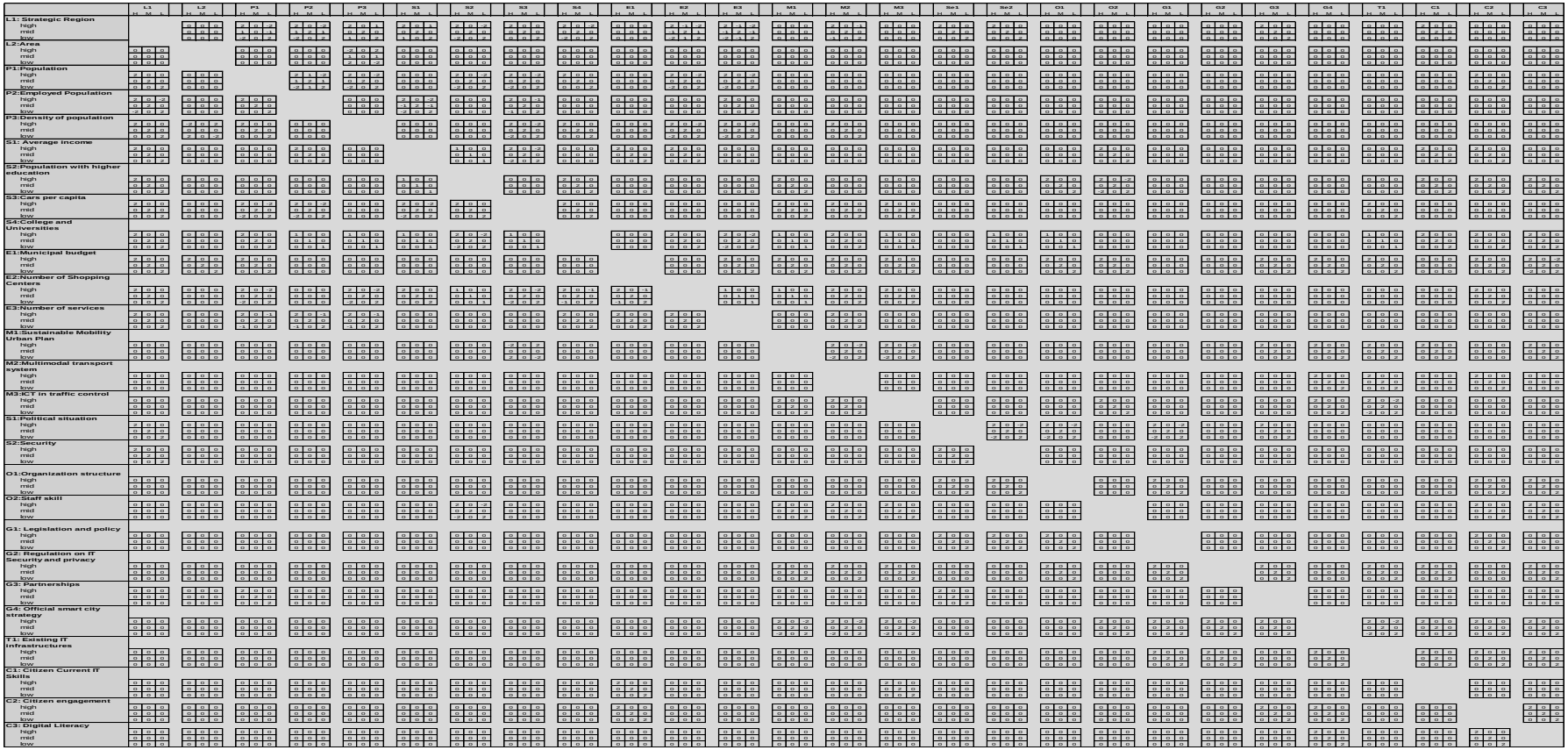
# Appendices

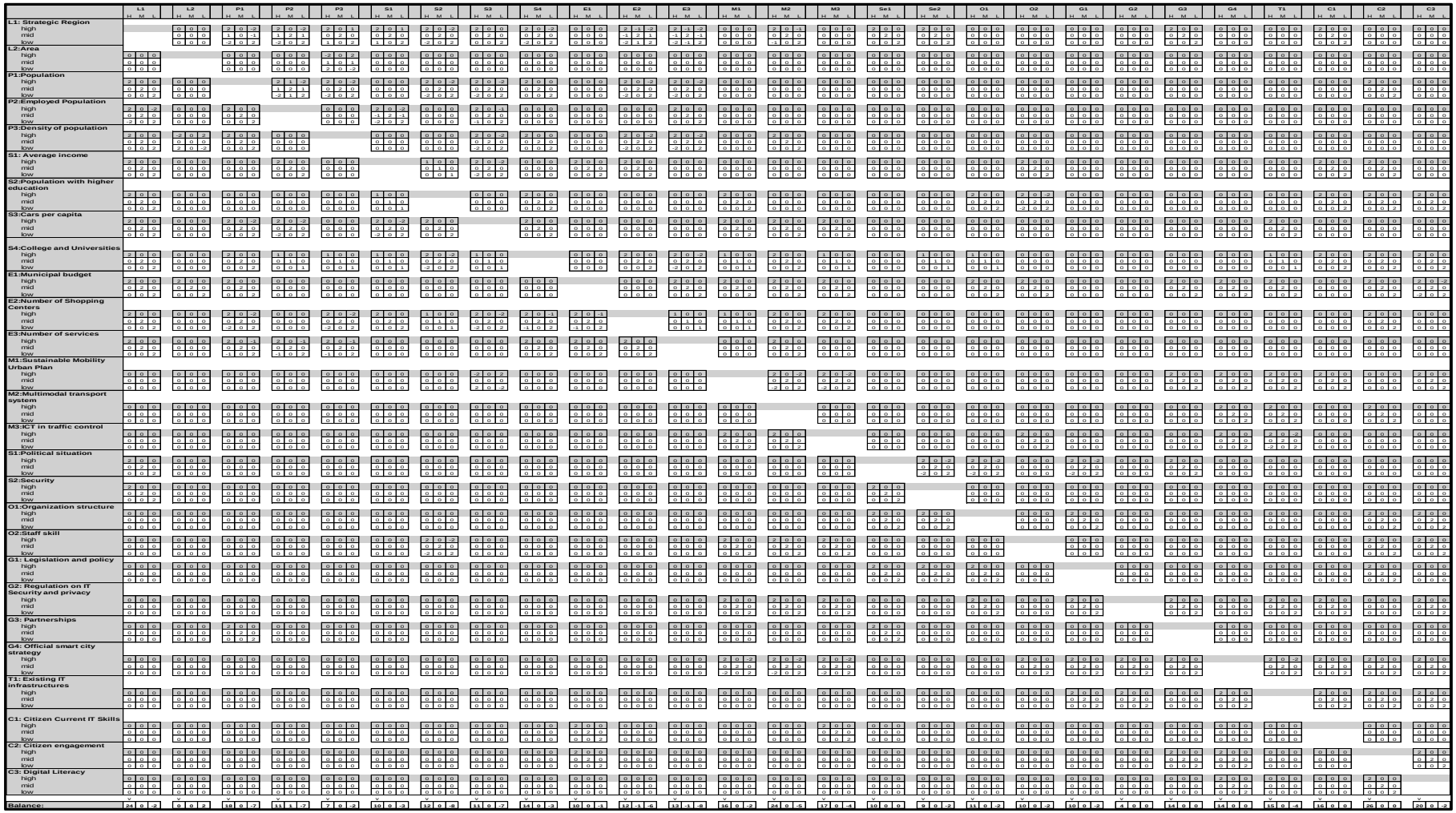
## Appendix A

## The Cross-impact matrix



# Appendix B

## Cross-impact balance



# Appendix C

## Scenarios development from the impact balance for the smart mobility for new cities in developing countries descriptors

| Scenario No. 1 | Scenario No. 2 | Scenario No. 3 | Scenario No. 4 | Scenario No. 5 | Scenario No. 6 | Scenario No. 7 | Scenario No. 8 | Scenario No. 9 | Scenario No. 10 | Scenario No. 11 | Scenario No. 12 | Scenario No. 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1: Strategic Region | L1: Strategic Region | | L1: Strategic Region | | | | | | L1: Strategic Region | | | |
| High | Low | | High | | | | | | Low | | | |
| L2:Area | L2:Area | L2:Area | L2:Area | L2:Area | | | | L2:Area | L2:Area | | | |
| Low | High | Low | High | Med | | | | High | Med | | | |
| P1:Population | P1:Population | P1:Population | P1:Population | | | | | | | | | |
| High | Med | High | Med | | | | | | | | | |
| P2:Employed Population | P2:Employed Population | | P2:Employed Population | | | | | | P2:Employed Population | | | |
| High | Low | | High | | | | | | Low | | | |
| P3:Density of population | P3:Density of population | P3:Density of population | P3:Density of population | | | | | | | | | |
| High | Med | High | Med | | | | | | | | | |
| S1: Average income | S1: Average income | | S1: Average income | | | | | | S1: Average income | | | |
| High | Low | | High | | | | | | Low | | | |
| S2:Population with higher education | S2:Population with higher education | | S2:Population with higher education | | | | | | S2:Population with higher education | | | |
| High | Low | | High | | | | | | Low | | | |
| S3:Cars per capita | S3:Cars per capita | | S3:Cars per capita | | | | | | S3:Cars per capita | | | |
| High | Low | | High | | | | | | Low | | | |
| S4:College and Universities | S4:College and Universities | S4:College and Universities | S4:College and Universities | | | | | | | | | |
| High | Med | High | Med | | | | | | | | | |
| E1:Municipal budget | | | E1:Municipal budget | | | | E1:Municipal budget | | E1:Municipal budget | | | |
| High | | | Med | | | | High | | Med | | | |
| E2:Number of Shopping Centers | E2:Number of Shopping Centers | E2:Number of Shopping Centers | E2:Number of Shopping Centers | | | | | | | | | |
| High | Med | High | Med | | | | | | | | | |
| E3:Number of services | E3:Number of services | E3:Number of services | E3:Number of services | | | | | | | | | |
| High | Med | High | Med | | | | | | | | | |
| M1:Sustainable Mobility Urban Plan | | | M1:Sustainable Mobility Urban Plan | | | | | | M1:Sustainable Mobility Urban Plan | | | |
| High | | | Low | | | | | | High | | | |
| M2:Multimodal transport system | | | M2:Multimodal transport system | | | | | | | | | |
| High | | | Med | | | | | | | | | |
| M3:ICT in traffic control | | | M3:ICT in traffic control | | | | | | M3:ICT in traffic control | | | |
| High | | | Low | | | | | | High | | | |
| S1:Political situation | S1:Political situation | | S1:Political situation | | | | S1:Political situation | | | | | |
| High | Low | | High | | | | Low | | | | | |
| S2:Security | S2:Security | | S2:Security | | | | S2:Security | | | | | |
| High | Low | | High | | | | Low | | | | | |
| O1:Organization structure | O1:Organization structure | | O1:Organization structure | | | | O1:Organization structure | | | | | |
| High | Low | | High | | | | Low | | | | | |
| O2:Staff skill | O2:Staff skill | | O2:Staff skill | | | | | | O2:Staff skill | | | |
| High | Low | | High | | | | | | Low | | | |
| G1: Legislation and policy | | G1: Legislation and policy | G1: Legislation and policy | G1: Legislation and policy | G1: Legislation and policy | G1: Legislation and policy | G1: Legislation and policy | | G1: Legislation and policy | | G1: Legislation and policy | |
| High | | Low | High | Low | | High | Low | | High | | Low | |
| G2: Regulation on IT Security and privacy | | | G2: Regulation on IT Security and privacy | | | | | | G2: Regulation on IT Security and privacy | | | |
| High | | | Low | | | | | | High | | | |
| G3: Partnerships | | | | | | G3: Partnerships | | | G3: Partnerships | | G3: Partnerships | |
| High | | | | | | Low | | | High | | Low | |
| G4: Official smart city strategy | | | G4: Official smart city strategy | | | | | | G4: Official smart city strategy | | | |
| High | | | Low | | | | | | High | | | |
| T1: Existing IT infrastructures | | | T1: Existing IT infrastructures | | | | | | T1: Existing IT infrastructures | | | |
| High | | | Low | | | | | | High | | | |
| C1: Citizen Current IT Skills | | | C1: Citizen Current IT Skills | | | | | | C1: Citizen Current IT Skills | | | |
| High | | | Low | | | | | | High | | | |
| C2: Citizen Engagement | | | | | | | | | C2: Citizen Engagement | | C2: Citizen Engagement | |
| High | | | | | | | | | Med | | Low | |
| C3: Digital Literacy | | | | | | | | | | | | |
| High | | | | | | | | | | | | |

## Appendix D

## Tables

**Table 3.1**

*The strategy framework for the smart mobility for new cities in Palestine*

| Goals | Objectives | Main projects | Tools | The official authorities | Monitoring and Evaluation | Priority |
|---|---|---|---|---|---|---|
| **1.** Main strategy for location: Emphasizing connectivity in strategically located areas | | | | | | |
| - Optimize the city's strategic location to enhance connectivity and economic opportunities | • Develop and implement a comprehensive urban plan to maximize accessibility<br>• Reduce commute times, and attract businesses to strategically located areas. | • Development and implementation of urban master plan | • Location analysis software including (GIS)<br>• Traffic Simulation Software<br>• Big Data Analytics<br>• Transportation Management Systems | • Ministry of Transportation<br>• Ministry of Local Government | KPI 1: Percentage increase in connectivity within strategically planned urban areas.<br>KPI 2: Accessibility index measuring the ease of transportation within the city's overall urban plan. | High |
| **2.** Main strategy for population: Foster a balanced sustainable population | | | | | | |
| - Promote economic growth by strategically aligning the employed population with emerging industries<br>- Implement urban planning measures that optimize population density for sustainable living | • Implement zoning and land-use policies that encourage balanced density of population and their development needs.<br>• Ensure adequate housing, amenities, and infrastructure to support the growing population sustainably.<br>• Identify key industries for development.<br>• Create incentives for population growth, and align workforce development programs to meet the skill demands of these industries<br>• . | • Establishment of smart zoning regulations incorporating mixed-use development principles, green spaces, and affordable housing initiatives | • Spatial analysis tools (GIS)<br>• Zoning Simulation Tools<br>• Data Analytics Tools | • Ministry of Local Government<br>• Ministry of Public Works and Housing | KPI 3: Inclusivity score for mobility solutions, reflecting accessibility for diverse demographic groups.<br>KPI 4: Percentage increase in accessibility for vulnerable and underserved communities. | High |
| **3.** Main strategy for social: Promoting social inclusion through mobility | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| - Increase the average income levels through job creation and economic development initiatives<br>- Prioritize education to cultivate a skilled workforce and support knowledge-based industries. Support the establishment and growth of educational institutions to enhance human capital.<br>- Optimize the municipal budget to prioritize smart infrastructure | • Invest in the development of educational institutions, including universities and research centers, to nurture local talent and attract students from diverse regions.<br>• Enhance educational infrastructure, curriculum, and vocational training to meet the demands of emerging knowledge-based industries, fostering a skilled and competitive workforce. | • Promotion of compact mixed-use with smart technologies to enhance walkability and community engagement<br>• Upgrading the educational infrastructure project, focusing on modernizing school facilities | • Economic modeling software<br>• Industry analysis tools<br>• Workforce planning software<br>• Urban design software<br>• 3D modeling tools<br>• Spatial analysis tools (GIS)<br>• Environmental impact assessment software<br>• Education management systems (EMS) | • Ministry of Transportation<br>• Ministry of National Economy<br>• Ministry of Education | KPI 5: Social inclusion index assessing the impact of mobility systems on community engagement.<br>KPI 6: Percentage reduction in transportation disparities within the population. | Med |
| **4.** Main strategy for economy: Driving economic growth through smart mobility | | | | | | |
| - Facilitate economic growth and convenience through the strategic development of shopping centers.<br>- Diversify the economic landscape by attracting and supporting services across various sectors | • Implement policies that attract and support businesses, encourage entrepreneurship, and provide job training programs to uplift the economic status of the population.<br>Allocate budgetary resources efficiently, prioritizing investments in smart mobility infrastructure, public transit, and technology to ensure sustainable and efficient urban transportation.<br>• Plan and develop strategically located shopping centers to stimulate economic activity, enhance convenience for residents, and create vibrant commercial hubs. | • Launching an industry development and workforce training program, offering incentives for targeted industries, providing skill development initiatives, and creating collaborative partnerships with educational institutions<br>• Implementing the economic Empowerment Initiative, offering financial incentives for businesses<br>• Establishing vocational training centers to align education with industry demands<br>• Establishing the smart learning hub, a comprehensive initiative to invest in the development of universities, research centers, and innovation hubs, fostering a knowledge-based ecosystem<br>• Implementing policies and incentives to attract a spectrum of service-oriented industries<br>• Introducing the smart budget allocation system, leveraging data analytics and | • Infrastructure planning software<br>• Learning platforms<br>• VR/AR education tools.<br>• Research collaboration platforms<br>• Location analysis software<br>• Retail Planning Tools<br>• GIS<br>• Commercial real estate software. | • Ministry of Local Government<br>Ministry of National Economy<br>• Ministry of Education | KPI 7: Economic growth rate attributed to investments in smart mobility infrastructure.<br>KPI 8: Job creation index resulting from improved movement of goods and people. | Med |

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| | • Develop policies and incentives to attract a diverse range of service-oriented industries, fostering economic resilience and reducing dependency on specific sectors. | performance metrics to ensure the efficient allocation of municipal resources<br>• Development of smart commercial hubs | | | | |
| | **5.** Main strategy for transportation and mobility: Establishing a comprehensive sustainable mobility plan | | | | | |
| - Develop and implement a comprehensive urban plan that prioritizes sustainable mobility solutions.<br>Encourage sustainable transportation modes to reduce dependence on private cars.<br>- Establish an efficient and interconnected transport network to enhance mobility options and multimodal transport system.<br>- Promote alternative modes of transportation such as walking, cycling, and electric vehicles.<br>- Integrate Information and ICT for smart traffic control and optimization. | • Integrate sustainable mobility principles into urban planning, including the development of pedestrian-friendly zones, cycling lanes, and efficient public transportation systems.<br>• Development policies and infrastructure that promote the use of sustainable transportation modes, including walking, cycling, and electric vehicles, to reduce environmental impact.<br>• Develop an integrated and efficient transport network that seamlessly connects various modes, enhancing accessibility and reducing congestion.<br>• Create infrastructure and awareness programs to encourage the adoption of alternative transportation modes, promoting sustainability and reducing the carbon footprint.<br>• Implement advanced ICT systems for real-time traffic monitoring, intelligent traffic signal control, and data-driven decision-making to optimize | • Sustainable mobility integration project<br>• Green mobility campaign<br>• Public awareness programs to encourage walking, cycling, and the adoption of electric vehicles for sustainable transportation<br>• Smart connectivity network<br>• Alternative mobility adoption program<br>• Intelligent traffic management system | • Intelligent traffic management systems tools<br>• IoT sensors<br>• Traffic analytics platforms.<br>• bike and scooter sharing platforms<br>• EV charging infrastructure<br>• Intelligent transportation systems (ITS)<br>• Real-time GPS tracking<br>• Traffic flow optimization software<br>• Smart parking systems<br>• Public awareness apps | • Ministry of Transportation<br>• Ministry of Local Government | KPI 9: Comprehensive Mobility Plan effectiveness index.<br>KPI 10: User satisfaction score reflecting the enhanced experience with smart technologies. | High |

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| | traffic flow and reduce congestion. | | | | | |
| **6.** Main strategy for security: Enhancing smart security infrastructure | | | | | | |
| - Navigate and address political challenges to ensure a stable environment for development<br>- Implement measures to enhance overall security and safety within the city. | • Engage in diplomatic efforts, stakeholder consultations, and conflict resolution to create a stable political environment conducive to sustained urban development.<br>• Collaborate with law enforcement agencies<br>• Implement smart city surveillance systems<br>• Enact policies to ensure a secure and safe urban environment. | • Smart city security integration.<br>• Organizational Efficiency Enhancement<br>• Smart city surveillance systems | • Stakeholder engagement platforms<br>• Political risk analysis software<br>• Crisis management systems<br>• Smart surveillance cameras<br>• Threat detection software<br>• Incident response platforms | • Council of Ministers<br>• Ministry of Interior | KPI 11: Effectiveness of smart security infrastructure measured by the reduction in security incidents.<br>KPI 12: Cybersecurity readiness index for smart mobility systems. | Low |
| **7.** Main strategy for organization/municipality: Building responsive and agile municipality | | | | | | |
| - Optimize the organizational structure for effective governance and decision-making.<br>- Develop and enhance the skills of municipal staff to manage and implement smart mobility initiatives. | • Evaluate and streamline the organizational structure, enhancing transparency, efficiency, and accountability in municipality.<br>• Provide training programs and professional development opportunities to municipal staff to enhance their skills in managing and implementing smart mobility projects. | • Municipality restructuring program<br>• Municipal staff training program | • Learning management systems (LMS)<br>• Training needs assessment tools<br>• Skill development platforms | • Ministry of Local Government<br>• Municipalities | KPI 13: Organizational agility index assessing responsiveness to smart mobility challenges.<br>KPI 14: Innovation adoption rate within municipal structures. | Low |
| **8.** Main strategy for governance: Fostering collaborative governance | | | | | | |
| - Establish supportive legislation and policies to facilitate the integration of smart mobility solutions.<br>- Ensure robust regulations on IT security and privacy to safeguard sensitive data. | • Formulate and enact policies that provide a regulatory framework supporting the seamless integration of smart mobility solutions and technologies.<br>• Establish and enforce regulations that prioritize the security and privacy of data collected through smart mobility | • Regulatory framework establishment<br>• Data security and privacy compliance<br>• Collaboration and partnership program<br>• Smart city strategy development | • Strategic planning software<br>• Data analytics for urban development<br>• Visioning platforms<br>• Project management software | • Council of Ministers<br>• Ministry of Local Government | KPI 15: Collaboration effectiveness score based on multi-stakeholder engagement.<br>KPI 16: Level of transparency in decision-making processes. | Med |

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| - Foster collaborations and partnerships with local and international entities for resource sharing and expertise.<br>- Develop and implement an official smart city strategy to guide long-term planning and development. | systems, ensuring compliance with international standards.<br>• Seek collaborations with local and international organizations, leveraging expertise and resources to enhance the effectiveness of smart mobility initiatives.<br>• Formulate a comprehensive smart city strategy that aligns with long-term urban development goals, ensuring a cohesive and sustainable approach. | | | | | |
| | **9.** | Main strategy for technology: embracing cutting-edge technologies | | | | |
| - Invest in and upgrade IT infrastructures to support smart mobility systems. | • Allocate resources for the development and upgrade of IT infrastructures, ensuring the robustness and scalability of smart mobility systems. | • Development and upgrade of IT infrastructures, ensuring the robustness and scalability of smart mobility systems | • Cloud computing platforms<br>• IT Infrastructure monitoring tools<br>• Cyber security solutions | • Ministry of Transportation<br>Ministry of Telecom & Information Technology<br>• Ministry of Local Government<br>• Ministry of Public Works and Housing | KPI 17: Technology adoption rate, including IoT, AI, and data analytics in smart mobility.<br>KPI 18: Efficiency improvement index in traffic flow and user experience. | Med |
| | **10.** | Main strategy for citizens: Prioritizing citizen-centric solutions | | | | |
| - Enhance the IT skills of the citizens through education and training programs.<br>- Promote active citizen participation in decision-making processes related to smart mobility.<br>- Increase digital literacy among the population to ensure widespread acceptance and use of smart technologies. | • Implement educational programs aimed at enhancing the digital literacy of the population, ensuring widespread understanding and adoption of smart technologies<br>• Facilitate community engagement initiatives, encouraging citizens for active participation.<br>• Implement awareness campaigns to enhance digital literacy, ensuring the population is well-informed and comfortable with smart technologies. | • Digital literacy education program<br>• Community empowerment platform<br>• Digital literacy awareness program | • eLearning platforms<br>• Digital literacy apps<br>• Online training modules<br>• Surveys and feedback apps<br>• Social media campaign tools | • Ministry of Local Government<br>• Municipalities | KPI 19: Citizen engagement index measuring participation in planning and decision-making.<br>KPI 20: Digital literacy improvement rate within the community. | High |

جـامعـــة النجاح الوطنية

كليـــة الدراســـات العليـــا

# التخطيط الاستراتيجي للنقل الذكي في المدن الجديدة في الدول النامية: فلسطين كحالة دراسية

إعداد

راية فاضل محمد صوافطة

إشراف

أ.د. سمير أبو عيشة

قدمت هذه الرسالة استكمالا لمتطلبات الحصول على درجة الماجستير في هندسة الطرق والمواصلات، من كلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس– فلسطين.

2024

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## الملخص

**خلفية الدراسة:** مع تسارع عمليات التحضر في الدول النامية، يُعَد إنشاء مدن جديدة فرصة فريدة لدمج حلول النقل **الذكي** المبتكرة التي يمكنها التعامل مع التحديات التي تواجه الدول النامية وخلق بيئات حضرية مستدامة. تقدم هذه الرسالة إطارا للتخطيط الاستراتيجي للوصول لأنظمة النقل الذكي في المدن الجديدة في الدول النامية، مع اعتبار فلسطين كحالة دراسية

**أهداف الدراسة:** الهدف الرئيسي من الرسالة هو الاستفادة من التكنولوجيا لتعزيز كفاءة النقل، وتقليل التأثير البيئي، وتحسين جودة الحياة. وتشمل أهداف الرسالة إعداد إطار التخطيط الاستراتيجي ذو عدة أبعاد، بما في ذلك تطوير البنية التحتية، وصياغة السياسات، وتكامل التكنولوجيا، ومشاركة المجتمع. بالاستناد إلى دراسة الحالات الناجحة في الدول المتقدمة والنامية، يوضح البحث الاعتبارات الرئيسية لتصميم وتنفيذ مبادرات النقل الذكي المصممة خصيصًا لتلبية احتياجات المدن الجديدة في الدول النامية.

**المنهجية:** اتبعت منهجية البحث المتسلسل لاقتراح إطارا للتخطيط الاستراتيجي للنقل الذكي في المدن الجديدة في فلسطين. بدأ العمل بمراجعة للأدبيات وفحص التجارب الدولية والإقليمية في هذا المجال. ومن ثم تم تحديد مفهوم ومتطلبات ومكونات النقل الذكي، لتشمل المرحلة الثانية اختيار منطقة الدراسة، وتشمل مدينتين جديدتين تعكسان واقع التنمية الحضرية الجديدة في فلسطين، ثم جمع البيانات اللازمة من مصادر موثوقة لتحليل الوضع الحالي، وعمل مقابلات مع ذوي الاختصاص، ومن ثم تجهيز المعلومات للانتقال إلى مرحلة التحليل باستخدام طريقة التأثير المتبادل (CIB)، ومن ثم الخروج بالنتائج حول أهم العوامل المؤثرة. وفي ختام هذه المرحلة تم إعداد إطار التخطيط الاستراتيجي للنقل الذكي، ليكون دليلاً للسلطات المحلية والجهات ذات الصلة، ومن ثم تمت صياغة إصدار التوصيات.

**نتائج الدراسة:** تقدم الرسالة إطارا للتخطيط الاستراتيجي للنقل الذكي في المدن الجديدة في فلسطين والذي سيساعد في توجيه اتخاذ القرار لدى المسؤولين والمخططين الحضريين والمعنيين من أجل التخطيط المناسب لإنشاء مدن جديدة ذكية وخاصة فيما يتصل بالتنقل. كما تقدم الرسالة منهجية ونتائج لتطبيق طريقة الـ CIB، مما يسمح بتحليل شامل للعوامل المترابطة وتأثيراتها المحتملة على عملية التخطيط الاستراتيجي. وقد تضمن ذلك تحديد الأهداف والغايات، وكذلك الاستراتيجيات العامة لتحقيق رؤية إقامة مدن جديدة يمكن أن تتميز بنظام نقل ذكي ومتكامل.

**الاستنتاجات من الدراسة:** تركز الرسالة على التخطيط الاستراتيجي للنقل الذكي في المدن الجديدة في فلسطين والذي يرتبط مع قطاعات ذات صلة مثل النقل والمواصلات والأمان والتكنولوجيا والقطاعات الاجتماعية والاقتصادية والحوكمة والمواطن. ويبرز البحث أهمية استخدام أدوات ملائمة للتحليل والتخطيط لتحقيق أهداف الدراسة، مثل أنظمة المعلومات الجغرافية (GIS)، وبرامج المحاكاة، وتحليل البيانات الضخمة، وبرامج التخطيط الحضري، وأنظمة إدارة حركة المرور الذكية، وأجهزة استشعار انترنت الأشياء. كما يبرز البحث أهمية مشاركة المواطنين والمعرفة الرقمية، وضرورة وجود إطار تنظيمي والتعاون مع الجهات المحلية والدولية لتحقيق استراتيجيات النقل الذكي.

**الكلمات المفتاحية:** مدن ذكية جديدة، التنقل الذكي، التخطيط الاستراتيجي، طريقة التأثير المتبادل (CIB)، الدول النامية، فلسطين.