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**SUSTAINABILITY OF SUSTAINABLE MOBILITY POLICIES
THROUGH ENHANCING PERFORMANCE OF MUNICIPAL
POLICE AND LOCAL STAKEHOLDERS: APPLYING DYNAMIC
PERFORMANCE MANAGEMENT AND GOVERNANCE
IN THE PALERMO CASE**

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CICLO XXXVII
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Alhamdulillah wa syukru lillah

*To Ayah, Mama,
all my family and colleagues*

Declaration of Originality

I, Nasrulhaq, confirm that this thesis is my doctoral dissertation for the Doctoral Program in Model-Based Public Planning, Policy Design, and Management, Department of Political Science and International Relations (DEMS), University of Palermo, Italy.

I hereby declare that this thesis is entirely my original work. All sources are acknowledged and listed in the text, footnotes, and reference sections. I bear full responsibility for all content on the pages. I recognize that any misrepresentation of this thesis can be deemed academic fraud.

This thesis, titled ‘Sustainability of Sustainable Mobility Policies through Enhancing Performance of Municipal Police and Local Stakeholders: Applying Dynamic Performance Management and Governance in the Palermo Case,’ is written for academic purposes. It is a requirement for the PhD degree at the University of Palermo. This declaration is made sincerely.

Palermo, October 2025

A handwritten signature in black ink, appearing to read 'Nasrulhaq', with a large, stylized loop at the end.

Nasrulhaq

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Abstract

The primary challenge in sustaining sustainable mobility policies in Palermo includes mobility access violations, such as unauthorized private vehicles (e.g., cars, motorcycles, mopeds, and micromobility) parking and passing in pedestrian areas and limited traffic zones. To address these issues, this research examines strategies to enhance the intended performance outputs and outcomes of municipal police at the individual, organizational, and inter-institutional levels. This includes initiatives by local stakeholders. To this end, the analysis employed street-level bureaucracy theory, integrated with collaborative approaches and sustainable mobility concepts, as the theoretical framework.

This research applied Dynamic Performance Management (DPM) and Dynamic Performance Governance (DPG) approaches to frame the causal mechanisms. A single-case study strategy was used to conduct an in-depth analysis, focusing on pedestrian areas and limited traffic zones in the city center. In the modeling process, primary data and information were collected from interviews with relevant stakeholders and direct observations in different locations. Supporting data encompassed official documents, government websites, mass media, and social media.

This study found that mobility violations occur daily in pedestrian areas and limited traffic zones. To address these violations through mitigation actions, municipal police officers need to proportionally increase the time allocated to patrolling and consistently reduce the discretion granted to violators. To optimize the achievement of intended outputs, the municipal police agency should increase the number of patrol officers and enhance the effective use of traffic cameras. Furthermore, preventive actions require the crucial support of relevant stakeholders to achieve the intended outcomes over time. Collaborative actions by local stakeholders regarding education for sustainable mobility may minimize violations. Also, relevant public and private organizations are expected to install and maintain adequate mobility facilities and infrastructure to pursue sustainable outcomes. Maximizing these actions simultaneously and sustainably may achieve a sustainable mobility culture and behavior as the final outcome.

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List of Abbreviations

CLD	Causal Loop Diagram
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
DPM	Dynamic Performance Management
DPG	Dynamic Performance Governance
EU	European Union
ISTAT	<i>Istituto Nazionale di Statistica</i> / National Institute of Statistics
KPI	Key Performance Indicator
LTZ	Limited Traffic Zone
MDGs	Millennium Development Goals
NPM	New Public Management
NPG	New Public Governance
NO _x	Nitrogen Oxides
OECD	Organization for Economic Co-operation and Development
PMS	Performance Management System
PGTU	<i>Piano Generale del Traffico Urbano</i> / General Urban Traffic Plan
RTZ	Restricted Traffic Zone
SFD	Stock and Flow Diagram
SUMP	Sustainable Urban Mobility Plan
SDGs	Sustainable Development Goals
SLB	Street Level Bureaucrat
SISTAN	<i>Sistema Statistico Nazionale</i> / National Statistical System
UN	United Nations
UNESCO	United Nations Educational, Scientific, and Cultural Organization
VOC	Volatile Organic Compounds
VUCA	Volatility, Uncertainty, Complexity, and Ambiguity

Chapter 1

Introduction and Background

This chapter begins with an introduction, including the context, objectives of the study, and research questions. The subsequent section presents the research background, providing comprehensive contextual and theoretical information relevant to the study, which is elaborated in the significance of the study.

1.1 Research Context

Sustainable mobility, considering the sustainability transitions (Ansell et al., 2022) in the multi-level perspectives (Köhler et al., 2009) from local to global level (van Nunen et al., 2011), is a pivotal agenda in urban areas worldwide. It may determine the achievement of the Sustainable Development Goals (SDGs) by 2030, especially the goal of sustainable cities and communities that target a better environmental quality and a higher quality of life. Accordingly, sustainable urban mobility plays a role as the driving force in achieving a city's sustainability and resilience.

Focusing on “making the city more blue and green” (Ansell et al., 2022, p. 37), municipal governments in Italy¹ have implemented various policy interventions (e.g., designing pedestrian areas and improving public transport) to promote sustainable mobility in recent years. These interventions aim to tackle unintended consequences (e.g., traffic congestion and unauthorized vehicle circulation) and pursue desired sustainable outcomes (e.g., environmental quality and quality of life).

In Palermo, the municipality initiated the design of the local urban plan in 2013. Dating back to that year, the municipal administration approved the General Urban Traffic Plan (PGTU)². Subsequently, the plan is operationally implemented by the

¹ Based on the Italian National Law No.340/2000 regarding urban mobility plans, the Italian government encourages municipal governments to design and implement an urban mobility plan in their respective areas.

² The local name is *Piano Generale Traffico Urbano* (PGTU). The PGTU is a local plan comprising various interventions and related information regarding urban mobility. Chapter 4 explains this plan in more detail.

relevant municipal government agencies (e.g., Urban Planning Agency and Public Works Agency) and a municipally owned corporation (i.e., AMAT Palermo), in accordance with their respective responsibilities. For instance, the Urban Planning Agency designs pedestrian areas technically, and the AMAT Palermo provides public transportation (e.g., Buses and Trams).

The PGTU comprises various interventions, focusing on pedestrian areas, Limited Traffic Zones (LTZs), public transport, private vehicle circulation, and parking zones. Each intervention has distinct specific objectives, but the same main goal, which is to enhance the quality of urban mobility. To achieve the main goal, all the interventions have been implemented over the past decade.

In 2020, in terms of enhancing the impact of the PGTU, the local authority adopted and implemented the Sustainable Urban Mobility Plan (SUMP)³. The European Commission regularly issues the SUMP guidelines and related regulations. Next, European Union (EU) countries and their municipal governments ratify them accordingly. Adopting the SUMP has become a symbol that Palermo is moving towards a sustainable city, akin to other leading European cities that have adopted the concept of a green city. Implementing the SUMP has also symbolized that sustainable mobility policies are a part of the current and future agenda in Palermo.

As a keynote, the SUMP is not only a global strategic plan localized in various cities, but also a new paradigm for urban mobility. The SUMP focuses on people rather than traffic, planning with local stakeholders rather than by experts, emphasizing quality of life rather than just traffic issues (Rupprecht Consult, 2019, p. 10). In fact, such quality of life is a common good owned by all stakeholders in the urban area. The quality of life may be affected by mobility behavior. In turn, it may affect mobility behavior. Achieving a quality of life may be challenging

³ SUMP “is a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. It builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles” (Rupprecht Consult 2019, p. 9). The primary goal of the SUMP is to improve accessibility and provide sustainable mobility in the urban area, according to COM(2013) 913 final, European Commission (https://eur-lex.europa.eu/resource.html?uri=cellar:82155e82-67ca-11e3-a7e4-01aa75ed71a1.0011.02/DOC_3&format=PDF).

without changing mobility behavior and vice versa. Indeed, changes in quality of life and mobility behavior are complicated due to the complexity of the causal mechanisms behind them. They may be interrelated with other common goods or shared strategic resources, which are commonly intangible (e.g., private vehicle preference, social awareness, and mobility culture).

As many stakeholders influence policy design and implementation in urban areas (Bianchi, 2021), complexity in causal mechanisms affecting the performance of urban areas is unavoidable. The complexity may affect “inconsistencies in public policy design and implementation” (Bianchi, 2022, p. 416). Certainly, inconsistency between policy design and implementation regarding sustainable mobility may hinder the achievement of intended outcomes.

1.2 Statement of the Problem

The municipal government of Palermo has been implementing the SUMP, especially in the city center of Palermo. It encompasses increasing public transport (e.g., bus and tram), allowing shared transport and micromobility (e.g., car sharing, bike sharing, and e-scooter sharing), increasing pedestrian areas, and improving limited traffic zones. The SUMP aims to enhance the overall quality of urban life by reducing traffic congestion, lowering carbon emissions from private vehicles (e.g., cars and motorcycles), and supporting non-motorized modes of travel such as walking and cycling. These initiatives not only address immediate urban challenges but also contribute to the long-term sustainability of communities in urban areas. Maximizing these efforts over time will help to achieve the Sustainable Development Goals (SDGs), particularly Goal 11, focusing on sustainable cities and communities. Otherwise, sustainable cities and communities might be just a utopia.

Implementing the SUMP faces major issues, including congestion and pollution. Based on the INRIX 2023 Traffic Scorecard Report⁴ of Palermo, 44 hours are lost due to daily traffic congestion. The report ranked Palermo fourth in Italy. This data

⁴ The annual reports are available at <https://inrix.com/scorecard-city-2023/?city=Palermo&index=103>. The available information on this website appears to be from the latest year. Therefore, the information displayed may change from year to year.

is certainly not expected to occur. Besides, data on pollution is also discouraging. World Cities Report 2024 published by UN-Habitat⁵ reported Palermo has 0.8 metric tons of Carbon Dioxide (CO₂) emissions per capita. It means that, on average, each person in a specific area is responsible for emitting 0.8 metric tons of CO₂ each year. The amount of emissions per capita should be lower over time. These two data points mentioned in the previous statements indicate that there are complex problems regarding congestion and pollution, which require appropriate solutions.

Such congestion in the city center is not only a consequence but also a contributing factor. The rise in private vehicle users (e.g., cars, motorcycles, and mopeds) is likely to exacerbate congestion. In other words, the increase in private vehicle users has significant consequences for traffic. Furthermore, increasing congestion at a certain location may worsen the surrounding environment. By Lin et al. (2025), traffic emissions contribute to air pollution in urban areas. Thus, it can be concluded that the rise in the number of private vehicle users may lead to increased traffic congestion, which exacerbates air pollution. In a broader system, air pollution may impact the quality of life. Quality of life may affect the need for municipal police to enforce regulations on pedestrian areas and limited traffic zones. In turn, the need for municipal police to enforce regulations may affect the number of private vehicle users in the city center. This condition demonstrates a closed loop, highlighting the urban mobility issues. In this loop illustration, actions that reduce private vehicle use may be necessary.

Local public and shared transportation operated by AMAT Palermo SpA⁶ has not significantly reduced the use of private vehicles. In Palermo, the use of private cars is greater, while the use of public transport is lower (Giannico et al., 2022). This phenomenon appears to continue occurring in 2025. Instead of the government's efforts to reduce the use of private vehicles by providing public and shared

⁵ www.unhabitat.org.

⁶ In 2005, AMAT Palermo SpA was incorporated as a joint stock company (i.e., municipally owned corporation), with the Municipality of Palermo as its sole shareholder, underscoring the municipality's significant role in the city's urban development and sustainability initiatives.

transport, traffic and mobility violations have risen. In fact⁷, many shared transport and private vehicle users frequently disregard traffic signs installed at various locations, specifically in the city center. An increase in traffic violations may have the potential to intensify congestion, leading to an increase in pollution. Designing pedestrian areas and limited traffic zones may effectively respond to congestion and pollution in the city center.

However, the mere enactment of local regulations (e.g., regulations on urban mobility) appears insufficient to address sustainable mobility issues in Restricted Traffic Zones (RTZ)⁸. Despite enacting various technical interventions (e.g., traffic signs and pedestrian barriers) that support the local regulations, these endeavors have not yielded significant impacts either. Based on observations from the beginning of 2022 until the beginning of 2025, there are some issues consisting of parking in the RTZ without permission or illegally, private vehicles—including micromobility—passing in the RTZ without authority, and indifference to pedestrian barriers (e.g., benches and concrete stones). Regarding the sustainability of government policies in urban mobility, actions should not just be limited to making regulations or interventions. A crucial aspect lies in how municipal police, as local law enforcement officers, enforce existing regulations or interventions.

Such pedestrian areas and limited traffic zones, designed by the municipal government as essential policies for sustainable mobility, demand the attention of municipal police. Mobility access violations in pedestrian areas and limited traffic zones are assumed to be correlated with law enforcement. Increasing violations indicate that there is improper performance of municipal police. For instance, violations tend to occur around *Quattro Canti*⁹ without municipal police patrols. Conversely, the presence of municipal police patrols mitigates these violations. This situation is frequent in other areas around the city center of Palermo. Thus, if local

⁷ This argument is based on personal experiences, citizen reporters (social media) and journalist investigations (online news) during 2022 – 2025.

⁸ In this thesis, the term Restricted Traffic Zone (RTZ) refers to both pedestrian areas and Limited Traffic Zones (LTZs).

⁹ *Quattro Canti* in Palermo is a restricted traffic zone. However, the passage of private vehicles (e.g., cars, motorcycles, mopeds, and scooters) through this area remains common.

law enforcement performs effectively, policies focusing on sustainable mobility will yield a positive impact.

As a pivotal force in enforcing municipal government policies, municipal police play a significant role in following urban mobility regulations or interventions. The actions of municipal police are not just necessary but crucial for the sustainability of mobility initiatives. Their primary responsibility is to ensure that all local regulations regarding sustainable mobility align with officially determined provisions. Their rules can significantly improve the city's current and future mobility landscape. The potential impact of their actions on the city's mobility landscape is immense. Mostly, such policemen have the desire to conduct successful citizen interventions and to change citizens' behavior following desired outcomes (Lipsky, 1980).

Regrettably, according to Lipsky (2010), police officers (e.g., municipal police officers), as street-level bureaucrats, face a lack of resources to solve cases. The resources include allocated time to patrol and municipal police capability. In the Palermo case, the municipal police have significant challenges¹⁰ in their duties. The first challenge is that the number of violators is greater than the number of municipal police personnel patrolling. The second challenge is that areas requiring control are extensive. The third challenge is that municipal police work in complex arenas that involve many stakeholders. The fourth challenge is that municipal police enforce laws on 'the street' directly, which may be at high risk. These challenges can potentially impede improvements in municipal police performance, exacerbating urban mobility issues. The complexity of the challenges may escalate in the future.

Addressing the challenges faced by the municipal police officers, the municipal police agency, as an organizational entity, has installed hundreds of traffic cameras at various locations and established a control room at the main municipal police office. These efforts maximize the effectiveness of limited traffic zones—and pedestrian areas. All traffic cameras are connected to a central control room. To

¹⁰ The challenges were derived from the results of interviews and observations.

optimize these initiatives, the local authority has consistently recruited new municipal police officers, thereby increasing personnel resources. All these endeavors are designed to enhance the performance outputs of the municipal police, ultimately improving intended outcomes.

Simultaneously, local stakeholders (e.g., cyclist communities and neighborhood committees) have undertaken various actions (e.g., routine dialogues and advocacy movements) to support the performance of municipal police in achieving sustainable city and community goals. The municipal police agency, as an organizational entity, and local communities, as social institution entities, consistently strive to support the performance of municipal police. They may contribute to the achievement of SDGs by 2030. The performance of municipal police who interact with violators of restricted traffic areas intersects with all actions of the municipal police agency that relate to sustainable mobility. The performance of municipal police also intersects with the initiatives of multiple stakeholders regarding sustainable mobility.

Related to the current actions, the primary issue is the emergence of side effects caused by individual actions of municipal police officers. Also, the issue includes side effects of actions undertaken by the municipal police agency and related stakeholders in supporting the performance of municipal police officers. For instance, increasing the allocation of patrol time can increase sanctioned violators. However, increasing the allocation of patrol time may negatively impact the physical and mental health of patrol officers, hindering their ability to work optimally. At the organizational level, adding traffic cameras by the municipal police agency can lead to higher routine maintenance costs, thereby increasing overall operational expenses. Instead of maximizing the number of fined violators, these increased costs detract from operational efficiency.

At the inter-institutional level (i.e., community level), related stakeholders have initiated¹¹ and installed pedestrian barriers to enhance pedestrian safety. However,

¹¹ Local communities frequently engage in dialogues with authorities (e.g., Mayor, City Council, and Municipal Police) concerning pedestrian barriers.

in reality, vandals often damage these pedestrian barriers. In addition, designing pedestrian areas encourages restaurant tables in several pedestrian areas¹², obstructing mobility or diminishing public space availability.

The challenges associated with sustainable mobility in Palermo are significant. To address the problems, creating scenarios or strategies that align with sustainable mobility policies is necessary to achieve the desired outcomes. In this regard, comprehending critical success factors may assist municipal police at the administrative level and various stakeholders at the community level in achieving sustainable city and community outcomes.

1.3 Research Objectives

In general, this research seeks to address the challenges of sustainable mobility in Palermo. Specifically, the objectives of the study are divided into three parts. First, the study aims to identify the interconnected factors shaping the municipal police performance at the individual level in managing sustainable mobility issues in Palermo. Second, the study aims to identify the interconnected factors influencing the municipal police performance at the organizational level in controlling sustainable mobility issues in Palermo. Third, the study aims to investigate the interconnected factors within local areas—specifically pedestrian zones and Limited Traffic Zones—by considering the roles of the municipal police and other relevant stakeholders.

To achieve the first and second objectives, the study adopts the Dynamic Performance Management (DPM)¹³ approach, while the third objective is addressed through the Dynamic Performance Governance (DPG)¹⁴ approach. Both approaches are presented in an integrated manner to provide a comprehensive exploration of the research problem.

¹² For example, the streets *via Orologio* and *via Bara All'Olivella* in the city center.

¹³ Detailed explanation of Dynamic Performance Management (DPM) is provided in the research method chapter.

¹⁴ Detailed explanation of Dynamic Performance Governance (DPG) is also provided in the research method chapter.

To accurately model the DPM and DPG, data and information were collected from multiple sources, including interviews, observations, and document analysis. These sources were analyzed in an integrated way to strengthen the interconnected variables and ensure the robustness of the study.

1.4 Research Questions

Following the statement of the problem and research objectives, this research aims to answer three questions related to emerging issues. The questions refer to individual, organizational, and inter-institutional levels for comprehensive analysis. As noted by Cohen (2018) and Rossi et al. (2024), street-level bureaucrats, as a theoretical framework within this research, are related to individual and organizational levels. Meanwhile, Bianchi (2016, 2021, 2022) underscored the significance of focusing on the inter-institutional level (i.e., community level) when examining performance management and governance. Emphasizing the inter-institutional level is essential when focusing on the performance of a local area because “a local area dimension for performance management and governance entails a number of social wicked problems” (Bianchi & Caperchione, 2022, p. 7). In the urban area, on the one hand, the capacity of the inter-institutional level may shape the presence of wicked problems (e.g., traffic congestion, pollution, and poor mobility behavior). On the other hand, wicked problems may affect local stakeholders' behavior and perceptions about urban mobility. In this thesis, it is assumed that the performance of municipal police regarding sustainable mobility issues is contingent upon their individual performance. Furthermore, the organizational capacity may influence its performance and vice versa. Also, local stakeholders at the community level may impact their performance and vice versa.

The first question focuses on municipal police officers as individual government agents. Basically, street-level bureaucrats are individual entities that represent local government agencies. Although they represent an organization, they work individually and are responsible for their actions. The first question is posed to them: How do municipal police officers enhance performance in enforcing sustainable mobility policies in Palermo?

The second question focuses on the organizational level where municipal police officers are on duty. The organizational level refers to the municipal police agency. Performance outputs and outcomes of municipal police officers intersect with the efforts of the municipal police agency. As municipal police officers perform organizational tasks, their roles are closely tied to their organization. The second question posed to the municipal police agency: How does the municipal police agency enhance the performance of municipal police officers in enforcing sustainable mobility policies in Palermo?

The third question focuses on the inter-institutional level (i.e., community level), where municipal police officers collaborate, coordinate, and interact with multiple stakeholders. Performance outputs and outcomes of municipal police intersect with the efforts of multiple stakeholders who support urban mobility policies. Initiatives of local stakeholders may support the performance of municipal police. The third question is related to a broader context of municipal police in the local setting: How do municipal police and local stakeholders sustain sustainable mobility policies in Palermo?

The first and second questions serve as initial inquiries from the mitigation approach, while the third question follows as a subsequent inquiry from the preventive approach. Nevertheless, all three questions are interrelated. It is important to note that, from an administrative perspective, the municipal police play a significant role in enforcing local regulations. This rationale underpins the first and second questions. Furthermore, the initiatives undertaken by local stakeholders, with or without the involvement of municipal police, may significantly support the performance of municipal police in pursuing sustainable outcomes at the community level. This context justifies the third question. Municipal police are undoubtedly integral to the administrative and community levels regarding sustainable mobility issues in Palermo.

1.5 Significance of the Study

Municipal police should resolve the issues on sustainable mobility. From an administrative perspective (i.e., government perspective), municipal police have the

authority to enforce local regulations. Besides, as rules and regulations related to sustainable mobility are enacted at the local level (i.e., neighborhood level), it is essential to incorporate a community perspective to ensure sustainable community outcomes. Pursuing sustainable community outcomes is essential to research and practice regarding performance management (Bianchi, 2021, 2022) in the new public governance era (see Osborne, 2006). Integrating an administrative perspective with a community perspective may enhance the quality of life in Palermo.

At present, municipal police are expected to play a crucial role in achieving sustainable mobility in Palermo. Based on a regulation issued by the municipal government of Palermo concerning the municipal police¹⁵, the municipal police is the municipal government agency authorized by the municipality to ensure legal compliance. This includes regulations on pedestrian areas and limited traffic zones. Related to the municipal police duties and functions, an essential consideration is that residents expect an improved performance of municipal police, which will maximize the effectiveness of traffic restriction areas. Hopes and fears about the impacts of sustainable mobility converge on the actions of local law enforcement officers. This means that the sustainability of sustainable mobility policies relates to municipal police performance. Municipal police have become an integral part of sustainable mobility regulations and interventions. In the future, the significant role of municipal police officers remains essential.

As street-level bureaucrats, municipal police play an essential role in sanctioning violators (Piore, 2011; Tummers & Bekkers, 2014). If these mobility violators are not addressed, achieving sustainable mobility will be hindered. That is why the performance of municipal police officers cannot be disregarded. Research on their performance is needed to achieve sustainable mobility. The more often municipal policemen enforce local law, the fewer violations will occur. The treatment of citizens by street-level bureaucrats influences citizens' reactions (Comer, 1978). Frontline bureaucrats, such as police officers, can affect citizens directly (Bauhr &

¹⁵ *Regolamento della Polizia Municipale di Palermo approvato con delibera di Consiglio Comunale n. 100 del 02/05/1996*

Carlitz, 2021). Thus, it is essential to understand how the municipal police interact with citizens to manage urban mobility policies better.

As remarked by Tummers and Bekkers (2014), the role of performance for street-level bureaucrats as policy implementers is principal. This includes municipal police officers as local law enforcement. Police agencies have a role in enforcing local law (Pasha, 2018). Therefore, it is the responsibility of the municipal police to impose fines on violators (i.e., performance output). Potential violators cannot be deterred without effective fine enforcement. Moreover, the municipal police not only focus on increasing the number of sanctions but also emphasize the outcomes of their actions. Related to municipal police responsibility, emerging research on output performance (Thomann, 2015) and outcome-based performance (Bianchi & Rua, 2022) for street-level bureaucrats is noteworthy. It is critical to study the performance outputs and outcomes of the municipal police. Following Bianchi (2016), he emphasized the importance of performance outcomes in the public sector.

Street-level bureaucracy has become an essential issue and critical role in the fields of public management, public administration, and public policy (Sevä & Sandström, 2017; Nothdurfter & Hermans, 2018; Masood & Nisar, 2022). Sustainable transport and mobility policies are certainly one of the emerging actions regarding SDGs. Studying street-level bureaucrats related to sustainable mobility issues is suitable for public management, public administration, and public policy scholars. Moreover, urban mobility poses a complex problem in various cities and countries, including Palermo in Italy. This research may be relevant for improving practices and developing public administration, management, and governance theories.

A statement that “street-level bureaucracies are consistently criticized for their inability to provide responsive and appropriate service” (Lipsky, 1980, p. 27) is still relevant to the sustainable mobility context in Palermo. Street-level bureaucrats are “judged negatively by relevant public actors” (Hupe & Hill, 2007, p. 291). Pro-sustainable mobility citizens often criticize municipal police officers in Palermo.

Many of them engage in advocacy through citizen journalism and demonstrations. As a result of the poor performance of the municipal police, various violations are often committed without consistent intervention. Specifically, the municipal police are being criticized since they should impose sanctions on violators. There is a question as to why fines are not consistently issued to individuals who commit violations.

Benefits and sanctions delivered by police officers in 'the street' arrange and limit people's lives (Lipsky, 1980). When municipal police officers conduct patrols or investigations in public spaces, they should impose sanctions on mobility access violators, such as those illegally parking vehicles. Their actions may benefit pedestrians directly. Patrol officers perform dual roles in a contrasting manner; their actions benefit certain citizens as pedestrians while, on the other hand, they sanction citizens who are violators. Basically, policemen focus on enforcement policies (de Boer, 2019). Police officers can do both public service and law enforcement (Zacka, 2017). All street-level bureaucrats, particularly municipal police, may play a key role in policy implementation (Barral & Ghosh, 2023).

Municipal police, as street-level bureaucrats, have discretion regarding violators. All those classified as street-level bureaucrats have relative autonomy to exercise discretion (Lipsky, 1980). This means that policemen have the authority to punish violators or not punish them. Unfortunately, patrol officers more often appear not to punish violators than to punish them. This argument is based on the number of violations that frequently occur in the Palermo case. Discretion opens responses favorably (Lipsky, 1980). This means that discretion is carried out appropriately, getting a positive response from citizens and vice versa. Street-level bureaucrats' discretion is linked to citizen satisfaction (Scott, 1997). If discretion is not appropriate, then the sustainability of sustainable mobility can be regarded as being in doubt. Discretion and behavior are prominent issues in street-level bureaucracy studies (Chang & Brewer, 2023).

Principally, performance measures in street-level bureaucracy should be carried out (Lipsky, 1980). Performance issues of street-level bureaucracy are part of a study

in current research (Chang & Brewer, 2023). Thomann (2015), van Berkel, and Knies (2016) emphasized the importance of performance in street-level bureaucracy studies. There is a need to do performance research to prevent gaps in the public service provided by police officers (Hupe & Buffat, 2014). In policing affairs, a significant challenge is “encouraging agencies to attain performance goals” (Kang, 2023, p. 972). Street-level bureaucrats' practices can influence policy outcomes (Lavee et al., 2018), and working conditions can affect their behavior (Peeters & Campos, 2023).

The performance of street-level bureaucrats must be measured for quality improvement (Lipsky, 1980). Because street-level bureaucrats generate intended and unintended effects (de Boer, 2021), there is a need for mutual attention between street-level bureaucrats and their environment (Hupe & Buffat, 2014). Performance measurement—and performance management—is an individual and organizational driver in achieving goals. Plan and control systems can be handled through measurements to achieve desired goals. The general objective of this thesis is to achieve sustainable mobility goals in 2030 based on the SUMP. Nevertheless, the general objective may be insufficient. The main goal of this research is to sustain sustainable mobility over a long period. A more comprehensive study of performance measurement and management, especially on the role of municipal police, can provide insight into how to sustain sustainable mobility.

Unfortunately, performance measurement remains inappropriate (Lipsky, 1980) and problematic (Kosar, 2011). Policemen face high caseloads (van Berkel & Knies, 2016), difficult situations (Zacka, 2017), and complex roles (Cohen et al., 2023). Performance measurement and management using a static approach may not be appropriate for describing such complex problems and difficult situations. Static performance management is weak because it cannot help decision-makers describe system changes, adjust performance targets, and detect relevant resources (Bianchi & Rua, 2022). Moreover, an input-output view, characteristic of a static perspective, has limitations in identifying and analyzing systems within geographic areas (Bianchi & Tomaselli, 2015). A dynamic approach to performance management is recommended in place of static performance management in the public sector. It

may frame the complexity of problems in urban dynamics (e.g., sustainable mobility issues). Urban dynamics have complex problems (Forrester, 1969).

Therefore, this research applies system dynamics for performance management (i.e., Dynamic Performance Management) as a methodological approach to addressing the performance issues of the municipal police. The Dynamic Performance Management (DPM) approach, developed by Bianchi (2016), is explicitly applied in this thesis. According to Bianchi (2016), DPM is a methodological approach that integrates performance management systems and system dynamics to enhance organizational effectiveness. Performance management includes individual and organizational levels. Related to the municipal police, performance at organizational and individual levels is interrelated. Organizational performance is assumed to be an accumulation of individual performance. The dynamic performance management approach has been widely used and developed in public management and administration research.

The DPM approach can be applied to research on street-level bureaucracy (Bianchi & Rua, 2022). Bianchi and Rua (2022) focused on schoolteachers, while this research focuses on municipal police. Both teachers and police officers are street-level bureaucrats (Lipsky, 1980). Nonetheless, teachers and police officers have different roles in their duties. Teachers tend to provide benefits, while police officers tend to provide sanctions. There is a different side to the previous research conducted by Bianchi and Rua (2022). This difference is assumed to be an empirical gap in this research. Additionally, according to a search of various scientific article databases, no research has yet been identified that utilizes the DPM approach for municipal police cases related to sustainable mobility issues. Although there may be previous research on this topic, the research has not been conducted in Palermo's pedestrian areas and limited traffic zones simultaneously.

In addition, this study also uses Dynamic Performance Governance (DPG) to strengthen the DPM. The DPG focuses on policy networks (Bianchi et al., 2019) rather than single-organization entities. According to Bianchi (2021, 2022), Bianchi and Grippi (2024), the DPG supports collaborative platforms, collaborative

performance management, and collaborative stakeholder relationships at local areas or community levels. Policy networks and other forms of collaboration may exist within the local ecosystem.

Stakeholders in pedestrian areas and limited traffic zones vary significantly, including residents, tourists, and local associations. This includes relevant stakeholders such as drivers of passenger and tourist transport (e.g., taxis and ape tour taxis). They interact with the municipal police daily and exist in restricted traffic zones. Based on research observations, pedestrian, cyclist communities, and residents frequently engage in dialogue with authorities (e.g., City Council, Mayor, and Municipal Police) to address violations of mobility access (e.g., unauthorized parking and passing vehicles). Local communities are also undertaking various initiatives to address mobility violations. In this thesis, the DPG aims to contextualize these social phenomena, thereby extending the organizational boundary. The DPG frames collaborative actions among networked stakeholders (i.e., local communities) in the context setting (Bianchi & Grippi, 2024).

This research contributes to methodological approaches, practical applications, and theoretical foundations. Methodologically, this research contributes to the DPM and DPG approaches as a helpful methodology within the context of municipal police and collaborative actions of related stakeholders in addressing sustainable mobility issues. Theoretically, the study advances performance management for municipal police within the theory of street-level bureaucracy. Practically, this research offers policy recommendations for sustaining urban mobility initiatives in Palermo.

The intersection of the theory of street-level bureaucracy, collaborative platforms, sustainable mobility, and the DPM and DPG approaches represents the main research novelty. Further research on combining street-level bureaucracy, performance management, and performance governance may, with great expectation, benefit from this study. Subsequent multidisciplinary research regarding sustainable mobility issues can advance the academic perspective. Many scholars have recognized that addressing sustainable mobility requires more than a

monodisciplinary approach. This thesis follows an academic paradigm requiring a multidisciplinary approach to solve public problems.

1.6 Scope of the Study

Given the extensive range of urban mobility policies, it is imperative to delineate the scope of the study. In this research, sustainable mobility policies specifically refer to regulations on pedestrian areas and limited traffic zones in the city center. Other policies related to sustainable transport and mobility, such as those related to public and shared transport, are excluded from this study. Designing parking areas as part of the policies is also excluded. All these policies are managed by AMAT Palermo SpA and other related companies authorized by the municipal government. Even though this study includes some discussion of public transport, shared transport, and parking areas, they are only in the context of their relation to pedestrian areas and limited traffic zones. Its intent is not to provide an in-depth analysis of them. This delineation ensures a focused analysis on specific aspects.

This research focuses solely on local regulations on pedestrian areas and limited traffic zones related to municipal police as local law enforcement officers. In other words, the local regulations, which are not related to municipal police roles, are not included in the scope of the research. This consideration is made because the street-level bureaucracy theory is used as a theoretical framework. As mentioned earlier, according to Lipsky (1971, 1980), a police officer is one of the street-level bureaucrats. As municipal police officers perform similar roles and functions to police officers, as conceptualized by Lipsky, municipal police are considered street-level bureaucrats in this research. de Boer (2020) suggested research on street-level bureaucracy based on precise types of bureaucrats. One of them is the municipal police.

In this thesis, the term municipal police includes municipal police officers and the municipal police agency. The first term refers to an individual, while the second pertains to the organization. It is important to note that 'municipal police' is always used to refer to individuals, whereas 'municipal police agency' is the term used for an organizational entity. The initial focus of this research is to examine the

performance of municipal police as an individual entity. Moreover, the analysis includes the municipal police agency, which is essential in managing individual performance. Organizationally, the municipal police agency aims to create order within the city. In essence, municipal police cover individual and organizational entities. In agreement with Flamholtz (1996b), individual goals are the same as organizational goals.

The study of municipal police performance regarding sustainable mobility issues encompasses the inter-institutional level or local area where municipal police patrols. The term 'inter-institutional level' implies an inquiry that extends beyond individual organizations or encompasses the broader system. The institutions and agencies where street-level bureaucrats work can strengthen their performance (Lipsky, 1980). Bianchi (2016) underlined that assessing organizational performance on an inter-institutional level supports sustainability. Also, Bianchi (2021, 2022) ascertained that involving multiple stakeholders in designing, implementing, and assessing policies fosters sustainable outcomes. In this thesis, the inter-institutional level being analyzed pertains to pedestrian areas and limited traffic zones, particularly in the city center of Palermo.

In addition, this field research was conducted between mid-2022 and mid-2025. During this period, periodic observations were conducted at 15 locations in pedestrian areas and Limited Traffic Zones (LTZs), particularly in downtown Palermo. Interviews were conducted with 51 individuals representing diverse individual and organizational backgrounds. To complement the field data, supplementary information was collected from online media sources and official government websites.

1.7 Thesis Outline

Chapter 1 encompasses the introductory and background sections of this study. It begins by presenting the research context, the problem statement, and articulating the central issues that this research aims to address. This chapter further elaborates on the significance and scope of the study regarding sustainable mobility issues, highlighting the importance of research on both academic and practical fronts. It

includes rationalizing the street-level bureaucracy theory, as well as the DPM and DPG approaches.

Chapter 2 contains the literature review. This chapter explores the street-level bureaucracy theory, primarily emphasizing the municipal police as a street-level bureaucracy. Considering the strategic roles of municipal police regarding sustainable mobility issues, the concepts of sustainability and sustainable mobility are explained in the beginning as introductory insights. Also, this chapter explains collaborative governance and platforms as strategies for addressing sustainable mobility issues as wicked problems. The last section contains the related concepts, such as performance measurement, performance management, and performance governance. Through a comprehensive review of the existing literature, the chapter aims to provide a nuanced understanding of how these theoretical terms apply to the case in this research.

Chapter 3 outlines the conceptual framework and research methodology employed in this study. Initially, the chapter provides the conceptual framework. Subsequently, in the methodology section, a brief explanation of applied research and the system dynamics method is provided in detail. A significant focus of this chapter is to elucidate the justification for using the DPM and DPG approaches, highlighting their relevance to addressing the research questions. This chapter also explains the research strategy, emphasizing the case study. Lastly, data collection methods and data analysis techniques are explained comprehensively.

Chapter 4 provides a general overview of the case study in Palermo. It includes information about Palermo and its city center. It also includes a general description of sustainable mobility policies and the emerging issues. This chapter analyzes municipal police and relevant stakeholders to provide an initial explanation for the next chapters. This chapter elucidates all elements of the research focus. Moreover, this chapter provides a preliminary explanation for the subsequent chapters.

Chapter 5 presents the research findings in relation to the research questions. This chapter includes detailed causal loop diagrams, which are essential for illustrating dynamic relationships and feedback mechanisms inherent in the performance

management of municipal police and local stakeholders. In this chapter, the DPM approach frames strategic resources, performance drivers, and end results related to the municipal police. Moreover, the DPG approach frames shared strategic resources, performance drivers, and end results based on the community level. This chapter has implications for achieving desired performance outputs and outcomes. The chapter explores the implications of these findings for practice, providing actionable insights for improving the performance of municipal police and local stakeholders.

Chapter 6 provides discussions, conclusions, and recommendations, drawing on detailed findings in Chapter 5. This chapter synthesizes and analyzes the performance of municipal police at various levels. Furthermore, this chapter critically explains research implications, offering nuanced insights into enhancing local stakeholders' initiatives. In principle, this chapter explores the broader implications of theoretical and practical research findings. In conclusion, the chapter summarizes the principal research analysis, emphasizing its significance and relevance to current research in public management and administration. The conclusion includes study limitations. In addition, Chapter 6 outlines practical recommendations for enhancing municipal police performance and related stakeholders.

Chapter 2

Literature Review

This chapter intersects sustainable mobility concepts with the theory of street-level bureaucracy. Subsequent sections systematically explain performance management trends, including performance measurement, performance management, and performance governance. In addition, the chapter introduces relevant concepts such as collaborative governance and platforms.

2.1 Defining Sustainability and Sustainable Mobility in Urban Areas

2.1.1 Sustainability: More Than a Mere Term

Sustainability¹⁶ is no longer merely a term; it has evolved into a widely recognized notion. Sustainability means the ability to sustain the quality of life (Wulffhorst & Klug, 2016) on Earth over the long term. The notion of sustainability¹⁷ has been increasingly utilized since the publication of the World Commission on Environment and Development's report, titled *Our Common Future*, in 1987. The report is commonly known as the Brundtland Report, issued by the United Nations. It emphasizes four key elements of sustainability: (1) sufficient energy growth, (2) energy efficiency and conservation measures, (3) public health, and (4) the protection of the biosphere and the prevention of further pollution.

In the Brundtland Report, the notion of sustainability has become intertwined with the concept of sustainable development¹⁸. This indicates that sustainability is intrinsically linked to sustainable development. The concept of sustainable development emphasizes human activities (Colombo, 2001) and human needs (Michelsen et al., 2016), balancing economic growth, environmental

¹⁶ Sustainability refers to (1) “the quality of being able to continue over a period of time”, (2) “the quality of causing little or no damage to the environment and therefore able to continue for a long”, (3) “the idea that goods and services should be produced in ways that do not use resources that cannot be replaced and that do not damage the environment time”, and (4) “the ability to continue at a particular level for a period of time” (<https://dictionary.cambridge.org/>).

¹⁷ “The notion of ‘sustainability’ emerged in The Ecologist’s A Blueprint for Survival, in 1972” (Basiago, 1995, p. 109).

¹⁸ Sustainable development became the principal agenda of the Bergen Declaration on Sustainable Development in 1990 and the Rio Declaration on Environment and Development in 1992. The concept of sustainable development has gained significant traction since the declarations.

considerations, and social issues. The following quote elucidates the concept of sustainable development presented in the Brundtland Report.

“The concept of sustainable development does imply limits - not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effects of human activities ... poverty is not only an evil in itself, but sustainable development requires meeting the basic needs of all and extending to all the opportunity to fulfill their aspirations for a better life. A world in which poverty is endemic will always be prone to ecological and other catastrophes ... sustainable development is not a fixed state of harmony but rather a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present need”. (Brundtland Report, 1987, p. 5)

Sustainable development has been on the global agenda for a few decades. It began with establishing the Millennium Development Goals (MDGs) from 2000 to 2015. Subsequently, the United Nations established the Sustainable Development Goals (SDGs) from 2015 to 2030. The notion of sustainability, embedded in the SDGs, has become a cornerstone of the global agenda. Currently, the SDGs are a form of sustainability action. In the future, sustainable actions (e.g., MDGs and SDGs) are likely to remain the driving force behind the global agenda.

The SDGs¹⁹ represent a significant and genuine effort towards achieving global sustainability. These goals may address the concerns (e.g., environmental degradation, resource depletion, and complexity of human activities) highlighted in the book ‘The Limits to Growth’²⁰, focusing on global growth. The goals of economic and social growth are in our common interests (Colombo, 2001), which require global attention and action. According to Colombo (2001), the global ecosystem's sustainability cannot be deferred. Hence, sustainability is depicted and

¹⁹ The goals can be tracked at <https://sdgs.un.org/goals>.

²⁰ The Limits to Growth, authored by Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, and William Behrens III, was published in 1972. This book is widely regarded as the foundation for the emergence of the notion of sustainability and the concept of sustainable development. The authors of The Limits to Growth are widely recognized as members of the Club of Rome. “The Club of Rome is a platform of diverse thought leaders who identify holistic solutions to complex global issues and promote policy initiatives and action to enable humanity to emerge from multiple planetary emergencies” (<https://www.clubofrome.org/>).

embedded in the 17 SDGs. In summary, sustainability can be characterized as a forward-looking idea aimed at anticipating and addressing future challenges.

The primary dimensions of sustainability are ecological, societal, and economic aspects (Michelsen et al., 2016; Mensah, 2019). These three aspects are also referred to as the pillars of sustainable development (Wulforth & Klug, 2016; Mensah, 2019). Because sustainability encompasses essential aspects related to the quality of life, it has become an essential reference point for the future worldwide (Heinrichs et al., 2016).

In its evolution, sustainability has been interpreted in diverse ways. The concept of sustainability is interpreted differently by economists, sociologists, and environmental ethicists (Basiago, 1995). According to Basiago (1995), (1) economists emphasize the importance of maintaining production continuity, even in the face of potential constraints on raw materials, (2) sociologists emphasize the importance of individuals and local communities continuing to survive amidst the modernization and industrialization era, and (3) environmental ethicists focus on reducing the exploitation of natural resources and forests, thereby protecting the ecological balance. In conformity with Basiago (1995), sustainability requires four criteria to define it in the development process: futurity, equity, global environmentalism, and biodiversity. Following these criteria, sustainability refers to mitigating and preventing current excessive practices concerning nature.

In this thesis, sustainability is recognized as the foundational notion, whereas sustainable development is regarded as the encompassing concept of the idea. In other words, sustainability represents an idea, while sustainable development refers to the process of implementing that idea. The notion of sustainability and the concept of sustainable development are difficult to separate, as both are presented as a unified entity in the Brundtland Report (Mensah, 2019). Essentially, sustainability seeks to govern the universal functioning of the Earth (Basiago, 1995).

In the public management and governance paradigms, “there is a need to move beyond the simple definitions of the Brundtland report” (Osborne, 2010, p. 418).

Accordingly, Bianchi (2016, 2021) underscored the critical importance of sustainability in the context of inter-institutional and organizational performance (i.e., sustainability management and governance). As new actors have emerged within the sustainability policy arena (Mancebo, 2015), the sustainability of public collaborative networks is crucial (Austen, 2018) for achieving sustainable development goals. These arguments indicate that organizational and inter-institutional sustainability drives the sustainability of the Sustainable Development Goals. Such sustainability management and governance are futuristic and unified ideas. It is crucial because “the current institutional framework for sustainability is not really able to take charge of this new configuration” (Mancebo, 2015, p. 2).

Over the past decade, sustainability has evolved beyond its origins in the Brundtland Report, becoming a fundamental principle in public management and governance. However, the definition of sustainability in the Brundtland Report and the meaning of sustainability management and governance can remain interrelated. They can be interrelated when sustainability management and governance pertain to sustainable development agendas. Research on the performance of municipal police concerning pedestrian areas and limited traffic zones exemplifies the argument. On the one hand, sustainability pertains to sustaining pedestrian areas and limited traffic zones as part of sustainable mobility policies. On the other hand, sustainability refers to the continued performance of municipal police and relevant stakeholders in reinforcing, designing, and assessing these policies. Therefore, the term sustainability in this research encompasses a comprehensive understanding.

In sum, this thesis interprets sustainability as a notion and an initial concept of sustainable development. Although sustainability and sustainable development may have different meanings in various contexts, they intersect in this study. However, the study focuses specifically on sustainability rather than sustainable development. In principle, sustainability and sustainable development are closely linked to sustainable mobility agendas, which is one of the sub-goals of the SDGs. Sustainable mobility represents a notion of sustainability and the concept of sustainable development. In addition, sustainability is also understood as an idea in public management and governance, particularly in the context of sustainable

development. In this context, it pertains to achieving sustainable performance within the organizational or inter-organizational spheres, thereby fostering sustainable mobility goals.

2.1.2 Sustainable Mobility: A Concept and Policy for the Future

Sustainable mobility²¹ has widely been understood as one of the key agendas within the 17 SDGs. It derives from the concept of sustainable development (Gallo & Marinelli, 2020), which has emerged as a central theme in the discussion of urban mobility issues and initiatives across various countries (Halpern, 2014). Besides being a global agenda, sustainable mobility is a concept related to limiting transport volume, reducing transport intensity, congestion, equity, competitiveness, and decarbonization (Holden et al., 2019). This includes addressing the issue of uncontrolled private car ownership and use (Myrovali & Morfoulaki, 2021). Sustainable mobility relates to transport issues (Köhler et al., 2009) but focuses on people rather than traffic (Rupprecht Consult, 2019). “Sustainable mobility is defined as the simultaneous achievement of four global goals: universal (equitable) access, efficiency, safety, and green mobility” (Vandycke & Viegas, 2022, p. 2). It is often associated with transport systems (Gallo & Marinelli, 2020) and travel modes (Campisi et al., 2020).

In this thesis, sustainable mobility is defined in the context of urban areas, specifically at the neighborhood level. This limitation seeks to determine specific areas due to the broad scope of sustainable mobility. Werland (2020) suggested that sustainable urban mobility policies should be studied in relation to specific areas. Most of the literature on sustainable mobility focuses on environmental, social, and economic aspects of transport policies at all territorial levels (Gallo & Marinelli, 2020) and multi-level perspectives (Köhler et al., 2009). According to Myrovali and Morfoulaki (2021), the local contexts should be considered when understanding sustainable mobility.

²¹ Specifically, sustainable mobility is addressed in the Green Paper on the Impact of Transport on the Environment, published by the Commission of the European Communities in 1992. The Paper explicitly outlined a common strategy for sustainable mobility. Also, the paper marked the inception of practices and studies on sustainable mobility in various countries.

Sustainable mobility policies exist at the metropolitan region level (macro-scale) and urban neighborhood level (micro-scale) (Wulfhorst & Klug, 2016). Such neighborhood-level mobility is an emerging issue in urban mobility (Rupprecht Consult et al., 2021). On the macro scale, which covers long distances, sustainable mobility is often associated with eco-friendly transportation (e.g., public and shared transport). Conversely, on the micro-scale, which encompasses short distances, it is typically associated with active mobility, such as walking and cycling. Such pedestrian areas and limited traffic zones are designed for short trips (Migliore et al., 2020). Active transport modes, such as walking and cycling, should be promoted in the local arenas (Holden et al., 2019; Myrovali & Morfoulaki, 2021).

Promoting cyclists and pedestrians has developed in various cities (Tschoerner-Budde, 2019; Gallo & Marinelli, 2020). Pedestrians and cyclists benefit themselves and their environment, including health and environmental advantages. Therefore, providing pedestrian and cycling path infrastructure is of utmost importance (Panagopoulos et al., 2018). Compared to cyclists, “pedestrians play a critical role in creating lively and high-quality public spaces” (Belge & Ercan, 2022, p. 392). Pedestrians can interact directly with one another at specific locations, thereby promoting social inclusion. Physical mobility, such as walking, may support social inclusion (Inguglia et al., 2020). Thus, sustainable mobility encompasses active mobility, which supports social inclusion. “Active mobility can certainly be a step forward toward a future of sustainable mobility” (Khamis, 2021, p. 94).

Theoretically, sustainable mobility is a broad concept. There is no universally accepted definition among academics and practitioners. To understand the concept of sustainable mobility easily, the meaning of mobility²² needs to be defined. Mobility refers to “the moving of people and goods between different destinations within the city, including residences, workplaces, shopping areas, warehouses, ports, and factories” (Golub, 2016, p. 262). Particularly, mobility relates to physical movement (Inguglia et al., 2020), enabling people to do activities at different locations or places (Wulfhorst & Klug, 2016). Moreover, the key terms for

²² Mobility is “the ability to move or walk around freely” or “the ability to move easily” (<https://dictionary.cambridge.org/>).

understanding sustainable mobility are accessibility, social equity, environmental quality, and economic viability (Rupprecht Consult, 2019). Understanding sustainable mobility may involve the writings of the authors.

Sustainable mobility includes some aspects: (1) “impacts of transport activities must not threaten long-term ecological sustainability”, (2) “satisfying basic mobility needs”, and (3) “promoting inter and intra-generational mobility equity” (Holden, 2007, p. 9). Also, it includes the basic needs of pedestrians and cyclists (Panagopoulos et al., 2018). Pedestrianization and traffic calming are intermediate steps toward banning all motorized vehicles, such as cars, from environmentally sensitive locations (Banister et al., 2000). Pedestrianization and free vehicles should be considered when defining sustainable urban mobility. Such pedestrianization supports ecological sustainability directly.

Historically, the study of sustainable mobility has undergone significant evolution four times from 1992 to 2018 (Holden et al., 2019). According to them, the first generation (1992-1993) focuses on environmental impact, the second generation (1993-2000) focuses on societal impact, the third generation (2000-2010) focuses on economic impact, and the fourth generation (2010-2018) focuses on all dimensions of sustainability. All dimensions refer to environmental, societal, and economic impact. Sustainable mobility also encompasses technological trends, infrastructure availability, urban governance, and impact on the city (Gall et al., 2023). Furthermore, the most crucial aspect of sustainable mobility is the emphasis on human sustainability (Vos, 2024).

Sustainable mobility policies aim to change mobility behavior (Wulfhorst & Kesselring, 2016), promote eco-friendly modes of transport (Tschoerner-Budde, 2019), and reduce urban pollution (Migliore et al., 2020). The policies encompass regulations, plans, programs, projects, and interventions. The policies focus on “how to develop strategies that ensure mobility without the consequences” (Wulfhorst & Kesselring, 2016, p. 203). The governance aspect (Wulfhorst & Kesselring, 2016) and impact assessment (Banister et al., 2000) are essential in

sustainable urban mobility. Achieving sustainable mobility may not be possible without effective governance.

Moreover, “the chances of implementing sustainable mobility solutions significantly depend on the actors and stakeholders involved” (Klug et al., 2016, p. 197). In agreement with Mancebo (2015), the nature of mobility issues requires multi-stakeholder governance. Relevant stakeholders play a crucial role in determining whether targeted goals are achieved. Governance for sustainable mobility is inextricably linked to the issues within the field of policy (Tschoerner-Budde, 2019). Effective governance encourages the intended impact (Halpern, 2014; Khamis, 2021). Governance for urban mobility involves inter-institutional collaboration rather than reliance on a single institution.

Impact assessment of all urban mobility policy instruments is urgent (Halpern, 2014). According to the author, many policy objectives, structures, and instruments established since 1995 need to be studied to determine their impact. One of these is the policy instruments outlined in the SUMP, including local policy instruments such as the PGTU. As significant financial and non-financial resources have been expended to support the policies in recent years, the impact is expected to align with efficiency, environmental sustainability, and regional development (Banister et al., 2000).

To support the impact assessment, sustainable mobility policies must be evaluated based on specific criteria, including environment, economy, society, and mobility categories (Farmaki et al., 2022). The impact assessment should prioritize such mobility behavior (Wulfhorst & Kesselring, 2016) because mobility behavior or culture has become a key issue. According to Wulfhorst and Kesselring (2016), shaping sustainable mobility cultures is essential for the future.

In order to achieve the impact, in agreement with Belge and Ercan (2022), indicators for urban mobility related to pedestrian issues should encompass the aspects of (1) public facilities, (2) service and amenities, (3) accessibility, (4) impact zone, (5) perceived safety, (6) physical safety, (7) personal characteristics, (8) time, (9) connectivity, (10) comfort, (11), attractiveness, and (12) aesthetics quality. The

convenience and safety of pedestrian mobility (Panagopoulos et al., 2018) can be regarded as potential indicators. Additionally, towards a sustainable city, indicators such as transportation means, sidewalks, parking lots, and traffic congestion should be prioritized (Chan & Lee, 2019). Furthermore, the potential indicators listed in Table 2.1, which refer to the social, economic, and environmental domains, can serve as a reference for supporting impact assessments of sustainable mobility.

Table 2.1 Key Domains, Issues, and Potential Indicators for Sustainable Mobility

Domain	Issues	Potential Indicators
Social	Accessibility	Walk distances to local services/facilities
	Health	Report on incidences of transport-related illnesses
		Number of poor air quality days
	Safety	Road accident rates (causalities and deaths)
	Noise	Proportion of the population affected by noise
	Visual intrusion	The proportion of the population affected by visual annoyance
Economic	Congestion	Road vehicle-kilometres/road length
	Building corrosion	NOx emissions
	Road and bridge damage	HGV vehicle-kilometres
Environmental	Resource depletion	Energy consumption
	Climate change	CO2 emissions
		Loss of agricultural land
	Acidification	NOx emissions
	Air pollution	Emissions of NOx, VOCs, CO, and other pollutants
	Waste generation	Vehicles scrapped related to vehicles recycled
	Water pollution	NOx emissions
	Infrastructure intrusion	Length of transport infrastructure

Source: Banister et al., (2000, p.120)

The social, economic, and environmental domains are the primary domains for assessing the impact of sustainable mobility policies. As mentioned in the preceding paragraphs, these three domains have become pillars or main elements of sustainable mobility. Therefore, all three should be regarded as key domains of

research in the context of sustainable mobility. Based on Table 2.1, the three domains encompass several key issues, including accessibility, congestion, air pollution, and infrastructure intrusion. All potential indicators in Table 2.1 are critical parameters in identifying, measuring, and addressing the challenges within each domain, ensuring comprehensive and accurate assessments.

2.1.3 Sustainable Mobility Issues as Wicked Problems

Sustainable mobility issues are highly diverse. The issues include accessibility, safety, noise, congestion, building corrosion, road damage, acidification, air pollution, and infrastructure intrusion (Banister et al., 2000). This argument is further substantiated by Gallo and Marinelli (2020) that sustainable mobility issues include air pollution, congestion, noise, and safety. According to Armah et al. (2010), traffic congestion and air pollution are major problems in urban areas. Such traffic congestion and air pollutant emissions have dynamic complexity (Fontoura & Ribeiro, 2021).

Traffic congestion is a primary problem globally (Shaygan et al., 2022). Traffic congestion occurs when traffic demand exceeds available road or street capacity. Consequently, speeds are slowed, trip times are extended, and vehicular queueing increases. Traffic congestion may be caused by a high volume of vehicles (i.e., cars and trucks), inefficient traffic signal timings, social events (e.g., cultural parades and festivals), road incidents, traffic accidents, and road construction. One of the primary causes of traffic congestion is the rising use of private cars (Migliore et al., 2020). Private cars dominate in urban traffic (Campisi et al., 2020). Accordingly, increasing the number of cars requires attention (Salvo & Sanfilippo, 2014). The issues associated with traffic emissions are becoming increasingly urgent and severe (Migliore et al., 2020).

Traffic can increase pollutant concentration over time (Zito, 2009). “The connection between traffic congestion and air pollution has received much attention in sustainable development discourse” (Armah et al., 2010, p. 252). One of the consequences of traffic congestion is excessive air pollution (Shaygan et al., 2022). The pollutants of concern include carbon monoxide (CO), carbon dioxide (CO₂),

volatile organic compounds (VOC), and nitrogen oxides (NO_x) (Migliore et al., 2020, p. 2128). Various efforts are necessary to mitigate the pollutant, such as promoting walking and cycling (Panagopoulos et al., 2018). These efforts are crucial as air pollution represents the most significant environmental risk (Gallo & Marinelli, 2020).

Although traffic congestion and air pollution are significant issues, other concerns (e.g., noise pollution and street safety) are also closely linked to urban mobility. During traffic congestion, vehicle noises, such as engine sounds or vehicle horns, can contribute to noise pollution. Reduction in noise pollution is part of the urban mobility plan (Werland, 2020). The reduction of air and noise pollution should be pursued simultaneously (Panagopoulos et al., 2018; Werland, 2020). Moreover, safety barriers are essential parts of sustainable mobility (Gallo & Marinelli, 2020). In essence, the primary issues of sustainable mobility pertain to traffic congestion and air pollution. However, the scope of sustainable mobility issues extends beyond these two primary concerns.

Specifically, the main problem in pedestrian areas and limited traffic zones is unauthorized vehicle circulation. Unauthorized vehicle circulation includes cars, motorcycles, mopeds, micromobility vehicles, mini trucks, and passenger cars. Panagopoulos et al. (2018) remarked that difficulties in the neighbor's mobility and vehicle mobility occurred in pedestrian areas. These challenges persist in promoting pedestrian mobility. In some cities, using private cars has remained a short-distance movement (Campisi et al., 2020). Establishing pedestrian areas and limited traffic zones, which foster soft mobility, are essential policies for substituting motorized trips in urban environments (Gallo & Marinelli, 2020). As pedestrian areas aim to prohibit most or all automobile traffic (Panagopoulos et al., 2018), the challenge lies in ensuring that no private vehicles pass through or park within the areas.

All the sustainable mobility issues mentioned in the previous paragraphs are categorized as wicked problems. According to Gall et al. (2023, p. viii), "urban mobility is a complex challenge, also referred to as wicked problem". Transport and mobility issues reflect complex systems (Vandycke & Viegas, 2022). They may

affect pollution in the short term and jeopardize environmental quality in the long term. If preventive measures are not adopted, further nonlinear consequences (e.g., poor mobility behavior and limited social awareness) may emerge. The movement patterns of people present remarkable complexity (Banister et al., 2000). Hence, complex mobility consequences in the economic (e.g., economic losses due to traffic), environmental (e.g., increasing emissions and air pollution), and social (e.g., social costs in terms of the negative externalities) sectors may always exist (Banister et al., 2000). A complex relationship exists among the elements that contribute to achieving sustainable mobility (Holden, 2007). The complexity inherent in urban mobility signifies the presence of wicked problems.

Wicked problems²³ are a special category of problems (Peters, 2017). They refer to the combination of complexity²⁴, uncertainty²⁵, and divergence²⁶ (Head, 2008). Complexity concerns non-linear dynamics and various feedback mechanisms (Klijn, 2008). Uncertainty exists because various policy networks participate in policy arenas (van Bueren et al., 2003). Divergence occurs because stakeholders have different values (Head, 2008). Wicked problems describe adverse situations and are fraught with significant risks. The problems may change significantly over time (Armah et al., 2010).

Wicked problems do not have a singular definition. Also, there is no clear definition (Termeer et al., 2019). Instead, various distinct attributes characterize them. Following Peters (2017, p. 388, 2018, p. 65), characteristics of wicked problems comprise: (1) arduous definition, (2) no specific rule, (3) no perfect solution, (4) no immediate solution, (5) unavoidable effects of solution, (6) no clear solution, (7)

²³ This study uses the terms 'wicked problems' and 'complex problems' interchangeably, indicating that their differences are not contested. Although wicked and complex problems have different dimensions (see Peters, 2018), "both terms are appropriate when describing conditions that include numerous actors with conflicting goals and views, intangible variables that bear on the problem, and a substantial number of unknowns" (Hernandez, 2023, p. 77). Furthermore, as noted by Peters (2017, 2018), the distinction between wicked problems and super-wicked problems is not explicitly defined. This thesis focuses exclusively on the term 'wicked problems'.

²⁴ "The state of having many parts and being difficult to understand or find an answer"
(<https://dictionary.cambridge.org/dictionary/english/complexity>)

²⁵ "A situation in which something is not known, or something that is not known or certain"
(<https://dictionary.cambridge.org/dictionary/english/uncertainty>)

²⁶ "The situation in which two things become different"
(<https://dictionary.cambridge.org/dictionary/english/divergence>)

unique problem, (8) symptom shifting from one problem to another, and (9) multiple explanations of the problem. These nine characteristics, at a minimum, elucidate how wicked problems are understood. Such traffic congestion in urban areas and unauthorized vehicle circulation suit these nine characteristics. Regarding pollution and traffic congestion as wicked problems (Bianchi, 2021, 2022), as well as unauthorized vehicle circulation, there is “no clear definition and no obvious solution” (Emerson & Nabatchi, 2015, p. 7).

Furthermore, according to Head (2008, p. 106), “there is no single best approach to tackling such problems”. Also, a single organization may encounter significant challenges in addressing the issue due to its limited capacity (Bianchi, 2021, 2022). Thus, in the wickedness of public problems, it is insufficient to depend on a single action or intervention. Relying on a single organization to solve public problems is inadequate. Increasing the number of solutions by an organization may introduce additional complexities between solutions and problems and among the solutions themselves. Besides, the involvement of multiple actors may amplify the potential for diverse complexities between the actors involved. Accordingly, Head and Alford (2015) correlated wicked problems, beyond merely concentrating on solutions and problems by an organization, with the complexity of multiple stakeholders.

“Wicked problems are generally seen as associated with social pluralism (multiple interests and values of stakeholders), institutional complexity (the context of inter-organizational cooperation and multilevel governance), and scientific uncertainty (fragmentation and gaps in reliable knowledge)” (p. 716).

Wicked problems pertain to societal and policy actors, as well as institutional regimes (Termeer et al., 2019). “Solving the problem usually requires the joint action of various actors” (van Bueren et al., 2003, p. 211). Unfortunately, involving multiple actors can be politically and technically complex (Peters, 2017). Multiple actors describe various perspectives and interests. In situations where multiple stakeholders hold divergent views, the inherent complexity and uncertainty of the problem can further exacerbate (Head, 2008). Interactions among stakeholders can be intertwined with the issues (van Bueren et al., 2003). The degree of complexity is not an intrinsic property of the problem itself but rather depends on how the issue

is framed within the network of policy actors (Termeer et al., 2019). Accordingly, solving wicked problems faces significant challenges (Head, 2022).

The most important aspect is “how to tackle wicked problems in policy practice” (Termeer et al., 2019, p. 169), even though they are challenging (Head & Alford, 2015). Due to the inherent difficulty of solving wicked problems, strategic actions are essential. The presence of wicked problems necessitates strategic actions. Without strategic actions, the problems will persist, jeopardizing quality of life. Tackling wicked problems requires public officials to manage the issues, extending their efforts beyond their organizations to include other pertinent actors and institutions within their environments (Head & Alford, 2015).

One common strategy for addressing problems is a hierarchy-based approach. However, the hierarchical management of bureaucracy, which emphasizes output, has a limited impact on addressing wicked problems (Head & Alford, 2015). Head and Alford (2015) proposed collaborative action as a strategy for dealing with wicked problems. Collaborative action frameworks prioritize performance outcome over performance output. In collaborative action, stakeholder networks shape outcomes (Head, 2022). This implies that a single organization (e.g., municipal police agency) faces inherent limitations in achieving sustainable mobility outcomes. In line with Bianchi (2021, 2022), Bianchi and Grippi (2024), the focus on outcome-oriented performance extends beyond the confines of the organizational domain. Accordingly, intersectoral collaboration is crucial for addressing complex and multifaceted problems. However, based on the hierarchy-based approach and the collaborative approach, municipal police, as a street-level bureaucracy, play strategic roles.

2.2 Street-Level Bureaucracy as Theoretical Framework

This thesis uses the theory of street-level bureaucracy as the theoretical framework. This consideration is due to the municipal police being regarded as street-level bureaucrats. Such municipal police officers play strategic roles in enforcing regulations against mobility violators. Additionally, their actions can have a significant impact on the local areas where they perform their duties and functions.

The subsequent points provide a detailed explanation of the street-level bureaucracy theory, which is embedded within the sustainable mobility concepts previously explained.

2.2.1 Understanding Street-Level Bureaucracy

Lipsky (1969) introduced the first term of street-level bureaucracy in his article entitled ‘Toward a Theory of Street-level Bureaucracy’ in the 1969 Annual Meeting of the American Political Science Association. “Street-level bureaucrats are those men and women, who in their face-to-face encounters with citizens, represent government to the people” (Lipsky, 1969, p. 1). As government representatives, they provide services to citizens and interact directly with them (Lipsky, 1971). Based on the statements, street-level bureaucracy pertains to the interactions between government representatives and citizens.

Some years later, Lipsky (1980) stated that street-level bureaucracy is:

“Public service workers who interact directly with citizens in the course of their jobs, and who have substantial discretion in the execution of their work are called street-level bureaucrats ... Typical street-level bureaucrats are teachers, police officers, and other law enforcement personnel, social workers, judges, public lawyers and other court officers, health workers, and many other public employees who grant access to government programs and provide services within them.” (p. 3)

To provide a basic understanding, this thesis follows Lipsky's argument as explained above. “Bureaucracy implies a set of rules and structures of authority; street-level implies a distance from the center where authority presumably resides” (Lipsky, 2010, p. xii). In simple terms, street-level bureaucracy refers to a type of bureaucracy that operates outside the formal office, such as teachers, social workers, and police officers.

Generally, “bureaucracy is organizations within a governmental system” (Meier & Krause, 2003, p. 1). It is characterized by hierarchical dominance and procedural rules (Pollitt & Bouckaert, 2011). At least the dimensions of bureaucracy consist of “a division of labor based upon functional specialization”, “a well-defined hierarchy of authority”, and “a system of procedures for dealing with work

situations” (Hall, 1963, p. 33). However, street-level bureaucracy²⁷ has its characteristics. It is more specific than bureaucracy, which is extensively understood in the Weberian bureaucracy²⁸.

Furthermore, there is a tendency to interchange the terms bureaucracy and bureaucrat. Bureaucracy refers to the organization and its internal affairs, while a bureaucrat is an individual agent (Piore, 2011) within the bureaucracy. For example, a policeman who enforces traffic regulations represents the police agency (i.e., an organizational entity). Nonetheless, the decision to issue fines to traffic violators is a personal decision (i.e., an individual entity) of the police officer. Additionally, a police officer's decision reflects the decision of the police agency. This illustrates how municipal police officers simultaneously serve as individual agents and integral components of the organizational functions. Based on the example, the terms 'street-level bureaucracy' and 'street-level bureaucrat' are difficult to separate. That is why some scholars use the term street-level bureaucracy, while others use the term street-level bureaucrat.

Street-level bureaucracy refers to an organizational entity. “The term street-level bureaucracy reflects a state and a policy process characterized by discrete, hierarchical and bureaucratic silos” (Durose, 2011, p. 980). This indicates that a governmental agency is “embedded in a larger system that creates and fortifies working conditions” (Lipsky, 1980, p. 180). Street-level bureaucracy is a hierarchical entity in a governmental organization (Piore, 2011). Also, street-level bureaucracy is like frontline work (Peeters & Campos, 2023). It can exist anywhere, including at the neighborhood level.

²⁷ Some references use the term street-level bureaucracy, while others use street-level bureaucrat (SLB). In this thesis, it is necessary to clarify what street-level bureaucracy and street-level bureaucrat are. Understanding them is essential to prevent misunderstandings. However, this thesis uses both terms interchangeably. The term "street-level bureaucracy" refers to the municipal police agency, whereas "street-level bureaucrats" refers to the individual municipal police officers who represent the agency.

²⁸ This refers to the characteristics of bureaucracy by Max Weber: (1) “official jurisdictional areas”, (2) “regular activities”, (3) authority role in the commands, and (4) methodical provision for regular duties (Gerth & Mills, 1946, p. 196).

Meanwhile, street-level bureaucrat reflects public employees (Assadi & Lundin, 2018) or public servants. In principle, the street-level bureaucrat is a type of bureaucrat who plays a crucial role in the public policy arena (Lavee et al., 2018). Academics and practitioners have understood that a bureaucrat is an implementor of protocols and rules (van der Meer et al., 2024), such as regulations on urban mobility. In their daily activities on workdays, bureaucrats engage in regulation-oriented activities, service-oriented activities, or both (de Boer, 2020). As a key point, street-level bureaucrats differ from classic Weberian bureaucracy (Chang, 2022), which exists solely within the formal office. In the classic bureaucracy, there is no interaction with citizens directly and no discretion in daily activities (Chang, 2022). Street-level bureaucrats play a distinct role compared to other forms of bureaucrats.

Street-level bureaucrats are policymakers (Lipsky, 1980), policy formers (Hupe & Hill, 2007a), administrators (Kosar, 2011), frontline staff (Zang, 2016), and frontline workers (Lavee & Cohen, 2019; Peeters & Campos, 2023). Their status in the political system as informal policymakers is (Thomann et al., 2023). According to Hupe and Buffat (2014, pp. 550-551), street-level bureaucrats have three characteristics: (1) “working in direct contact with individual citizens”, (2) “doing their work while in public service”, and (3) “specific occupation for which they have been trained in a sustained way”. Officially, street-level bureaucrats are “a class of government workers whose day-to-day activities critically shape on-the-ground policy”(Arnold, 2013, p. 389).

Street-level bureaucrats work with complicated problems and require a human dimension to solve them (Lipsky, 1980). The problems faced are a lack of resources, the threat of harmful actions, and job uncertainty (Lipsky, 1971). “Street-level bureaucrats work at the interface between target groups and the state” (Thomann, 2015, p. 179). The roles of street-level bureaucrats are as extensive as those of government services, and as intensive as daily routines require citizens to interact with office personnel (Lipsky, 1980). In their work, street-level bureaucrats constantly interact directly with citizens or local communities.

To solve problems, street-level bureaucrats should have intellectual, emotional, and physical resources (Peake & Forsyth, 2022). Emotional intelligence is more critical than others in human interaction (Eshuis et al., 2023). Integrating skills, power, and norms (Assadi & Lundin, 2018) is essential. According to Hupe and Hill (2007), bureaucrats at the street level should work as professionals. Although, according to Lipsky (1980), there is a tendency for them to fulfill the ideal standards of their roles, non-compliance with ideal standard levels by street-level bureaucrats can occur at any time. Hence, professionalism is a must.

When working, street-level bureaucrats from various backgrounds follow the duties and responsibilities assigned to them. A teacher is responsible for educating students, and a doctor is responsible for caring for public health. A judge prosecutes criminals, and a police officer enforces regulations. Likewise, in the local urban areas, a municipal police officer ensures that local laws are obeyed under the provisions. A municipal police officer has the same function as a teacher, a doctor, a judge, and a state police officer. They all represent an organization and interact directly with citizens in accordance with their duties and functions.

2.2.2 Municipal Police Officer as Street-Level Bureaucrat

The municipal police officer is referred to as a city police officer. Other municipal governments may use terms such as local police officer, urban police officer, and other relevant names. The name depends on the provisions in force within a country. Typically, municipal police are integrated into the broader structure of the municipal government organization. It owns a particular department (Crank, 1992; King, 1999) or a specific organizational structure (Wilson, 2003). In other words, it has a special body or agency in the municipal government. According to Hassell et al. (2003, p. 236), “municipal police agency is one whose primary jurisdiction is a city or town, and not a state, a county, a territory”. Accordingly, municipal police officers are “subordinate policemen” (Denys, 2010, p. 344) or lower-level police, referring to the typical police force in a country.

Municipal police are considered as street-level bureaucrats even though their status differs from other typical police in Italy, such as metropolitan police (*polizia*

metropolitana), provincial police (*polizia provinciale*), local police (*polizia locale*), state police (*polizia di stato*), military police (*carabinieri*), penitentiary police (*polizia penitenziaria*), and finance police (*guardia di finanza*). Those police are directly responsible to the national government or other government levels (e.g., regional and provincial levels). In contrast, municipal police enforce the rules and regulations issued by the municipal government. Municipal police are responsible for the mayor (Prati & Pietrantonio, 2010) because local or municipal governments employ them (Gustafson, 2013; Eikenaar, 2019). The mayor can address urban problems by utilizing the local police (Calaresu & Selmini, 2017) or municipal police. Although municipal police and state police have different levels and statuses, their primary duties are the same: enforcing laws and regulations.

The municipal police officer is a civil police force (Sharma & Sachdeva, 1978). However, it has several characteristics in common with other types of police officers. Law enforcement, command management, and routine patrol are some areas of similarity. This includes order maintenance (Matusiak, 2019). All of them are crucial components in the policing function. In Italy's regulation, local police, state police, military police, penitentiary police, finance police, and coast guard are included in the police corps²⁹. The Italian police corps integrates local police and national police agencies (e.g., state police and military police). Accordingly, all police types at various levels, including municipal police, can coordinate and collaborate.

Municipal police in Italy have general competence in police, encompassing security, administrative, and judicial functions (Devroe & Ponsaers, 2017). According to them, the primary function is related to the administrative one. The administrative function consists of “traffic, control of licenses and of all municipal regulations of urban life, but also crime prevention at the local level, community policing, incivilities, and urban disorder” (p. 32).

²⁹ [https://www.protezionecivile.gov.it/en/approfondimento/police-forces/#:~:text=Police%20Corps%20\(State%20Police%2C%20Carabinieri,instrumental%20skills%20and%20staff%20availability.](https://www.protezionecivile.gov.it/en/approfondimento/police-forces/#:~:text=Police%20Corps%20(State%20Police%2C%20Carabinieri,instrumental%20skills%20and%20staff%20availability.)

Organizationally, police work in a hierarchy and are heavily disciplined, like the military (Cohen & Hertz, 2020). The police approach usually uses the command model (Engel & Worden, 2003) and militarized form (Denys, 2010). Direct supervision immediately boosts the impact on police officers' activities (Loyens & Maesschalck, 2010). A police chief can influence many police officers (Matusiak, 2019). Municipal police, specifically, have different activities from those of the military. Nevertheless, the command model persists between subordinates and superiors. In all police types, senior and junior officers have a solid and strong relationship. "The command and hierarchical rank structures" (Donnelly, 2013, p. 84) are associated with all police forms.

Police officers are a profession (Hupe & Hill, 2007b) with ethical standards and codes (Rowe, 2012). They should work in a skill-based (Chang, 2022). Professional actions (Denys, 2010) are part of their activities. It is, therefore, imperative that a municipal policeman act professionally. In line with Donnelly (2013), police should be as professional as the business sector. For example, if a municipal police officer encounters a mobility violator on the road, the officer must issue a fine accordingly. There is no compromise. Professionalism is the antithesis of nepotism. Street-level bureaucrats, such as police officers, serve as vital mediators between citizens and the state, navigating the complexities of public service delivery (Lipsky, 1980). Municipal police officers are problem solvers in civil protection, public security, and public order. Nowadays, police forces, including the municipal police, enact more punitive and exclusionary approaches (Selmini, 2017).

Police officers are governmental employees associated with street-level bureaucrats (Piore, 2011; Zhang et al., 2021; Cohen et al., 2023). They can be called frontline enforcers (Cohen & Golan-Nadir, 2020) because they enforce the law (Piore, 2011) or local law (i.e., rule, regulation, and policy). Preventing crime, promoting public order, and enforcing traffic are their prominent roles (Eikenaar, 2019; Cohen & Hertz, 2020; Levy, 2021; Sidha et al., 2021). These roles include "urban decline, physical and social disorder, prostitution and drug dealing, begging, alcohol abuse, illegal sale of goods, illegal occupation of public spaces, offences to public decency" (Selmini, 2017, p. 172). Many academics and practitioners agree that all

police types are responsible for enforcing public safety and order. This is either conducted by the municipal police or in collaboration with other police corps, such as the state police (*polizia di stato*) and the military police (*carabinieri*). Municipal police can do “co-workers and colleagues working within the same or related organization” (Hupe & Hill, 2007, p. 291).

In practice, police differ in functions from other types of street-level bureaucrats, such as teachers, social workers, and welfare workers (Zacka, 2017). As street-level bureaucrats, municipal police may differ specifically from teachers and doctors. There is a ‘broad space’ in which the municipal police work. Patrolling is necessary for them to provide service to residents in all urban areas, including neighborhood areas. Doctors and teachers may work in a ‘small space’. Teachers can serve pupils and students within or in a specially designed area (e.g., schools). Similarly, doctors can treat patients within the building (e.g., hospitals). Moreover, students or patients can attend classes and hospitals, where teachers and doctors provide services. Unlike teachers or doctors, municipal police must visit citizens in different areas over time. Their work aims to impose sanctions directly on violators. In addition, they often face more than one mobility violation during their duties. The task of municipal police is not as easy as the duties of teachers and doctors. When interacting with citizens, the arena or place where street-level bureaucrats work is quite diverse.

Regarding street-level bureaucracy in theory, Lipsky (1969, 1971, 2010, 1980) and many other authors (among them, Hupe & Buffat, 2014; de Boer, 2019; Cohen & Hertz, 2020) stated that policemen are street-level bureaucrats. However, they did not explicitly mention typical police officers. In practice, because the local police is part of the police corps in Italy and has similar functions to the municipal police as civil police, municipal police officers are referred to as street-level bureaucrats. Additionally, municipal police officers fulfill characteristics of what is known as street-level bureaucracy in the theory. Municipal police officers interact directly with citizens on ‘the street’ or ‘the road’. They also have the discretion to fine mobility access violators. However, municipal police officers have various duties.

Some work in the office (e.g., back office), and some are on the ‘street’ (e.g., patrol team).

This thesis primarily focuses on municipal police officers who work directly with citizens in the streets or outside their offices. In other words, this refers to those who conduct patrols related to sustainable mobility policies in pedestrian areas and limited traffic zones. Nevertheless, the activities undertaken by back-office officers remain integral to the analysis. From a systems thinking perspective, their roles and tasks are interrelated. For instance, back-office officers (e.g., Traffic Camera Operators) support the patrol team by providing information on locations where mobility violations occur, thereby facilitating the patrol team's tasks and functions. In turn, the patrol team may enhance the effectiveness of the back-office officers responsible for monitoring traffic cameras. Both those carrying out patrols and those serving in back offices have strategic roles in enforcing regulations related to sustainable mobility.

2.2.3 Strategic Roles of Municipal Police in Providing Sanctions on Mobility Violators

Municipal police perform roles similar to those of other types of street-level bureaucrats (e.g., judges and court officers), particularly in decision-making related to imposing sanctions on violators. According to Lipsky (1980, p. 13), “the policy-making roles of street-level bureaucrats are built upon two interrelated facets of their positions: relatively high degrees of discretion and relative autonomy from organizational authority”. This means that street-level bureaucrats have the authority to determine the level of enforcement, including the quantity and quality of actions taken against mobility violators. Because they do complex work (Kosar, 2011), municipal police have a discretionary role. Discretion is necessary for street-level bureaucrats (Hupe & Hill, 2007a).

The discretionary role and relative authority are fundamental aspects inherent in the function of the municipal police, enabling patrol officers to make judicious decisions in various situations and to exercise their powers within the local law framework. The discretionary role allows municipal police officers to assess each

situation individually and apply their judgment to enforce regulations on sustainable mobility effectively. Relative authority gives them the legal power to act and ensure compliance with municipal regulations on urban mobility. The concepts of discretion and authority within street-level bureaucracy are interrelated in both theory and practice. In practice, concerning sustainable mobility issues, discretion also implies a certain level of authority. Accordingly, the discretion role and relative autonomy of municipal police authority are explained in an integrated manner.

Discretion is a decision made on the street immediately and personally (Lipsky, 1980). The discretion of street-level bureaucrats is the central issue in research on street-level bureaucracy (Zang, 2016; Chang & Brewer, 2023). As street-level bureaucracy has emerged, Lipsky (1980) focused on the issue of discretion. According to Lipsky, in his various writings, discretionary roles lead to effectiveness. In response to Lipsky's statement, many scholars are currently focusing on the study of discretion among different types of street-level bureaucrats. One of them is the discretion of municipal police officers. Discretionary roles regarding traffic and mobility issues are paramount to the municipal police. In the policy process, discretion addresses the gap between formulating and implementing based on the specific context (Zhang et al., 2021).

Discretion can be in the form of specific rules or relative rules (Hupe & Hill, 2007b). Municipal police officers at work may not only follow specific and relevant rules but also follow the direction of their commanders. There may be a direction from the commander that affects the discretion of municipal police officers in addition to existing rules. For instance, the municipal police commander may explicitly direct what actions to take on a particular workday, whether to impose more or less punishment. In this case, municipal police officers always follow the commander's instructions. Bureaucrats' decisions are always concentrated on the upper echelons (Zacka, 2017). Some municipal police decisions are independent and based on their authority, while others may depend on the authority of their commander. Municipal police officers possess a unique sense of discretion.

Municipal police officers may face challenges in exercising appropriate discretion due to various factors. They are personal characteristics, organizational characteristics, and culture (Cohen, 2018; Cohen et al., 2023). The personal aspect includes “values, beliefs, standards, and economic preferences” (Cohen & Aviram, 2021, p. 428). The organizational aspect includes resources and incentives (Cohen & Aviram, 2021, p. 428). The culture, including the environmental aspect, includes all external pressures (Cohen & Aviram, 2021). These factors imply that the municipal police face challenges in imposing sanctions on mobility violators.

To overcome various factors influencing suboptimal decisions, discretion should be used to develop creative solutions (Visser & Kruijten, 2021). For street-level practitioners (Visser & Kruijten, 2021) in public organizations, discretion is used to find solutions. If the patrol officers enforce the regulation creatively, there may be fewer violations. Although there may be consideration of which areas violators should be fined and which areas violators should be forgiven or ignored, municipal police officers should take creative solutions when seeing violations. Although there may be technical rules regarding who should or should not be fined, municipal police officers should take various actions to punish all violators. Discretion exercised by patrol officers must be conducted creatively and effectively, as their performance can significantly impact the quality of urban mobility.

2.2.4 Municipal Police Performance and Its Impact on Urban Mobility

Lipsky (1980) emphasized that performance is a crucial aspect of street-level bureaucracy. Accordingly, the performance of municipal police includes achieving goals, accountability processes, resource allocation, and sustainable improvement. Performance underscores the importance of the effectiveness and efficiency of the municipal police in fulfilling their role, leading to the improvement of the desired state in individual, organizational, and inter-institutional spheres. This indicates that their performance can have an impact on the broader environment.

From an internal perspective, municipal police performance refers to the performance of municipal police officers and their respective agencies, including departments and units. “Performance is about intentional behavior, which can be

individual or organizational” (Dooren et al., 2015, p. 2). Based on the street-level bureaucracy theory, performance refers to the individual level of street-level bureaucrats, rather than the overall performance of the municipal police agency. Notably, the individual entity of workers or public servants underlies the emergence of the street-level bureaucracy theory (see Lipsky, 1980). However, in practice, the performance of municipal police officers represents the performance of a municipal police agency. Therefore, the performance of the municipal police encompasses both individual and organizational levels.

Furthermore, from an external perspective, municipal police performance is about its impact on a broader environment (e.g., local areas or local governance networks). Fischer (2021) remarked that street-level bureaucrats impact the local governance networks. In addition, Bianchi and Rua (2022) stressed that street-level bureaucracy can impact local areas where organizations (e.g., schools and hospitals) are located or where they operate. Accordingly, the performance of municipal police can impact pedestrian areas and limited traffic zones. Combining internal and external perspectives, the performance of municipal police can affect organizations and local areas.

Performance refers to the achievement and the process of accomplishing or completing something (Blackman, 2021). Accordingly, the performance of municipal police in relation to sustainable mobility policies encompasses both the achievement and the process of enforcing sanctions against mobility violators. In cases of many mobility violations, the success of pedestrian areas depends on the number of violators sanctioned. It also depends on how the violators are sanctioned, whether the municipal police impose sanctions routinely or irregularly every hour. Apart from imposing sanctions, preventive measures can also be implemented. Preventive actions taken by the police and relevant stakeholders regarding undesired situations (e.g., criminal cases) can impact local performance (Bianchi, 2016).

The most important aspect is how performance is measured and managed³⁰. Performance needs to be measured to understand the achievement of goals (Lipsky, 1980). Performance measurement can be understood as “the bundle of deliberate activities for quantifying performance” (Dooren et al., 2015, p. 32). In the public sector, it is an integral part of the learning process (Lye, 2006). By taking measures, the productivity of municipal police in sanctioning violators per day (i.e., output) can be assessed accountable, leading to a change in mobility behavior (i.e., outcome).

Furthermore, measurements need to be based on performance indicators and standards (Bouckaert & Dooren, 2003). Effective performance management of street-level bureaucracy is necessary to maximize the desired impact. Performance management navigates which changes are beneficial or detrimental (Gunn et al., 2021). Performance management synchronizes outputs and outcomes based on available performance information (Dooren et al., 2015). By conducting performance management, the performance outputs and outcomes of the municipal police can be carefully planned and controlled. Ultimately, performance management drives the right strategy for achieving goals.

Regarding sustainable mobility policies, the primary goal of municipal police performance is to improve urban mobility. Focusing on increasing the number of offenders sanctioned (i.e., output) daily may be insufficient to achieve the desired outcomes. Other strategies focusing on mitigation efforts may be required to achieve the desired outcomes. If the mobility behavior of residents has not changed, the performance of the municipal police can be considered unsuccessful. Instead of focusing solely on mitigation efforts, municipal police need to consider how to change mobility behavior in pedestrian areas and limited traffic zones with preventive actions. Performance measurement and management require a strategy to achieve the mission (Buschor, 2013). Indeed, changing mobility behavior requires cooperation and collaboration among various stakeholders. As remarked

³⁰ The next sub-chapter explains performance measurement and management in depth. This sub-chapter only introduces its relation to street-level bureaucracy theory.

by Fischer (2021), cooperation between street-level bureaucrats and various stakeholders can increase the achievement of intended outcomes.

2.3 Collaborative Governance and Platforms as Strategies for Dealing with Sustainable Mobility Issues

According to Klijn (2008b), collaborative action can resolve societal policy problems. Accordingly, collaborative governance represents a new mode for addressing social problems, including sustainable development issues (Mah & Hills, 2012; Dai & Azhar, 2024). Meanwhile, Bianchi (2022) supported collaborative governance in tackling urban issues. Considering urban issues with various dimensions, multiple stakeholders should also contribute to the solution.

Collaborative governance is defined as follows:

“a governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets” (Ansell & Gash, 2008, p. 544).

The definition focuses on a formal forum initiated by public agencies, which involves non-state stakeholders. However, Emerson et al. (2012, p. 3) did not “limit collaborative governance to only formal, state-initiated arrangements, and to engagement between government and nongovernmental stakeholders”. They cover multi-partner governance (e.g., public-private partnerships), community-based collaboration, participatory governance, and civic engagement. The last definition allows governance without government. This means that nongovernmental stakeholders can independently solve complex social problems. Thus, collaborative governance can be understood as a set of joint actions, especially in decision-making and management stages, initiated by the government or non-governmental stakeholders.

Recently, many scholars in public administration have concentrated on the implementation of collaborative governance (Bianchi et al., 2021). Early, Silvia (2011) suggested that public management scholars should focus on collaborative governance as an emerging concept. It has become a common strategy in public

administration (Lee & Yoo, 2012) and public management. Besides, collaborative governance aligns with the new public governance that focuses on inter-organizational governance (Osborne, 2006).

Scholars of public governance, management, and administration focus on various aspects related to collaborative governance and its implementation. For instance, Ansell and Gash (2008) contributed to defining collaborative governance. Emerson et al. (2012) concentrated on building the integrative framework of collaborative governance and its logic model. Bianchi (2021) focused on linking collaborative governance to performance management in the local areas. Bianchi et al. (2021) studied models, experiences, and challenges in implementing collaborative governance. Most scholars investigate case studies conducted in various countries.

A case study concerning sustainable mobility problems is relevant to collaborative governance. Co-creation for sustainability needs collaborative governance (Ansell et al., 2022). In fact, the design and implementation of policies involve not only municipal governments but also non-governmental stakeholders, such as community-based and non-profit organizations.

In addition to collaborative governance, stakeholders can address issues through collaborative platforms. Collaborative platforms³¹ are “organizations or programs with dedicated competencies and resources for facilitating the creation, adaptation, and success of multiple or ongoing collaborative projects or networks” (Ansell & Gash, 2018, p. 16). The platforms aim to promote and facilitate collaborative governance. In principle, a collaborative platform refers to a “public-private actor mix” (Winickoff et al., 2021, p. 23).

In the broader context, collaborative platforms may strengthen policy networks³². Policy networks are collective actions (Carlsson, 2000) for joint problem-solving

³¹In the scope of the program—or project, examples include The Coral Triangle Center (<https://www.coraltrianglecenter.org/>) and the East Africa Dairy Development Program (<https://www.worldagroforestry.org/project/east-africa-dairy-development-program>) (Ansell & Gash, 2018). In the formal organization scope, the local platforms include regional forums, work groups, and planning councils (Bell & Scott, 2020).

³² Policy networks refer to “actors and relationships in the policy process that take us beyond political-bureaucratic relationships” (Atkinson & Coleman, 1992, p. 156). The policy network types

(Sandström & Carlsson, 2008), including formal and informal relationships (DeLeon & Varda, 2009). “Policy network is used to describe more pluralistic forms of state-society cooperation” (Ansell & Gash, 2008, p. 547). These arguments indicate that policy networks encompass a broader spectrum of facets. A network should be understood as an organized entity rather than an organization (Carlsson, 2000).

Concerning collaborative governance as a formal mode and policy network as an informal mode (Ansell & Gash, 2008), a collaborative platform may contribute to both the formal and informal processes. In addition, since the collaborative process encompasses both policymaking and implementation (Ansell & Gash, 2008), the collaborative platform serves as the foundation for all policy processes. It describes a circular process, from the policymaking phase to the implementation phase and, in turn, from the implementation phase to the evaluation phase and back to the policymaking phase. In this thesis, the collaborative platform is understood as a more pluralistic strategy that encompasses all phases of policy, both formal and non-formal.

Collaborative platforms are associated with inter-organizational or inter-institutional spheres. However, it is necessary to understand that "collaborative platforms typically do not mandate collaboration or collaborative governance but rather catalyze and facilitate voluntary efforts" (Ansell & Gash, 2018, p. 17). Simply, a collaborative platform can be understood as "the nexus of multiple collaborations or networks" (Ansell & Gash, 2018, p. 20). This simple definition avoids the complications of terms and concepts related to collaborative governance. As remarked by Emerson and Nabatchi (2015, p. 14), “collaborative governance, as a concept and a term, has a complex provenance”. Simplifying the definition is intended to clarify the meaning of the collaborative platform within other relevant concepts, such as network governance and collaborative networks.

Collaborative platforms are not limited to formally managed organizations or forums in the study of public administration, management, and policy. Following

consist of the policy community, professional networks, intergovernmental networks, producer networks, and issue networks (Avecedo & Common, 2010). Emerson and Nabatchi (2015) remarked that collaborative governance regimes are embedded within policy networks.

Ansell and Gash (2018), collaborative platforms include programs or projects that imply collaboration or network. As previously stated by Ansell and Gash (2018), collaborative platforms pertain to organizations or programs. Accordingly, the SUMP represents a collaborative platform. The SUMP has become a collaborative local project, more than a global strategic plan. In the policymaking and implementation phases of the SUMP³³, government and non-government actors collaborate, with participation from community-based organizations and citizens.

Bianchi (2021) asserted that a collaborative platform is essential to addressing wicked problems. If collaborative actions are successful, they can enhance citizens' quality of life and engage citizens in the policy process (Temmerman et al., 2021). Conversely, the failure of collaborative action may exacerbate sustainable mobility issues as wicked problems.

Regarding collaborative governance and platforms, the most critical aspect is their outcomes (Lee, 2023). Earlier, Ansell and Gash (2008) underscored the significance of outcomes in the collaborative process. "Outcomes are the consequences of collaborative actions" (Emerson & Nabatchi, 2015, p. 29). Each platform may vary outcomes (Bell & Scott, 2020). However, the outcomes should direct attention to the sustainable societal impact (Temmerman et al., 2021) or the sustainable community (Bianchi, 2021). Managing outcomes should be a priority, as addressing wicked problems often yields suboptimal or unforeseen consequences (Head & Alford, 2015).

A collaborative approach can trigger performance outcomes (Bianchi & Grippi, 2024). Collaborative efforts support sustainable outcomes (Bianchi, 2021, 2022). Also, Head (2022) emphasized the importance of promoting collaborative networks to tackle wicked problems. The collaborative approach must certainly be effectively

³³ In addition, decision-making regarding the SUMP in Palermo involves participation from citizens, associations, stakeholders, and any individuals interested in contributing to the development of sustainable mobility through the digital platform (<https://pums.cittametropolitana.pa.it/partecipa/>). Citizens, associations, stakeholders, and individuals are also able to conduct face-to-face meetings with local authorities (i.e., municipal government agencies).

managed. According to Grippi (2023, p. 11), “if collaborative public administration initiatives are not managed properly, a potential consequence could be a lack of efficiency and effectiveness”. Collaborative efforts require the right approach. Applying performance governance with a dynamic approach may enhance the effectiveness of collaborative actions.

Various external and internal factors shape the collaborative platform, such as “local environmental, institutional, and demographic features” (Bell & Scott, 2020, p. 64). Apart from the contributing factors, several challenges may arise, such as the sustainability model, value creation, and the collaboration process (Winickoff et al., 2021). Concerning the challenges, collective action is “difficult to stimulate individuals to act beyond their immediate self-interest and work together on shared problems” (Emerson & Nabatchi, 2015, p. 39). This indicates that collaborative action is not a strategy devoid of weaknesses. Challenges may persist. However, compared to the hierarchical model, the collaborative model is a better strategy (Emerson & Nabatchi, 2015).

In summary, collaborative governance and platforms can address sustainable mobility issues. Municipal government agencies, particularly municipal police, that operate within a hierarchical bureaucratic model require a strategy that incorporates a collaborative approach. This would facilitate their tasks and duties, leading to the achievement of intended outcomes. Additionally, initiatives led by non-governmental stakeholders should be supported by the authorities and all relevant actors. The most crucial point is that collaborative actions are a priority in addressing complex issues. Following Ansell et al. (2022, p. 139), collaborative adaptation is an implementation strategy for achieving sustainability.

2.4 Collaborative Performance Management

The presence of collaborative governance and platforms, as well as other approaches that extend beyond organizational boundaries (e.g., network governance and public-private partnerships), in the public sector may underscore the need for collaborative performance management. The collaborative approaches may involve individual entities, such as residents and tourists, in the local area. On

a large scale or global level, they may involve countries or international organizations. In fact, the sustainable mobility agenda encourages the involvement of multiple stakeholders, ranging from local to global actors, including both public and private sectors. They work together, share resources, and engage in deliberation, covering policy design, implementation, and evaluation stages.

In this thesis, the concept of collaborative performance management encompasses collaborative initiatives originating from corporations that work with other organizations and efforts stemming from government or public organizations that involve corporations or other entities. In line with existing literature, for instance, Busi and Bititci (2006) focused on enterprise collaboration, while Choi and Moynihan (2019) focused on collaboration efforts related to government organizations. Considering sustainable mobility policies primarily associated with the performance of local areas, which is related to the performance of municipal police and local stakeholders, the definition of collaborative performance management refers to joint actions initiated by public organizations and community-based organizations rather than corporations.

According to Choi and Moynihan (2019, p. 1539), who focus on collaborative efforts in the public sector, collaborative performance management refers to the “sharing of resources and information among different actors for the purposes of achieving a formal performance goal”. In other words, collaborative management refers to the boundary-crossing dialogues or a hybrid organization (Rajala et al., 2020). In its practice, some organizations may provide financial resources, and others may provide human resources. Performance dialogues may be conducted in formal or informal meetings. Accordingly, performance management based on collaborative approaches appears to be more complex yet flexible. In addition, from a conceptual basis, collaborative performance management is closely related to performance governance, which is linked to inter-organizational networks (Uusikylä & Valovirta, 2007). Collaborative performance management and

performance governance³⁴ are two concepts extending beyond the organization's boundaries. Both are interrelated in the field of the SDGs.

Collaborative performance management may be motivated by the concept of collaborative public management³⁵ introduced by Agranoff and McGuire (2003). They aim to address the lack of bureaucratic management in dealing with complex problems. Like collaborative performance management, collaborative public management also responds to the emergence of collaborations among public and private organizations, focusing on ideas, concepts, and issues (O'Leary & Vij, 2012). Moreover, according to Agranoff and McGuire (2003, p. 69), collaborative management encompasses vertical (e.g., information seeking and adjustment seeking) and horizontal (e.g., policymaking, resource exchange, and project-based action) activities. Regarding sustainable mobility policies, each activity may involve different actors. For instance, vertically, the adjustment seeking is associated with the municipal government, the regional government of Sicily, the Italian government, and the European Union (EU). Horizontally, the policymaking is associated with local stakeholder engagement, including community involvement in local areas.

Following the mapping collaborative activities by Agranoff and McGuire, collaborative performance management includes intra-agency and interagency collaborations (Choi & Moynihan, 2019). Intra-sectoral collaborations only cover the interrelations of departments or agencies within an organization (e.g., municipal government agencies). In contrast, intersectoral collaboration involves public and private organizations, including community-based organizations, that participate in joint actions. For instance, collaboration between the municipal police and the urban planning department, both municipal government agencies, is an intra-sectoral collaboration. Collaboration between the municipal police and community-

³⁴ The concept of performance governance is specifically explained in the next sub section.

³⁵ "Collaborative public management is on the front lines of the transformation from the traditional concept of bureaucracy, with its emphasis on a pyramid of control and maximum specialization of work, to a postbureaucratic paradigm, where new forms of transactions based on marketlike discipline substitute for the external surveillance of supervision" (Agranoff & McGuire, 2003, p. 38-39).

based organizations or non-municipal government agencies is an example of intersectoral collaboration.

In both intra-agency and interagency collaborations, an organization interacts across structural boundaries, forming networks (Kumar et al., 2007) or organizational relationships. Networks are coordination patterns within collaborative management arenas (Sandström & Lundmark, 2016). Organizational relationships persist in hybrid performance management (Rajala et al., 2020). Their form may be either formal or informal. The agreements and interests of the involved stakeholders determine the nature of collaboration. If a collaboration is established through a formal agreement, it may be classified as formal. Conversely, if a collaboration is driven solely by the interests of the stakeholders, without a formal agreement, it may be considered informal. Referring to Ansell and Gash (2008), a collaborative approach may form formal or informal modes. According to them, the formal mode is related to collaborative governance.

Considering that collaborative performance management may be related to many governance concepts, this thesis does not debate their differences. Rather, this section links the theory of street-level bureaucracy with the collaborative approaches. This refers to activities in which the municipal police collaborate, coordinate, and interact with various stakeholders in pedestrian areas and LTZs. The linkages³⁶ of the municipal police with other stakeholders can be categorized as collaborative governance or collaborative platform, as well as other relevant concepts. The main point is that the municipal police officers work across their organizational boundaries in local areas.

Collaborative efforts of street-level bureaucrats are relevant to the concept of collaborative performance management introduced by Choi and Moynihan (Bianchi & Rua, 2022). Accordingly, collaborative efforts involving public and private institutions that support municipal police roles may sustain sustainable mobility policies. Joint actions aimed at reducing mobility violations and promoting improved mobility behavior may decrease the workload of municipal police officers

³⁶ Further research is required to explore this topic in greater depth.

who are responsible for overseeing both aspects. In fact, as mentioned in the previous chapter, municipal police face significant challenges in addressing mobility violations in the city center. Through collaborative strategies, these challenges may be minimized.

Integrating street-level bureaucracy theory with the concept of collaborative performance management is crucial for framing the role of municipal police in addressing mobility violations and promoting more sustainable mobility behavior. Currently, studies on street-level bureaucracy primarily focus on organizational performance rather than inter-organizational performance. This section aims to bridge the theoretical gap based on the need for empirical evidence. As remarked by Agranoff and McGuire (2003), local governments need collaborative public management to address social problems. Additionally, there is a need to focus on an interorganizational setting regarding urban contexts (Bianchi, 2021). In fact, the duties and responsibilities of municipal police are closely tied to urban issues, including sustainable mobility problems that involve multiple actors. Therefore, the scope of performance measurement and management should be expanded to include performance governance.

2.5 Performance Management Trends in the Public Sector

2.5.1 Shifting from Performance Measurement to Performance Management

Performance measurement is a science that has a methodological view and an art that has a possibility in action (Cheung, 2011). It has been utilized and developed by academics and practitioners from the Industrial Revolution to the present day. It is a technocratic process (Bouckaert & Halligan, 2008). Models, approaches, and techniques are available for applying performance measurement (Talbot, 2009). Referring to Talbot's statement, two of the most widely recognized performance measurement tools are Key Performance Indicators (KPIs) and Balanced Scorecard. Performance measurement refers to the process of evaluating the effectiveness and efficiency of an individual's or organization's actions in achieving their goals. It is related not only to the private sector but also to the public sector, such as the municipal police agency.

Performance measurement is a trending topic in governmental organizations (Lye, 2006). It is essential to police officers as street-level bureaucrats (Lipsky, 1980). To ensure performance accountability, the actions of law enforcement officers necessitate systematic measurement and evaluation. This is imperative to ensure that the desired inputs align with the expected outputs and outcomes, encompassing all related processes. Performance reviews have long focused on police agencies (Davenport, 1999). As a public service organization, the municipal police is the object of performance measurement. The reason is that “if appropriate performance measures were available, street-level bureaucrats could be made more accountable for their behavior” (Lipsky, 1980, p. 199).

Performance measurement aims to improve public policy (Bouckaert & van Dooren, 2003) and to manage results (Sanger, 2008). Measurement quantifies performance with a set of activities (Dooren et al., 2015). Hence, the private and public sectors must measure their programs (Lye, 2006) or policies. The measurement process is required anytime and anywhere to determine performance. Good or bad performance can only be determined through a measurement process. Within the framework of enforcing regulations on sustainable mobility, performance measurement constitutes an integral component of the municipal police's functions.

Measurement is studied from several angles, consisting of “types, designs, span and depth, criteria for indicators used, specific issues such as quality, and concerns for potential measurement dysfunctions” (Bouckaert & Halligan, 2008, p. 69). The purpose of measurement is to evaluate, control, budget, motivate, promote, celebrate, learn, and improve (Behn, 2003, p. 593). Accordingly, this research utilizes measurements to enhance the performance of municipal police in local areas.

In its development, performance measurement research and practice have adopted the system dynamics method (Oladimeji et al., 2020). It supports planning and control systems in both private and public organizations. By adapting system dynamics, measurement is a feedback process between a performance indicator and

another. When employing the system dynamics method, performance measurement is suitable for addressing complex problems, including sustainable mobility issues. Regarding the complexity, the Dynamic Performance Management (DPM) approach, which adopts system dynamics, can detect and counteract the cause and effect of the problems (Bianchi, 2016).

The main point in measurement is an indicator. It comprises inputs, processes, outputs, and outcomes (Talbot, 2009). A process transforms the input into the output (Franceschini et al., 2007). Outputs and outcomes are the results of inputs and processes. Results are about the outputs and the outcomes (Dooren et al., 2015).

Inputs include “personnel, infrastructure, finance, and premises” (Bouckaert & Dooren, 2003, p. 129). The output is about “products made, or services delivered” (Cokins, 2009, p. 123). “Outcomes are events, occurrences, or changes in conditions, behavior, or attitudes” (Bouckaert & van Dooren, 2003, p. 130). “Outcomes generally refer to the effects on specific groups of beneficiaries or some larger collectivity, such as the wider community or society, resulting from the provision of one or more outputs” (Modell & Grönlund, 2007, p. 276).

Outcomes consist of intermediate and final outcomes. One or more outputs generate one or more intermediate outcomes. Furthermore, one or more intermediate outcomes generate a final outcome. “Intermediate outcomes are measures that experience suggests will result in end outcomes” (Wichowsky & Moynihan, 2008, p. 909). According to Wichowsky and Moynihan, intermediate outcomes generate end outcomes. Outcomes directly or indirectly affect the impact (Franceschini et al., 2007). Although some scholars distinguish between outcomes and impacts, the final outcome and impact are interchangeable in this research. Regarding input, output, and outcome, Table 2.2 below provides a detailed explanation and includes examples.

Table 2.2 Single Indicators for Measurement

Single Indicators	Direction	Example
Input	What goes into the system? Which resources are used?	Desired Number of Patrol Officers
Output	Which products and services are delivered? What is the quality of these products and services?	Number of patrol services
Intermediate outcome	What are the immediate impacts of the output?	Change in mobility culture
Final outcome	What are the ultimate outcomes achieved that are significantly attributable to the output?	Change in mobility behavior

Source: Adapted from Dooren et al. (2015, p. 69)

In addition to single indicators, various experts and practitioners emphasize the importance of ratio indicators for measurement. Ratio indicators facilitate the comparison of different variables. Table 2.3 below provides an overview of the terminology commonly used in ratio indicators for measurement.

Table 2.3 Ratio Indicators for Measurement

Ratio Indicators	Formula	Example
Economy	The cost divided by the input	Operational costs per patrol officer
Productivity	The output divided by one specific input	Number of patrol services per patrol car
Efficiency	The ratio of output to input	Number of patrol services per patrol officer
Effectiveness	The outcome divided by the output	Change in mobility behavior per patrol services
Cost Effectiveness	The ratio of cost to outcome	Operational cost per change in mobility behavior

Source: Adapted from Bouckaert & Dooren (2003, p. 131)

Table 2.3 provides an explanation that performance measurement is not only related to single indicators but also to ratio indicators. Ratio indicators allow performance measurement by comparing two different resources or comparing the same

resources between the actual value and the desired value. In the DPM approach, ratio indicators play a crucial role in generating end results.

Moreover, there is a transition from an emphasis on measurement to a focus on management (Sanger, 2008). The shift occurs because practitioners are confused about “how performance measurement systems can be used to inform their learning” (Lye, 2006, p. 26). Gunn et al. (2021) underlined information and impact aspects in performance management. “Performance management can be broadly defined as acting upon performance information” (Bouckaert & van Dooren, 2003, p. 132). Based on this understanding, “performance management is crucial in policing” (Pasha, 2018, p. 218). Therefore, understanding the impact of municipal police performance is essential.

Although “performance oriented toward goal achievement tends to be difficult if not impossible to measure” (Lipsky, 1980, p. 28), this does not mean that performance measurement and management cannot be maximized. Measuring the performance of street-level bureaucrats is essential (Lipsky, 1969; Lipsky, 1980). The performance of the municipal police in relation to sustainable mobility policies aims to support the continued implementation of the policies.

Performance management of street-level bureaucrats aims to analyze their actions' consequences and outcomes for the broader environment (van Berkel & Knies, 2016). “Measuring implies the identification of relevant parameters and the operationalization of indicators” (Hupe & Buffat, 2014, p. 559), pursuing street-level bureaucrat performance. Performance measurement and management are inevitable because municipal police performance is hindered by the nature of the community environment (Davenport, 1999). Additionally, technical and institutional environments can affect performance (Matusiak, 2019). The performance may also affect technical and institutional environments. This is akin to a feedback loop within a system, where each element influences the others. According to Lipsky (1980, p. 40), “performance measures offer feedback to adjust the system”.

Performance management must also be in place for performance measurement to be effective. Performance management needs valid performance measurement (Metzenbaum, 2013). In principle, performance measurement is an integral part of performance management. As remarked by Bouckaert and Halligan (2008), performance management focuses on systemic processes and measurement systems. Performance management involves setting goals, monitoring performance, and providing feedback. Besides, performance measurement focuses on determining indicators and collecting data related to those goals. Accordingly, performance measurement and management are essential for effective organizational performance.

Performance management is close to hierarchy, accountability, and achievement (Bouckaert & Halligan, 2008). Sketchily, performance management is “the framework for managing the execution of an organization’s strategy” (Cokins, 2006, p. 2) and “the translation of plans into results” (Cokins, 2009, p. 9). Performance management is about “acting upon performance information” (Bouckaert & van Dooren, 2003, p. 132). Information must be generated, integrated, and used (Bouckaert & Halligan, 2008). Information is required at all stages of public policy and service to ensure accountability and sustainability. It can be stated that there is a process that happens (Gerrish, 2016) in public policy and management. The information process is universally applicable (Cokins, 2006) in an organization as a whole (Cokins, 2009).

Performance management forms a continuous flow (Cokins, 2009). Performance management controls the organizational environment (Bouckaert & van Dooren, 2003), both at the individual and organizational levels (Talbot, 2009). Indeed, performance management has a positive impact on public organization performance (Gerrish, 2016). Many public and private organizations apply performance management to increase accountability, achieve outcomes (Heinrich, 2011) and allocate resources (Talbot, 2009).

One important aspect is that “performance management systems need to be able to deal with the complexity in the environment” (Dooren et al., 2015, p. 215-216).

Thus, performance management is appropriately combined with system dynamics. The system dynamics is an approach to understanding complexity (Andersen et al., 2020). The system dynamics method aims to address the complexity that arises. Applying the DPM approach, which aims to facilitate decision-making, problem-solving, police assessment, and performance monitoring, is appropriate for the performance of municipal police concerning sustainable mobility policies.

Managing performance aims to achieve goals, enact the purposes (Brumback, 2011), and make decisions (Axson, 2010). It comprises the process of strategic planning, tactical planning, financial planning, reporting, forecasting, and risk management (Axson, 2010). Currently, performance management needs design and management in multiple contexts (Gerrish, 2016). It encompasses both internal and external information (Buschor, 2013) aimed at maximizing outcomes. According to Buschor (2013), performance management is a central tool for making decisions, not only for input and output but also for outcomes.

Outcomes-based performance management has been growing (Heinric, 2002; Modell & Grönlund, 2007). It focuses on external effects and social changes (Borgonovi et al., 2018). Outcome-based performance in the public domain is essential for institutional assessment (Cosenz, 2022) and policy analysis (Vignieri, 2022). The DPM approach, as a basis framework of the Dynamic Performance Governance (DPG) approach, emphasizes outcome-based performance (Bianchi, 2016). Thus, performance measurement and management extend beyond merely considering input and output. The most critical aspect is outcome-based performance. Outcome-based performance is appropriate for use at an inter-institutional level (Noto, 2020) because “outcome is also affected by other public and private sector stakeholders in a city” (Bianchi, 2022, p. 412). Moreover, outcome-based settings in the performance regimes are associated with performance governance (Vignieri, 2022).

2.5.2 Shifting from Performance Management to Performance Governance

Several scholars (among them, Uusikylä & Valovirta, 2007; Bouckaert & Halligan, 2008; Liguori & Kelly, 2023) emphasized that performance management moves to

performance governance. In other words, the managerial approach in organizations is shifting to a network approach that involves multiple individuals, communities, and organizations. Performance management focuses on the organizational level, while performance governance focuses on the inter-organizational level (Bianchi & Hall, 2023) in the local areas.

Moving from performance management to performance governance is influenced by a generalized governance movement that integrates processes, structures, and indicators across levels (Halligan et al., 2012). According to Halligan et al. (2012), three points are related to performance governance: organizational relationship, citizen engagement, and societal impacts. The concept of performance governance is “more than one level of government and addresses relationships between sectors” (Halligan et al., 2012, p. 230). It covers a more comprehensive environment within the public sector.

According to Dooren et al. (2015), one of the paradoxes of performance management is when actors from different backgrounds, including citizens, share responsibilities with the municipal administration. Accordingly, performance governance aims to address the paradox in performance management. Therefore, actions undertaken by other public and private agencies in pedestrian areas and limited traffic zones require attention. This encompasses the collaboration between municipal police officers and other stakeholders. Their actions and interactions may influence the objectives and goals of sustainable mobility policies.

Liguori and Kelly (2023) stated that “the idea of performance governance links together a holistic approach with the measurement needs to assess public-sector results” (p. 272). Therewith, Uusikylä and Valovirta (2007) stated that performance governance relates to “democratic control and accountability” (p. 409). Performance governance pertains to the concept of governance within the public sector. Governance reflects self-governing (Kooiman & van Vliet, 2000). Governance is about linkages among public sector actors and others in governing (Peters, 2011). In summary, performance governance is “governing for performance in a multidimensional way” (Liguori & Kelly, 2023, p. 271).

Performance management and performance governance have different perspectives. Most experts agree that performance governance encompasses a broader scope than performance management. Performance management regimes have broadened significantly in scope, extending beyond organizational boundaries.

Table 2.4 Ideal Type of Performance Management and Performance Governance

	Performance Management	Performance Governance
Measuring	Hierarchical performance measurement systems	Consolidated performance Measurement system
Incorporating	Systemically internal integration	Systemically internal and external integration
Using	Coherent, comprehensive, consistent	Societal use
Limitations	Complex, perhaps not sustainable as a stable system	Uncontrollable, unmanageable

Source: Adapted from Bouckaert and Halligan (2008, p. 37)

As shown in Table 2.4, the ideal type of performance management and governance consists of four key aspects: measuring, incorporating, using, and limitations. These four aspects depict the ideal distinctions. However, these aspects may still not be ideal in practice. For instance, uncontrollable limitations on performance governance, as outlined in the lowest row, require further discussion. Following the DPG approach, system performance can be managed and controlled. It aims to manage and control the existing system within and across organizations. Sustainable mobility issues that transcend organizational boundaries and involve complex systems can be effectively managed by applying the DPG approach.

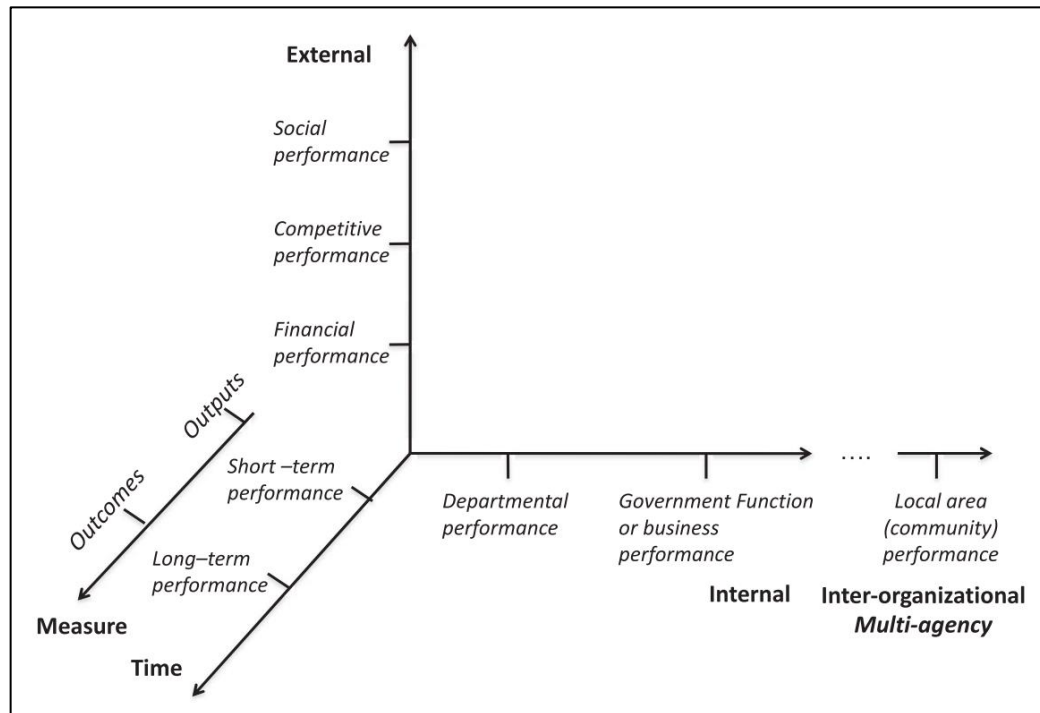
Furthermore, the DPG approach aims to pursue outcomes in public-sector institutions, and its relevance extends to policy networks in policymaking, implementation, and public services (Bianchi, 2021). It can frame a local area or geographical area that has a wicked problem (Bianchi, 2022). Overcoming wicked problems of sustainable mobility requires action and an accountability process involving various stakeholders. In the context of measurement, it discloses the measurement of a local area with various actors. Indeed, measuring governance in the local context improves its validity, reliability, and legitimacy (Norris, 2011).

Because “the measurement of individual (micro-level), organizational (mesolevel), and system (macrolevel) performance is a strong leverage to pursue improvements and activate change processes” (Borgonovi et al., 2018, p. ix), the DPG approach emerges in the performance governance arena. It emphasizes inter-institutional performance rather than organizational performance. However, performance governance is practically close to performance measurement as an operational aspect (Castelo & Gomes, 2023) and performance management as a strategic aspect (Nankervis & Compton, 2006; Cokins, 2009).

As a basis for understanding performance governance, this research focuses on what Bianchi and Caperchione (2022) stated that the performance governance domain reflects stakeholders’ performance as a collaborative network in the local area, rather than within a single organization. In other words, it is an inter-institutional dimension that intercorrelates with more than one institution. An institution is related to the normative environment (Bouma, 1998), while inter-institutions are related to the broad environment (Silva et al., 2024). Kaplan (1960, p. 179) noted that the institution is “a complex of status-role relationships which is concerned with a particular area of activity within any specified social system (total or part)”. According to Kaplan, inter-institutions describe something more complex than a single institution.

Additionally, the need to shift from performance management to performance governance can be linked to a balanced view of performance, as illustrated below, which underscores the importance of performance governance. The balanced view of performance provides an overview of the scope of performance management and governance.

Figure 2.1 A Balanced View of Performance



Source: Bianchi et al. (2019, p. 5)

Figure 2.1 illustrates the transition from performance management, focused on short-term performance (outputs) and internal organization, to performance governance, which emphasizes long-term performance (outcomes) and inter-organizational agency. Performance governance, especially when adopting the DPG approach, focuses on social performance that involves multi-agency. It is associated with local area performance. Accordingly, this thesis focuses on local area performance, where municipal police work, rather than the individual performance of the municipal police agency.

In summary, the concept of performance governance is an emerging issue in performance management regimes. Shifting from performance management to performance governance indicates the need for new approaches, such as the DPG approach, that can analyze the phenomenon of performance governance. Indeed, collaborative approaches, including policy networks, in the local areas are the object within the DPG approach (Bianchi, 2021). In the existing literature, performance governance is close to collaborative and policy network issues. In addition, performance governance represents a new agenda in public management

(Bouckaert & Halligan, 2008), as well as in modern public administration and governance (Bianchi & Hall, 2023). Performance governance may be closely aligned with New Public Governance (NPG), which focuses on an inter-organizational perspective (Osborne, 2006).

Chapter 3

Conceptual Framework and Methodology

This chapter starts with an explanation of the conceptual framework. The subsequent sections present the research methodology in detail, elaborating on the Dynamic Performance Management (DPM) and Dynamic Performance Governance (DPG) approaches, from a general overview of system dynamics methods to their instrumental view. In addition, the chapter addresses research design, data collection, and data analysis.

3.1 Conceptual Framework

The higher number of private vehicle ownership and circulation is a significant issue that has emerged in Palermo over the last decade. Campisi et al. (2020, p. 1) predicted that “private car ownership will keep its dominance in urban traffic”. Consequently, the increase in car ownership leads to more individualized travel patterns (Banister et al., 2000) that can affect traffic congestion. Campisi et al. (2020) and Armah et al. (2010) added that if car use increases, traffic congestion will emerge. In fact, traffic congestion is one of the key urban mobility challenges in Palermo (Inguglia et al., 2020).

Regarding the traffic congestion in the city center, designing pedestrian areas and limited traffic zones is expected to reduce private vehicle circulation. However, mobility access violations, such as cars parked without authorization and personal vehicles (e.g., cars, motorcycles, mopeds, and micromobility vehicles) passing through these zones illegally, have become significant issues. Mobility access violations seem to have occurred consistently throughout the day. Ultimately, the offenders may affect the pedestrians’ access. While the local authority implements pedestrian areas and limited traffic zones in the city center of Palermo, the mobility access violations remain in the city center. If the number of offenders increases, the number of pedestrians may decline. This undoubtedly is an undesired state. Pedestrian areas are intended exclusively for pedestrians, rather than for private vehicles. Therefore, the presence of unauthorized private vehicles in pedestrian areas is regarded as a mobility violation.

Mobility behavior may cause mobility violations. As remarked by He (2013), mobility behavior can shape mobility patterns in an urban area. Hence, Wulforth and Kesselring (2016) suggested that policies designed to promote sustainable mobility need to consider behavioral aspects in the sustainable transition process. This idea is essential because complex mechanisms may influence mobility behavior (Wulforth & Klug, 2016). In the causal mechanism approach, mobility behavior is both a driving force and a resulting outcome. For instance, mobility violators may break rules in pedestrian areas due to poor mobility behavior. Then, their mobility behavior may be affected by social awareness and mobility habits, which are influenced by the higher number of mobility violators. This means that mobility violations can become mobility habits, which, in turn, affect mobility behavior.

In terms of sustainable mobility, local governance capacity is considered the primary factor influencing the success or failure of policies. Governance for sustainable mobility plays an important role (Tschoerner, 2016). A good capacity may be able to sustain sustainable mobility policies. Conversely, a bad capacity can further exacerbate urban mobility problems. Therefore, apart from the urban mobility problems explained previously, the governance challenges need an initial inquiry that supports a deep investigation. Early, Vinci and Di Dio (2014) noted that Palermo faces local governance challenges in mobility transition.

As stated by Ansell et al. (2022, p. 15), “local governance is vital for promoting the SDGs”. It determines both the future and current state of urban mobility. In this thesis, local governance refers to the municipal government agencies (e.g., Municipal Police and Office of Sustainable Mobility Planning), the AMAT Palermo, and other relevant stakeholders (e.g., residents, neighborhood committees, community-based organizations, private organizations, and public organizations) who are part of the design and implementation of policies.

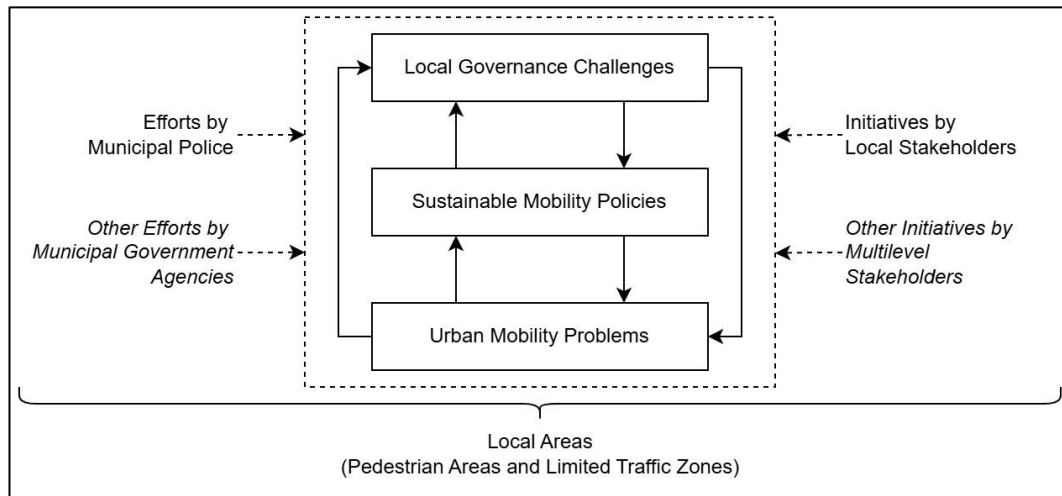
In recent years, all stakeholders, both public and private institutions, involved in and engaged with the performance of urban mobility areas have fulfilled their respective roles and duties. With time, they may also face significant governance

challenges (e.g., resource allocation, effective government rules and regulations, the enforcement of regulations on pedestrian areas and limited traffic zones, and local stakeholder engagement) that hinder the sustainability of sustainable mobility policies.

Indeed, pedestrian areas and limited traffic zones encompass a diverse range of ecosystems. Since urban mobility encompasses various ecosystems, causal mechanisms influencing complex systems may exist. Accordingly, common goods, such as environmental quality and social awareness, are integral to urban mobility. These two common goods, as an example, may function as cause and effect within the local urban ecosystem. In sum, the most important point, beyond an individual organization, is that “stakeholder collaboration for enhancing common goods is a key to ensure sustainable development of both a local area and the organizations” (Bianchi & Vignieri, 2021, p. 629). Notably, common goods and other shared strategic resources (e.g., private car preferences and ownership) may influence the capacity for individual organizations and stakeholder collaboration, and vice versa.

Hereinafter, the following figure illustrates the conceptual framework, summarized based on the arguments presented in previous paragraphs. Figure 3.1 includes sustainable mobility policies, urban mobility issues, and local governance challenges as three key conceptual components that are central to the analysis.

Figure 3.1 Conceptual Framework



Source: Author's elaboration

The brace symbol represents local areas, including pedestrian areas and limited traffic zones. The solid-line arrows signify the causal mechanism. The dashed-line arrows represent efforts or initiatives by relevant stakeholders. The use of the Roman text for the variables of 'efforts by municipal police' and 'initiatives by local stakeholders' highlights the study's primary focus. In contrast, the *Italic style* for the variables of 'efforts by municipal government agencies' and 'initiatives by multilevel stakeholders' indicates additional supporting elements. This study specifically investigates the efforts of the municipal police and the initiatives of the local stakeholders in depth, while other aspects require further research. However, all elements in the figure are assumed to contribute to the broader framework of sustainable mobility policies. Therefore, these elements are incorporated as interrelated components within the framework.

This thesis assumes that the problems are closely associated with the governance of the urban mobility system. The better the governance capacity, the better the urban mobility system is. If the problems intensify over time, achieving sustainable mobility policy outcomes will decrease. The explanation in the previous paragraphs shows the complexity of urban mobility problems, which require proper solutions from relevant stakeholders. Indeed, environmental change cannot occur without action. Effective local governance, which addresses problems, is essential to sustain

sustainable mobility. However, local governance may face challenges that can hinder the achievement of intended outcomes.

3.2 Applied Research: Paradigm and Urgency

This research is based on the applied research type. Unlike basic research advancing knowledge or theory, applied research aims to contribute to the solution of specific social issues by providing practical insights (van Thiel, 2022). This includes organizational or individual problems (Richardson, 2004). According to Brown and Hale (2014), the applied research allows researchers to interact with stakeholders or the entire community where the research is conducted. “The purpose of applied research is to understand and help solve practical problems” (Brown & Hale, 2014, p. 25). Regarding the sustainable mobility issues that have emerged in recent years in Palermo, this research aims to address and provide solutions to the problems.

In general, research in the fields of public administration and management is categorized as applied research (Bendor, 1994; van Thiel, 2022). Accordingly, Head (2010) suggested that public management researchers contribute to addressing the significant issues of the modern era. Instead of basic research, performance management in the public sector, as part of public management studies, needs to consider applied research that can directly contribute to tackling emerging issues. Therefore, as a public sector organization, the municipal police are expected to solve the social problems related to their duties. Regarding sustainable mobility issues, the municipal police play a crucial role in addressing various problems that arise over time. Additionally, in the new governance era, inter-organizational coordination and collaboration were necessary to solve complex problems (Head, 2010). The simple question of how municipal police and local stakeholders can solve sustainable mobility issues can be addressed through applied research.

The applied research emphasizes the pragmatic rather than the positivist paradigm (Richardson, 2004). Pragmatism refers to “consequences of actions”, “problem-centered”, “pluralistic”, and “real-world practice” (Creswell, 2014, p. 6). Compared to other research paradigms (e.g., postpositivism and constructivism) that have a primary methodology, pragmatism matches “methods to specific questions and

purposes of research” (Mertens, 2010, p. 11). Therefore, pragmatism is suitable for practical research, which tries to diagnose problems and design solutions (van Thiel, 2022). In recent years, practical research has emerged in research on public organizations (Brown & Hale, 2014).

Moreover, according to Dey (1993), the pragmatic view is relevant to the qualitative approaches (e.g., case study). Generally, “qualitative research prefers to focus on describing and understanding reality in the context in which actors operate or in which certain phenomena occur” (van Thiel, 2022, p. 141). Referring to qualitative research, this research focuses on municipal police and relevant stakeholders interacting in pedestrian areas and limited traffic zones. The qualitative method is tailored to research questions that provide an in-depth understanding rather than generalization.

Conducting applied research is crucial for deeply understanding sustainable mobility issues in Palermo. Currently, these issues are highly complex. Without applied research, it may be difficult to solve current problems. Through applied research, public management researchers can deeply inquire into emerging problems. In addition, applied research can assist practitioners in attaining sustainable outcomes. Notably, suitable methods are necessary to support applied research to understand the problems and find the solutions. Due to the complexity of the problems, this study adopts the system dynamics method, a widely utilized approach among academics and practitioners to detect and counteract issues.

3.3 Use of System Dynamics Method for Urban Dynamics

This research uses a qualitative approach that adapts the system dynamics method. System dynamics includes a qualitative approach (Wolstenholme & Coyle, 1983). “System dynamics is a perspective and set of conceptual tools that enable us to understand the structure and dynamics of a complex system” (Sterman, 2000, p. vii). System dynamics are analyzed from a system perspective. “System is a group of interconnected variables” (Bianchi, 2016, p. 13). A system is a set of components that work together to accomplish a particular purpose. The system may consist of various subsystems. Each subsystem can link to other subsystems. This research

defines dynamics as changing variables over time because of changes in one or more system variables.

Jay W. Forrester, a management theorist, is the founding father of system dynamics. In his early books, system dynamics was used for industrial dynamics (Forrester, 1961). In its development, system dynamics expands its field, namely, urban dynamics (Forrester, 1969). In a broader field, Forrester (1973) covered a global view, which includes economic development, environmental issues, and population growth as part of a system. Forrester called them world dynamics. Although system dynamics can cover industrial and world dynamics, this research does not discuss these issues. This research focuses on issues of urban dynamics, such as sustainable mobility. According to Forrester, system dynamics can be used for many complex problems, including personal matters (e.g., worker burnout). It can be concluded that system dynamics is a methodological approach that can be applied to many complex issues, such as urban mobility.

Nowadays, system dynamics has reached many fields of scientific disciplines (Meadows, 2008). It has been applied in urban planning, business processes, public health, psychology, geography, environmental studies, economic growth, and relevant social sciences. Therefore, system dynamics can be called a multidisciplinary research and practice method. The most important thing is that system dynamics has been used in performance management, as pioneered by Bianchi (2016). In addition, Andersen et al. (2020) applied system dynamics to public policy. System dynamics is a problem-solving approach (Andersen et al., 2020) for complex problems (Bianchi, 2016), both private and public affairs. The primary basis of its use is a control system of feedback (Forrester, 1961). In other words, the feedback system is the core of system dynamics (Bala et al., 2017).

This research follows ‘Urban Dynamics’ written by Forrester (1969) in the context of sustainable mobility. Such sustainable mobility policies are one of the main issues in urban planning and policy. Sustainable mobility certainly has its system in urban dynamics. Following a system perspective, this study considers sustainable mobility separate from other urban issues. This research limits data and information

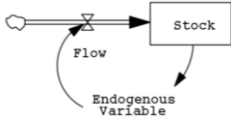
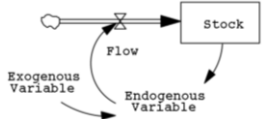
to relevant issues as urban issues encompass a large and complex system, including economic growth and population. Consequently, all data and information studied pertain solely to sustainable mobility issues.

This research uses system dynamics as a research approach because it explores “possible future and asks ‘what if’ questions” (Meadows, 2008, p. 47). In Palermo, sustainable mobility is one of the most challenging issues. To better understand a sustainable mobility system, asking "what if" questions is necessary. To narrow the scope of questions, the ‘what if’ questions relate primarily to the performance of Palermo’s municipal police, associated with local policy networks. According to this research, the municipal police and local stakeholders play an essential role in solving problems regarding urban mobility. Thus, this research assumes that optimizing their performance can achieve sustainable mobility policies.

System dynamics promotes system thinking (Vennix, 1996) for an analytical problem-solving approach (Andersen et al., 2020). In its application, system dynamics uses a closed-loop (Forrester, 1968a). The basic idea of system dynamics is a closed boundary (Vennix, 1996). A closed system means that results from the past action control action in the future, and, in turn, the future action controls back the past results. They connect previous and subsequent actions. This is what makes it different from other approaches to research. System dynamics is a research methodology based on system thinking (Sterman, 2000). “Systems thinking is about gaining understanding by looking at the relationships between things” (Reynolds & Holwell, 2020, p. 8). Accordingly, this research is based on the principle of system thinking. Even though many experts specifically distinguish between system dynamics and system thinking, this study perceives them as interrelated entities. In its application, the system dynamics method employs systems thinking.

Several elements and principles relate to system dynamics in practice. The following table explains them. These elements and principles form the foundation on which system dynamics is interpreted.

Table 3.1 Elements and Principles of System Dynamics

Term	Definition	Symbol
Stock (level)	An accumulation of quantities in specific conditions within a system	
Flow (rate)	The into and out movement of quantities between stocks within a system boundary	
Endogenous variable	An endogenous view assumes that a system's behavior is influenced by internal variables within the system. In other words, the endogenous variable refers to the auxiliary variable	
Exogenous variable	An exogenous view assumes that a system's behavior is influenced by external variables. In other words, the exogenous variable refers to the constant and input variables	
Positive polarity	The impacted variable moves in the same direction as the driving variable within the system	
Negative polarity	The impacted variable moves in the opposite direction to the driving variable within the system	
Reinforcing the feedback loop	The effect of the causal links tends to strengthen the movement of variables in the system	
Balancing the feedback loop	The resultant effect of the causal links within the system over time constrains the movement of variables	

Source: Adapted from Ford (2019, p. 369-379)

Table 3.1 depicts only a few elements and principles of system dynamics. This thesis only mentions the elements and principles used in the analysis processes. In this thesis, it is worth noting that the terms stock, flow, endogenous variables, and exogenous variables are used implicitly. The terms positive polarity, negative polarity, reinforcing loop, and balancing loop are used explicitly. This thesis does

not employ all terms explicitly, which is common in research using the system dynamics method. The terms in the table aim to highlight key aspects of the system dynamics method. In addition, there are a variety of other terms that can be found in various relevant journals and books explaining system dynamics.

These eight terms in Table 3.1 can be helpful for people who are new to the system dynamics method. For further explanation, stock is also called level, and flow is also called rate. They are often interchangeable. Flow terms consist of inflow, which means into movement, and outflow, which means out movement. Exogenous variables are sometimes divided into constant variables and auxiliary variables. Other variations of terms can be found in detail in several helpful software programs, such as Powersim³⁷, Stella,³⁸ and Vensim³⁹.

The causal loop diagram (CLD) and stock and flow diagram (SFD) are essential parts of system dynamics modeling. The CLD describes the system as a qualitative model (i.e., causal mechanism). The SFD quantifies the system with particular formulas or equations. The SFD is sometimes called a quantitative model. In practice, the CLD is meaningful for the SFD (Richardson, 1986). The CLD is “a tool that represents closed loops of cause-effect linkages (causal links) as a diagram intended to capture how the system variables interrelate and how external variables impact them” (Ford, 2019, p. 370). The SFD is “a visual depiction of the stock, flow and auxiliary (converter) variables in a system and how they are connected” (Ford, 2019, p. 377). The terms positive polarity, negative polarity, reinforcing loop, and balancing loop are used for the CLD, while stock, flow, endogenous variables, and exogenous variables are used for the SFD. The following two figures show how the CLD and SFD work. The first figure is CLD, and the second figure is SFD.

The CLD represents a qualitative model. This means a causal loop diagram only represents feedback links among variables. “Causal loop diagrams constitute a powerful way to express concisely causal statements and to identify feedback processes” (Vennix, 1996, p. 52). Creating the CLD as a feedback view is

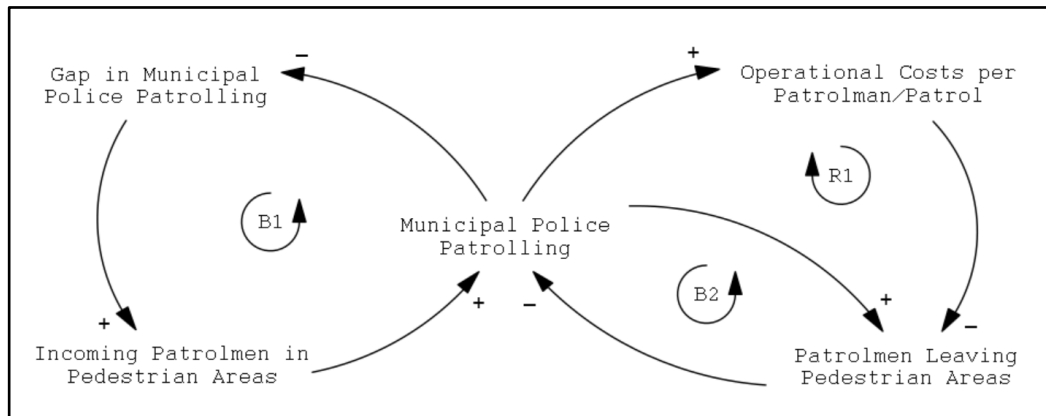
³⁷ <https://powersim.com/>

³⁸ <https://www.iseesystems.com/>

³⁹ <https://vensim.com/>

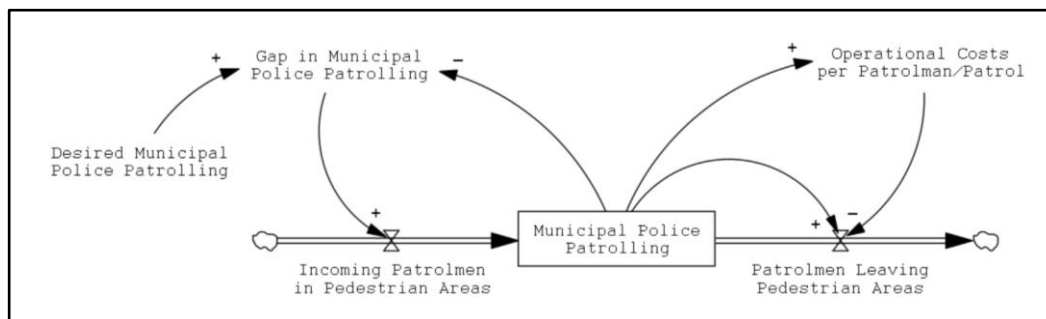
mandatory. This means that causal loop diagrams are the primary basis for understanding system dynamics modeling. The causal loop diagram must be completed first for research applying the system dynamics method. The next step is to create the SFD model. The SFD model must follow the CLD model. Completing the SFD model enables the simulation process if needed.

Figure 3.2 Example of the Causal Loop Diagram (CLD)



Source: Author's elaboration using Vensim Software (<https://vensim.com/>)

Figure 3.3 Example of the Stock and Flow Diagram (SFD)



Source: Author's elaboration using Vensim Software (<https://vensim.com/>)

In Figure 3.2, the CLD illustrates positive and negative polarities. For instance, positive polarity is from municipal police patrolling to operational costs per patrolman/patrol. This means that if municipal police patrolling increases, operational costs per patrolman/patrol will increase. Conversely, the link between municipal police patrolling and the gap in municipal police patrolling is negative polarity. This means that if municipal police patrolling increases, the gap in municipal police patrolling will decrease.

Figure 3.2 also describes the balancing and reinforcing loops. This figure comprises two balancing loops (B1 and B2) and one reinforcing loop (R1). The plus or minus sign determines whether it is a balancing or reinforcing loop. If there is an odd number (e.g., 1, 3, 5) of minus signs, then it is a balancing loop. Likewise, it is a reinforcing loop. For instance, the R1 loop has two minus signs. It means an even number. The loop is a reinforcing loop. Another example is the B1 loop, which has one minus sign. It is a balancing loop because one is an odd number of minus signs. If the loop consists of all plus signs, it is a reinforcing loop.

Figure 3.3 illustrates the SFD⁴⁰, consisting of stock, flow, indigenous, and exogenous variables. The stock is ‘municipal patrol patrolling’. The inflow influences it. Besides, it also influences the outflow. The variable of incoming patrolmen in pedestrian areas is an inflow, and the variable of patrolmen leaving pedestrian areas is an outflow. The variable of the gap in municipal police patrolling and the variable of operational costs per patrolman/patrol are called endogenous variables. Both variables are generated from stock and exogenous variables. The variable of desired municipal police patrolling is exogenous.

Furthermore, research that adapts the system dynamics method does not always emphasize process simulation. It depends on how system dynamics is adapted as a methodological approach. For instance, the DPM initiated by Bianchi (see Bianchi, 2016) adapts system dynamics to the performance management system. In the DPM, the simulation process is not mandatory. The DPM emphasizes qualitative models, even though it adopts the SFD principle. In principle, the instrumental view of the DPM, shown in the next subchapter, integrates the SFD model and performance management (see Bianchi, 2016), called the DPM approach. In the broader context, the instrumental view of the DPM is combined with performance governance (see Bianchi, 2021, 2022), called the DPG approach. In scientific

⁴⁰ Modeling the SFD typically utilizes a computer-based tool, using special software such as Powersim, Stella, and Vensim. Notably, each software has a specific term. Even though the terms for each software used may differ, the intent and purpose remain the same. The substance remains the same based on what Jay W. Forrester calls the principles of systems (see Forrester, 1968b).

literature, these approaches are commonly referred to as system dynamics for performance management and governance.

Based on various existing references (Bianchi, 2016, 2021, 2022), the DPM is a performance management approach adopting the system dynamics method. The DPG is a performance management approach that adopts the system dynamics and integrates performance governance, including relevant concepts such as collaborative governance and policy networks. The DPM is the basis for the DPG (Bianchi et al., 2019). In other words, the DPG is an overarching framework for the DPM when assessing policy in the local area (Bianchi, 2021, 2022). Both the DPM and DPG are new approaches in performance management literature.

This research does not involve a simulation process, which system dynamics modelers commonly conduct. It constitutes a preliminary study that offers qualitative insights to inform subsequent investigations requiring quantitative simulation. Basically, this thesis aims to contribute to the performance management systems in the public sector rather than the public policy simulation process, which requires quantitative modeling. Although the simulation process is not performed, the thesis emphasizes trade-off analysis, allowing policy recommendations. The models created in this thesis may be references for future research-based operational simulations. This thesis utilizes the DPM approach explicitly designed for municipal police performance. Also, this thesis utilizes the DPG approach, which is explicitly designed for performance governance in the context of the local area. Before explaining the DPM and DPG approaches in more detail, it is essential to understand the system boundary to ensure that the causal mechanism created in the DPM and DPG models have clear limits.

3.4 System Boundary of Sustainable Mobility Issues

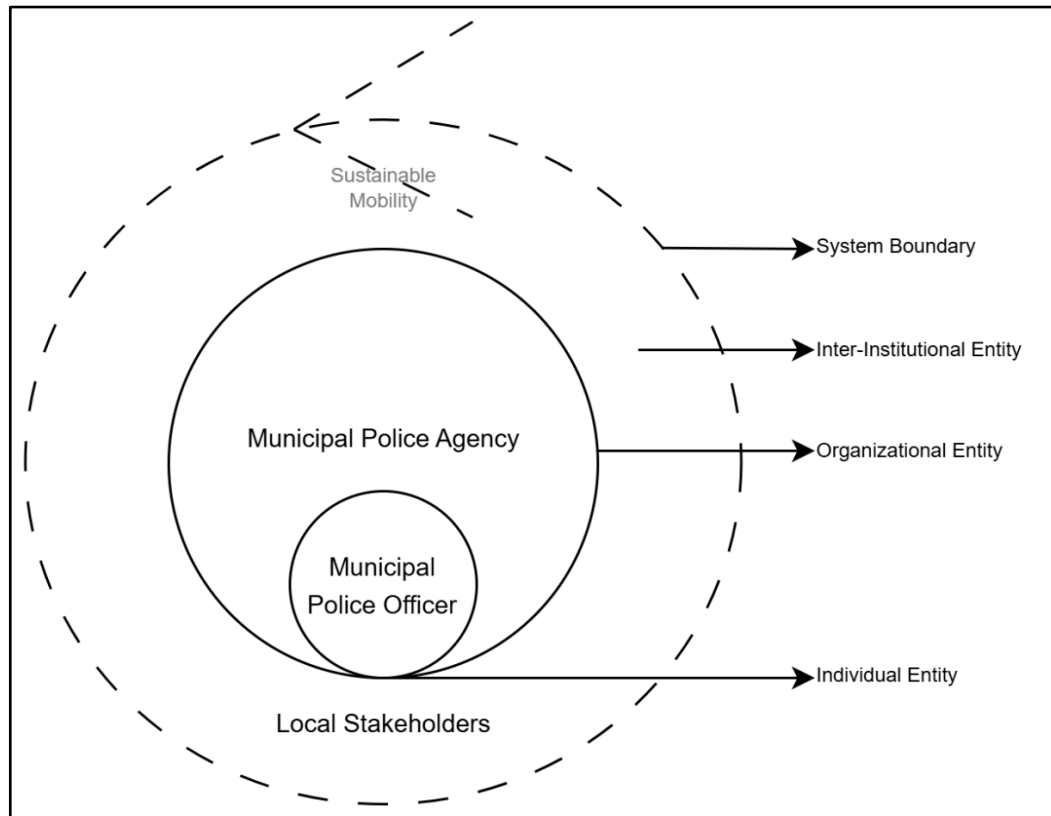
As remarked by Forrester (1968), system boundaries should be formulated first to emphasize the closed boundary. He argued that the boundary is a closed system. “A boundary around a system depends on the purpose of the discussion” (Meadows, 2008, p. 97). Meadows argued that boundaries are flexible. To limit the scope of the system, this section describes the system boundary in line with Forrester and

Meadows. In this section, the system boundary is conceptually described. On an operational level, the system boundary is described in the section about the general feedback loop.

Concerning the main actors, the system boundary refers to the municipal police and local stakeholders. Concerning the emerging issues, it refers to sustainable mobility problems. However, the system boundary related to sustainable mobility is limited to the scope of the pedestrian areas and the limited traffic zones in Palermo. On the whole, the system boundary explains the focus limits of the research using system dynamics. With an understanding of the system boundary, the research conducted is focused, and its implications for practice are more applicable. By creating such a system boundary, academic contributions can be considered more valid and reliable. System boundaries are needed when using system dynamics for sustainability (Nabavi et al., 2017).

Figure 3.4 describes the system boundary framework in this study. This figure explains the positions of individual, organizational, and inter-institutional entities. The small circle is the municipal police office as an individual entity. The medium circle is the municipal police agency as an organizational entity. The circle of municipal police agencies covers the circle of municipal police officers because they are part of the municipal police agency. The arrow at the inter-institutional level signifies local stakeholders. The inter-institutional level also represents the community level where a collaborative entity exists. The outermost dotted line explains the system boundary in this thesis. It refers to sustainable mobility arenas. In other words, the system boundary is related to sustainable mobility issues.

Figure 3.4 System Boundary Framework



Source: Author's elaboration

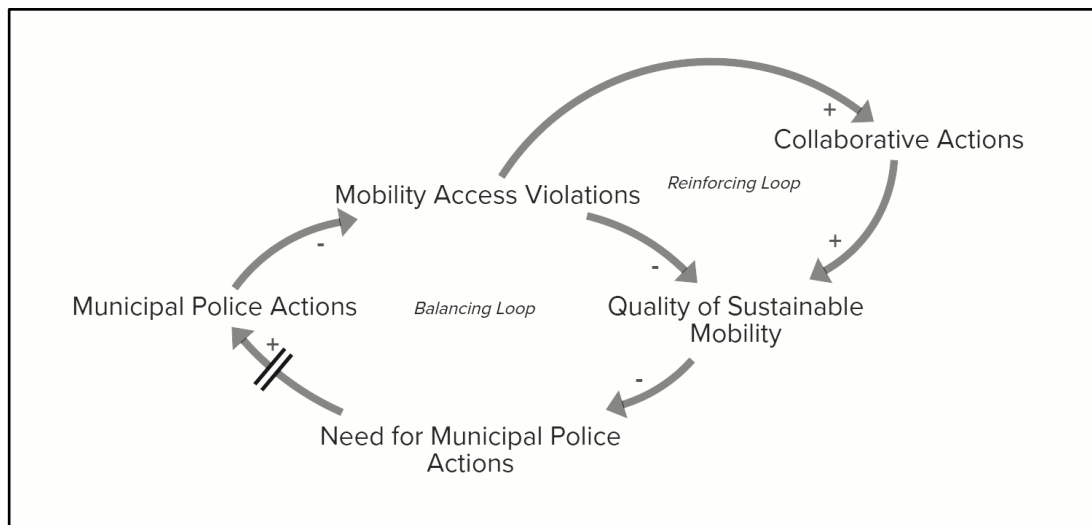
Figure 3.4 is the simple framework of the system boundary. Then, Figure 3.5 below describes the operational framework of the system boundary in Figure 3.4. It is necessary to note that causal links in Figure 3.4 are created with a general feedback loop rather than an analysis process. It is provided for informational purposes. Figure 3.4 shows a general feedback loop that illustrates the focus developed in the following chapters. The causal links loops in the figure below, as a general feedback loop, are associated with the models in Chapter 5. Figure 3.5 is created to re-emphasize, following Figure 3.4, the context of the system being studied. Figure 3.5 also explains the scope of the DPM and DPG as methodological approaches and the analysis views used in this study.

The general feedback loop can also be said to be the initial causal loop that describes the system boundary operationally. This at least describes how the models are explained in the next chapter. This means that the models in the following chapters refer to the system boundary. Three main variables are studied: municipal police

actions, collaborative actions, and sustainable mobility. Municipal police actions are related to their roles in providing sanctions. Collaborative actions are related to relevant stakeholder activities regarding pedestrian areas and limited traffic zones. Sustainable mobility is related to the quality of the sustainable mobility policies.

All variables are the core of the causal feedback loop. Sustainable mobility is closely associated with the role of municipal police. Since sustainable mobility policies are implemented in urban areas, the local areas represent an inter-institutional dimension. The feedback link between municipal police actions, relevant stakeholders in the local areas, and sustainable mobility policies is like an interconnected vehicle system component. The following figure describes the system boundaries between municipal police actions, collaborative actions of relevant stakeholders, and sustainable mobility.

Figure 3.5 Describing System Boundary



Source: Author's elaboration

The causal link between municipal police actions (e.g., patrols and utilization of traffic cameras) and mobility access violations (e.g., unauthorized parking and driving vehicles) is a negative polarity. This means that, for example, the more municipal police actions there are, the fewer unauthorized parking violations there will be. Unauthorized parking violations refer to private vehicles—such as cars, motorcycles, scooters, and mopeds—parked in pedestrian areas and limited traffic zones.

The causal link between mobility violations and the quality of sustainable mobility is negative polarity. This means that if unauthorized parking violations increase, then the quality of sustainable mobility will decrease. The quality of sustainable mobility represents an effect, while unauthorized parking violations are one of the causes. Good or bad quality depends on the cause.

The link between the quality of sustainable mobility and the need for municipal police action is negative polarity. As the quality of sustainable mobility increases, the need for municipal police action may decrease. In other words, as the quality of sustainable mobility increases, the need for municipal police action may increase. The need for municipal police action refers to the demand for services. Poor quality may drive a high demand for services (i.e., patrol) from the municipal police. On the contrary, good quality may reduce demand for services.

In turn, the need for municipal police actions generates municipal police actions. The link relationship is positive. Unfortunately, there may be a delay in the link. Even though the link is positive polarity, municipal police actions are not immediately conducted. For instance, many cars were in pedestrian areas at a particular time. Ultimately, the need for municipal police patrols also increased at that time. However, municipal police patrols were not frequently conducted at that time. Municipal police might patrol several hours later. For a long time, this situation may directly impact the quality of pedestrian areas.

In another part, the causal link between mobility violations and collaborative actions (e.g., community-based actions and public-private partnerships) is positive polarity. This means that if unauthorized parking violations increase, then the collaborative actions may decrease. When many unauthorized vehicles are parked in pedestrian areas, the local communities (e.g., residents and pedestrian associations) may take collective action by engaging in dialogue and urging the authorities to intervene. Next, the causal link between collaborative actions and the quality of sustainable mobility is also positive polarity. When active collaboration is implemented, local authorities and stakeholders may intervene by installing and

managing pedestrian barriers (e.g., benches and concrete stones). This action may lead to an increase in the quality of sustainable mobility.

Based on the causal link in Figure 3.5, it is known that there are two causal loops, one balancing loop and one reinforcing loop. In essence, the balancing and reinforcing loops are interrelated to a system's behavior. Based on the two loops, it can be concluded that the quality of sustainable mobility cannot be achieved without the actions of municipal police and relevant stakeholders. This thesis posits that if the municipal police of Palermo do not take real action to address various problems, sustainable mobility policy is merely a formality. Additionally, actions by relevant stakeholders can enhance the quality of sustainable mobility, leading to sustainable outcomes. Thus, the actions of municipal police and relevant stakeholders together are highly significant in achieving sustainable mobility goals. Referring to the argument, applying the DPM and DPG approaches can provide critical success factors for fostering sustainable outcomes. This thesis considers applying the DPM and DPG approaches, as these approaches can offer performance management systems for addressing complex issues such as sustainable mobility problems.

3.5 Applying Dynamic Performance Management (DPM) and Dynamic Performance Governance (DPG) Approaches

This research combines the DPM and DPG approaches. Firstly, the DPM is utilized to frame causal mechanisms affecting the performance outputs and outcomes (i.e., intermediate outcomes) of municipal police. The next step involves applying the DPG approach to frame the sustainable performance outcomes (i.e., intermediate outcomes and final outcomes) based on the local stakeholders' (e.g., neighborhood committees, cyclist associations, and residents) perspective in pedestrian areas and limited traffic zones—where they interact with municipal police. In this research, the DPM and DPG approaches are integrated to foster sustainable outcomes, achieving the goals of sustainable mobility policies. Due to the complexity of sustainable mobility issues, framing issues with a comprehensive approach is required.

According to Bianchi (2016), the DPM is “an approach that enables organization decision-makers to frame the causal mechanisms affecting organizational results over time” (Bianchi, 2016, 71). In its application, the DPM integrates system dynamics into performance management systems (Bianchi, 2016). As the pioneer of the DPM, Bianchi intends to transform a ‘static’⁴¹ view into a ‘dynamic’⁴² view of performance management systems. It is possible to embrace a dynamic and systemic perspective through the DPM (Noto, 2020) because static performance management cannot detect problems and solutions in decision-making (Bianchi & Rua, 2022).

The DPM is useful for capturing organizational complexity and facilitating strategic processes in public organizations (Cosenz, 2022). In addition, the DPM is the framework for performance regimes (Vignieri, 2022). The DPM can strengthen the planning and control systems, including decision-making. It can pursue sustainable outcomes in the long term (Rua, 2023). Apart from practical applications for practitioners (i.e., decision-makers), it is a methodological analysis in the research of performance management systems. Currently, the DPM has evolved into a practical application for various cases. It has been applied in the business (e.g., industrial sector companies) and public sector (e.g., municipal government agencies). Therefore, the DPM is a new approach in applied research for performance management in the public sector.

As remarked by Bianchi (2016), the DPM approach, both practice and research, can be applied to local governmental organizations such as municipal police. The complexity of the public sector can be framed through the DPM approach (Noto,

⁴¹ Term static refers to the classic of performance management that describes a link between variables or elements as a process rather than an effect. For instance, input processes into output. A process or activity is commonly used as a stage in performance management between input and output. Next, output processes into outcome. The outcome brings into impact. This is described as a process from one stage to the next at one period of time.

⁴² Dynamic refers to a link between variables or elements whose meaning is an effect rather than a process. All variables are linked like a loop. This link takes place over time, not one period. As an illustration, output will only change if the input changes. This means input may affect output. The outcome will change if the output changes. This means output may affect the outcome. Next, one of the outputs possibly affects other outputs. One of the outcomes (i.e., the intermediate outcome) may affect other outcomes (i.e., the intermediate outcome). In turn, the outcome (i.e., the final outcome) may affect back to the input. From a dynamic perspective, the keyword is interconnectedness and changing systems over time.

2020). This approach contributes to developing public-sector organizations (Cosenz, 2022). Indeed, in the volatility, uncertainty, complexity, and ambiguity (VUCA) era, practice and research on performance management require an approach that can improve public sector performance. Changes occurring internally and in a broader context must be considered when researching performance management. In this manner, the analysis can be more precise. According to Bianchi and Hall (2023, p. 1084), research in performance management must keep pace with trends and find innovative ways to enhance organizational learning.

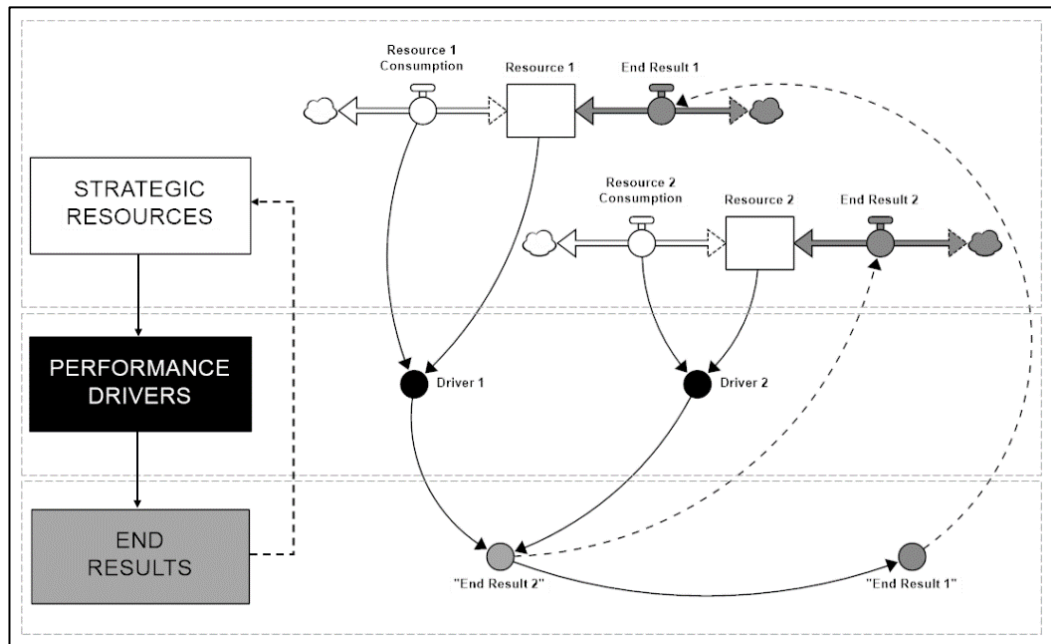
This thesis considers the DPM approach as an innovative approach to performance management research. At least three reasons, the DPM can help organizations to: (1) “understand and manage the forces driving performance over time”, (2) “frame and measure the indirect effects of intangibles on performance”, and (3) “foster a learning-oriented—rather than bureaucratic/incremental approach—to planning” (Bianchi, 2016, p. viii). Applying the DPM approach, municipal police can become more adaptive in understanding and controlling key success factors to achieve desired goals.

Furthermore, as remarked by Bianchi (2016), the DPM frames not only on the institutional level (i.e., single organization system) but also on the interinstitutional level (i.e., multi-organization system). In fact, complexity exists both within and outside the organization. Internal situations can impact external contexts and vice versa. There is a feedback process that is sometimes overlooked when performing actions. This feedback process is a crucial concern for the municipal police in enforcing sustainable mobility rules in Palermo.

In framing the feedback process or causal mechanisms affecting performance, the DPM approach has an instrumental view⁴³, illustrated in the following figure.

⁴³ The instrumental view of DPM delineates the SFD model, as previously elucidated. Strategic resources mean the stock. Performance drivers mean the endogenous variable. End results mean the flow. However, the instrumental view encompasses more than the mere scope of an SFD model. It epitomizes the performance management systems based on the dynamic view. This view not only provides feedback in the system but also encompasses the causal mechanisms of performance management. Three primary elements—strategic resources, performance drivers, and end results—distinguish the instrumental view of the DPM from the general SFD model.

Figure 3.6 Instrumental View of Dynamic Performance Management (DPM)



Source: Bianchi (2016, p. 73)

Figure 3.6 shows three main elements of the DPM approach. They are strategic resources, performance drivers, and end results. All are interrelated in the causal mechanisms. Strategic resources affect performance drivers, performance drivers affect end results, and, in turn, end results affect strategic resources.

Strategic resources are “physical or information resources held by the system that can be employed in order to achieve some desired result” (Noto, 2020, p. 31). Strategic resources are inputs in the system (Cosenz, 2022). According to Bianchi (2016), the type of strategic resources consists of physical resources, capacity resources, information resources, financial resources, and resources generated by management routines. Related to municipal police performance, physical resources refer to tangible assets such as police officers and patrol cars. Capacity resources refer to the maximum or minimum service per time, such as the number of police patrols daily. Information resources refer to the municipal police's perception of mobility violations, such as perceived parking violations. Financial resources refer to the budget owned by the municipal police, such as the budget allocated to patrol. Resources generated by the management routine refer to municipal police activity daily, such as the time allocated to patrol.

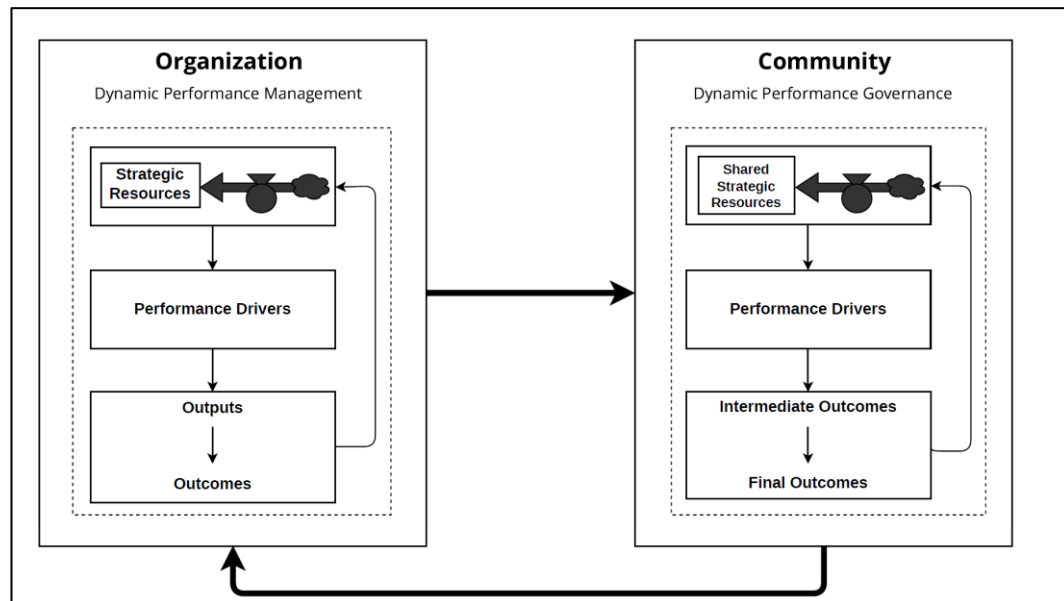
Performance drivers represent performance indicators (Noto, 2020). Furthermore, performance drivers are pivotal elements that constitute key or critical success factors (Bianchi et al., 2019). They represent benchmark measures based on ratio metrics (i.e., actual performance/desired performance or actual performance/standard performance). Other quantitative metrics, such as percentage, average, number, and total number, can be used as metrics. The metrics depend on the organizational context and the intended performance design (i.e., planning and control systems).

End results refer to the results that the organization attains over time (Noto, 2020). They consist of outputs and outcomes, which are common in performance measurement and management. Related to municipal police performance, output refers to activities or products derived from input (e.g., the amount of the fine paid by the sanctioned offender and the number of traffic cameras installed). Mainly, the output refers to services performed by patrol officers (e.g., the number of patrol services in pedestrian areas). Next, outcomes refer to short and medium-term changes (i.e., immediate outcomes) and long-term changes (i.e., final outcomes) resulting from outputs. Regarding sustainable mobility, a change in mobility behavior may be categorized as the intermediate outcome, and a change in the sustainable community (or quality of life) may be categorized as the final outcome.

In a broader context, the DPM view can be integrated with the DPG view. The combined view of DPM and DPG is illustrated in the following figure. In Figure 3.7⁴⁴, the organization refers specifically to municipal police, and the community refers to all stakeholders interacting in pedestrian areas and limited traffic zones.

⁴⁴ The detailed explanation of this figure can be seen in Bianchi (2021, 2022).

Figure 3.7 Combining the View of Dynamic Performance Management (DPM) and Dynamic Performance Governance (DPG)



Source: Adapted from Bianchi (2021, p. 342)

Figure 3.7 delineates the boundaries of the DPM and DPG views, clearly illustrating where each approach is situated. Additionally, it visually represents the interplay between the DPM and DPG approaches, highlighting how these approaches complement and integrate within the broader context of performance management systems. Based on the combined view, on the one hand, municipal police actions can impact the local community. On the other hand, local community activities can influence the performance of the municipal police.

Separately, three aspects distinguish the DPM view from the DPG view. First, the DPG is for community-based entities, while the DPM is for organization-based entities. Second, strategic resources in the DPG approach are shared resources of the local community, while the organization owns strategic resources in the DPM approach. In the DPG, shared strategic resources include common goods⁴⁵ and other kinds of shared strategic resources (Bianchi, 2021, 2022). For example, pedestrian barriers, sidewalks, and pedestrian safety are considered common goods in pedestrian areas and limited traffic zones. The strategic resources include

⁴⁵ In the local areas, “common goods refer to natural, social, and historical assets which are rooted in a region” (Bianchi, 2021, p. 340).

mobility behavior and education for sustainable mobility. Third, end results in the DPG include intermediate and final outcomes, whereas end results in the DPM encompass outputs and outcomes (i.e., intermediate outcomes). Although there are differences in some elements, both are interrelated within a broader context.

Specifically, the DPG is an “outside-in” view (Bianchi, 2021, 2022) related to performance governance. The “outside-in view” of performance governance is the antithesis of the “inside-out” view of outcome-based performance management, which is rooted internally within the organization (Bianchi, 2021, 2022). This means that the DPG focuses on the community perspective in the local areas rather than the organization’s perspective in designing, implementing, and assessing policy. Indeed, sustainable mobility policies should consider the community perspective because the success or failure of these policies is related to the performance results of various institutions in pedestrian areas and limited traffic zones.

Like the DPM, the DPG approach is innovative in applied performance management and governance research in the VUCA era. “DPG frames policy design as a process aimed at fostering sustainable outcomes in a local area” (Bianchi, 2021, p. 341). It supports local networks, collaborative governance (Bianchi et al., 2019; Bianchi, 2021, 2022), active community (Vignieri, 2023) and other local governance modes (e.g., participatory and community-based governance). The DPG encompasses a broader perspective that transcends organizational boundaries, incorporating a holistic approach to performance governance. This broader view includes considerations of external factors, inter-organizational dynamics, and the broader societal impacts.

This thesis utilizes the combined view of DPM and DPG to answer research questions. Initially, an analysis based on the DPM view was conducted to address the first and the second research question of this thesis, which investigates how the performance of municipal police enhances intended outcomes. Subsequently, the third question was addressed using the integrated view of DPM and DPG. The third

question explores how various stakeholders support municipal police performance and foster sustainable city and community outcomes.

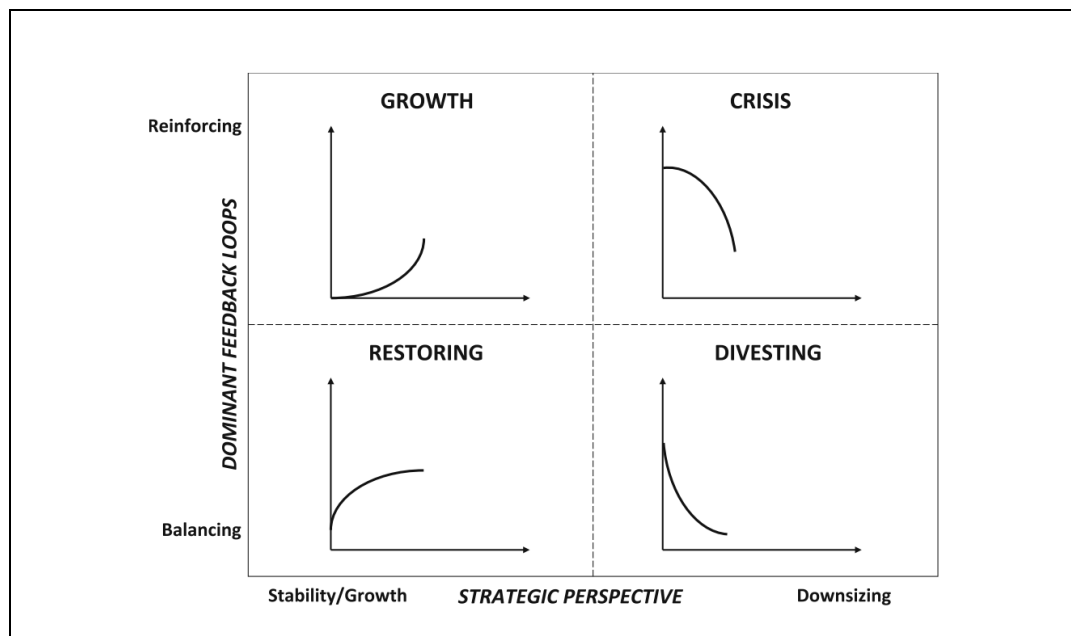
Additionally, the DPM and DPG approaches are not limited to framing causal mechanisms. These approaches also emphasize trade-off analysis. According to Bianchi and Tomaselli (2015), the DPM approach may support a trade-off analysis. Trade-off refers to the analysis of performance over time (i.e., trade-offs in time) and across space (i.e., trade-offs in space) (Bianchi, 2016). “Trade-offs in time concern the effects of policies in the short vs. long term; trade-offs in space relate to the effects of policies on a subsystem vs. another subsystem” (Bianchi, 2021, p. 337). An example of the trade-off in time is the budget allocated for pedestrian barriers in the short run versus financial resources in the long run. An example of the trade-off in space (and time) is pedestrian barriers in the short run versus mobility behavior in the long run. As an illustration, cutting the budget for pedestrian barriers may increase spending on other items unrelated to pedestrian areas but reduce the number of pedestrian barriers. Ultimately, reducing pedestrian barriers may negatively impact sustainable mobility behavior in the long term.

Moreover, scenario modes of performance are required to strengthen trade-off analysis. Scenario modes in the DPM and DPG approaches are needed to foster intended performance outcomes and prevent unintended performance outcomes. Scenario modes can foster sustainable outcomes or counteract side effects based on trade-off analysis. Trade-off analysis needs to be linked to the scenario modes of performance for comprehensive analysis. The modes of performance scenario represent the subsequent step in conducting a trade-off analysis within the public sector.

3.6 Scenario Modes of Performance in Dynamic Performance Management (DPM) and Dynamic Performance Governance (DPG) Approaches

One of the most important aspects of applying the DPM and DPG approaches is that the models created are based on scenario modes⁴⁶. This means the model considers which scenarios are appropriate for current and future performance regarding sustainable mobility policies. In this way, the models can frame the performance of the system's behavior (e.g., strategic resources, outputs, and outcomes) over time. The scenarios for current performance include the growth perspective, the crisis perspective, the restoring perspective, and the divesting perspective; the scenarios for future performance include the prevention perspective, the stabilization perspective, the restructuring perspective, and the revitalization perspective (Bianchi, 2016). Each of these scenarios has characteristics determined by the dominant causal loop. The following figure depicts scenarios for current and future performance. Each scenario depicts distinct dynamic behavior.

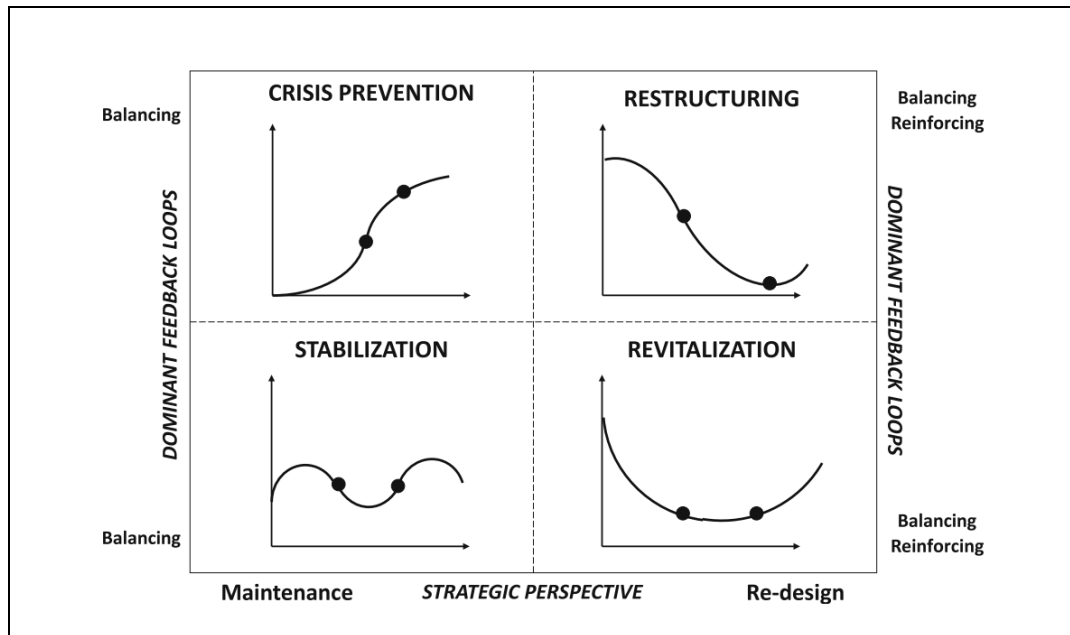
Figure 3.8 Main Scenarios for Current Performance



Source: Bianchi (2016, p. 42)

⁴⁶ Scenario modes reflect behavior in dynamic systems (see Sterman, 2000) or system view (see Vignieri, 2022).

Figure 3.9 Main Scenarios for Future Performance



Source: Bianchi (2016, p. 43)

In Figure 3.8, the growth scenario is characterized by a reinforcing loop or dominant reinforcing loops in the system. Its behavior resembles exponential growth. An expected state of growth is referred to as a growth perspective. This scenario represents a rising state. For instance, if the causal loop associated with pedestrian barriers represents a (dominant) reinforcing loop, increasing the number of pedestrian barriers—due to budget boosts—is a favorable option.

The crisis scenario is characterized by a reinforcing loop or dominant reinforcing loops in the system. However, its behavior resembles collapse. An expected state of shrinkage is referred to as a downsizing perspective. This scenario represents a reducing state. For instance, if the causal loop associated with traffic cameras represents a (dominant) reinforcing loop, decreasing the number of traffic cameras—due to budget cuts—is an unfavorable option.

The restoring scenario is characterized by a balancing loop or dominant balancing loops in the system. Its behavior resembles goal-seeking from a lower state to a higher state. A desired state is referred to as a stability perspective. This scenario represents a rising state. For instance, if the causal loop associated with patrol officers represents a (dominant) balancing loop, increasing the number of patrol

officers toward a desirable state is essential. Goals need to be set because excess patrol officers may increase operational costs.

The divesting scenario is characterized by a balancing loop or dominant balancing loops in the system. Its behavior resembles goal-seeking from a higher state to a lower state. A desired state is referred to as a downsizing perspective. This scenario represents a reducing state. For instance, if the causal loop associated with the allocated time to patrol represents a (dominant) balancing loop, decreasing the allocated time to patrol toward a desirable state is essential. Goals need to be set because excessive time allocated to patrol may affect patrol officers' fatigue.

In Figure 3.9, the crisis prevention scenario is characterized by dominant balancing loops in the system. This scenario aims to maintain the system's behavior. Managing an unexpected state of growth is referred to as a maintenance perspective. This scenario represents a rising state based on the desired state. For instance, if the causal loop associated with pedestrian barriers represents a (dominant) balancing loop, increasing the number of pedestrian barriers in the future should be adjusted according to actual needs. Specifically, this action can be taken in case the vandalism of pedestrian barriers increases.

The stabilization scenario is characterized by dominant balancing loops in the system. This refers to an oscillation state. Managing unexpected growth or shrinkage is referred to as a maintenance perspective. This scenario represents a stabilized state based on the desired state. For instance, if the causal loop associated with patrol officers represents a (dominant) balancing loop, after delay, increasing and decreasing the number of patrol officers in the future should be adjusted to the needs. On the one hand, an excess of patrol officers may increase operational costs. On the other hand, reducing the number of patrol officers may increase mobility violations.

The restructuring scenario is characterized by dominant reinforcing loops and balancing loops in the system. This scenario aims to redesign the system's behavior to anticipate crisis conditions. This scenario counterbalances the actual state dominated by reinforcing loops towards the desired state dominated by balancing

loops. This scenario represents a reducing state based on the desired state. For instance, if the causal loop associated with traffic cameras represents a (dominant) reinforcing loop and a (dominant) balancing loop, decreasing the number of traffic cameras—due to budget cuts—should be adjusted to meet needs in the future. Excessive reduction in the number of traffic cameras may lead to an increase in traffic and mobility violations.

The revitalization scenario is characterized by dominant balancing loops and reinforcing loops in the system. This scenario also aims to redesign the system's behavior by enhancing growth conditions. This scenario fosters a growth state enhanced by a reinforcing loop after dominating a balancing loop. This scenario initiates a rising state based on the expected state. For instance, if the causal loop associated with the allocated time to patrol represents a (dominant) balancing loop and a (dominant) reinforcing loop, increasing—after decreasing—the allocated time to patrol should be adjusted to meet needs in the future. In the event of many mobility violations, the allocated time for patrol should be increased.

3.7 Research Design

This research uses a qualitative method. Qualitative research aims at understanding and exploring the meaning of individuals, groups (Creswell, 2014) and organizations (O'Sullivan et al., 2017) related to social problems. This includes local areas where individuals, groups, and organizations do social activities or work, based on their interests and responsibilities. Following Bianchi and Tomaselli (2015) who focused on the local area's performance, investigating qualitative research is not limited to an organization. Rather, it includes multi-organizational spheres. This aligns with the DPG approach as explained previously.

Focusing on individuals, groups, organizations, and local areas (multi-organizational spheres) depends on the research questions being addressed. Basically, qualitative research focuses on the context of actors or phenomena (van Thiel, 2014). Furthermore, the most crucial point is that qualitative research is a more in-depth investigation (O'Sullivan et al., 2017) compared to quantitative research. It relates to many factors or determinants in a problem (Creswell, 2014).

In general, qualitative research involves “detailed verbal descriptions of characteristics, cases, and settings” (O’Sullivan et al., 2017, p. 608). Researchers are permitted to refine their ideas and concepts throughout the research process. In applied research using a qualitative method, researchers can refine their analysis to improve research findings (Brown & Hale, 2014). Therefore, a qualitative method not only focuses on the object of investigation (e.g., an organization or inter-organizational entity) but also on the process (e.g., data and analysis process).

Specifically, research adopting the system dynamics method integrated with performance management and governance such as the DPM and DPG approaches, qualitative research is associated with the diversity of qualitative aspects, consisting of (1) qualitative variables, (2) qualitative data and information, (3) qualitative data collection and analysis methods, (4) qualitative methods or procedures, (5) qualitative visualizations, (6) qualitative representations, (7) qualitative interpretation and description, and (8) qualitative communications of model insights (Stave et al., 2024, p. 3-4). This research is based on eight qualitative aspects, closely associated with the trend of the system dynamics method in general, and the DPM and DPG approaches specifically.

Meanwhile, this research employs an empirical approach, where the researcher serves as the field investigator in investigating the problems in the pedestrian areas and limited traffic zones. Also, participants’ meanings (Creswell, 2014) or stakeholders’ experiences are part of the problem investigations in the city center of Palermo. An empirical approach focuses on “a particular contemporary phenomenon within its real-life context” (Saunders et al., 2007, p. 592). Accordingly, an empirical analysis is suitable for a single case study (Bianchi & Tomaselli, 2015) or multiple case studies.

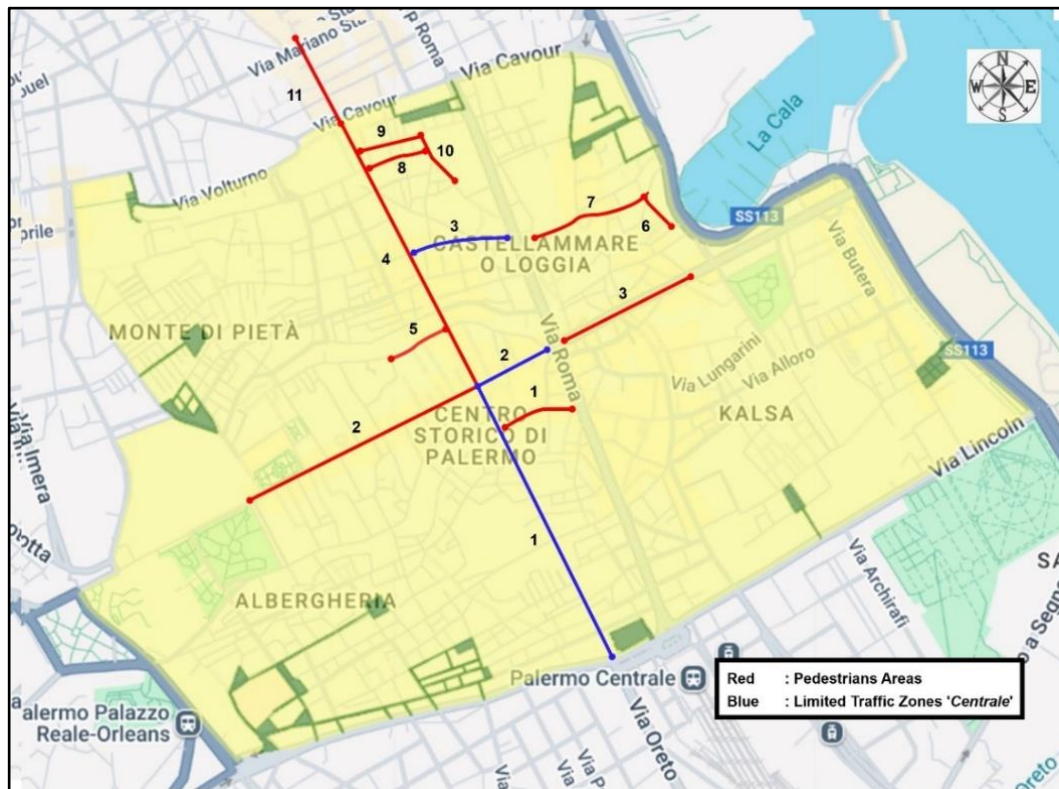
3.8 Research Setting

Research setting refers to research locations and time. This research focuses on the city center of Palermo, where pedestrian areas and limited traffic zones are designed. The city center of Palermo was chosen as the central research location because it is the primary area for designing and implementing sustainable mobility

policies, particularly pedestrian areas and limited traffic zones. In addition, the city center of Palermo is a mobility hub where various modes of transportation are active. The city center also serves as the hub for the daily activities of residents and tourists. Since the city center is the hub of various activities, implementing pedestrian areas and limited traffic zones presents a challenge.

The following figure provides an overview of the city center, highlighting the research locations: pedestrian areas and limited traffic zones. However, this research has not been conducted comprehensively on all pedestrian areas and limited traffic zones within the city center. Figure 3.10 highlights the main pedestrian areas and limited traffic zones referenced in this thesis, understanding the spatial condition of the city center.

Figure 3.10 Research Locations



Source: Modified by the author from Google Maps⁴⁷

⁴⁷https://www.google.com/maps/@38.1147841,13.3680039,15z/data=!10m2!1e3!2e10!12b1?rapsr c=apiv3&entry=tu&g_ep=EgoyMDI1MDIwNC4wIKXMDSoJLDEwMjExMjM0SAFQAw%3D%3D

Figure 3.10 depicts the city center of Palermo in general. Specifically, the yellow color depicts the main area of the city center. Red refers to pedestrian areas: (1) *piazza Bellini*⁴⁸ and *via Discesa dei Giudici*⁴⁹; (2) *via Vittorio Emanuele*⁵⁰ (from *Porta Nuova* to *Quattro Canti*); (3) *via Vittorio Emanuele*⁵¹ (from *via Roma* to *Porta Felice*); (4) *via Maqueda*⁵² (from *via Cavour* to *Quattro Canti*); (5) *via del Celso*⁵³; (6) *piazza Fonderia*⁵⁴; (7) *via Giovanni Meli*⁵⁵; (8) *via Orologio*⁵⁶, (9) *via Bara all'Olivella*⁵⁷; (10) *piazza Olivella*⁵⁸; (11) *via Ruggero Settimo*⁵⁹. Blue refers to limited traffic zones: (1) *via Maqueda*⁶⁰ (from *via Corso Tukory* to *Quattro Canti*); (2) *via Vittorio Emanuele*⁶¹ (from *Quattro Canti* to *via Roma*); (3) *via Bandiera*⁶².

The limited traffic zones cover only the central areas (i.e., *ZTL Centrale*). This implies that this study does not encompass the general limited traffic zones surrounding the yellow border in the figure above. Several areas are not explicitly marked in Figure 3.10, but they are part of this research to strengthen the information and data. The following sub-chapter mentions these areas in detail (see Table 3.2).

Moreover, this thesis focuses on the current state of urban mobility from 2022 to 2025. By focusing on this specific timeframe, the research aims to capture the dynamics and the contemporary issues of sustainable mobility. Although this thesis primarily focuses on 2022 to 2025, it also incorporates specific information and data from earlier years. Local regulations and interventions implemented before 2022 play a critical role in the analysis and synthesis as they provide a foundational

⁴⁸ 38°06'53.7"N 13°21'44.7"E (the coordinate on Google Maps)

⁴⁹ 38°06'55.1"N 13°21'48.2"E (the coordinate on Google Maps)

⁵⁰ 38°06'54.7"N 13°21'36.8"E (the coordinate on Google Maps)

⁵¹ 38°07'04.1"N 13°21'59.8"E (the coordinate on Google Maps)

⁵² 38°07'05.6"N 13°21'35.4"E (the coordinate on Google Maps)

⁵³ 38°06'59.2"N 13°21'35.0"E (the coordinate on Google Maps)

⁵⁴ 38°07'09.2"N 13°21'58.4"E (the coordinate on Google Maps)

⁵⁵ 38°07'09.5"N 13°21'54.2"E (the coordinate on Google Maps)

⁵⁶ 38°07'13.1"N 13°21'33.3"E (the coordinate on Google Maps)

⁵⁷ 38°07'14.6"N 13°21'32.7"E (the coordinate on Google Maps)

⁵⁸ 38°07'14.9"N 13°21'36.5"E (the coordinate on Google Maps)

⁵⁹ 38°07'17.2"N 13°21'27.7"E (the coordinate on Google Maps)

⁶⁰ 38°06'44.1"N 13°21'49.3"E (the coordinate on Google Maps)

⁶¹ 38°06'57.5"N 13°21'43.8"E (the coordinate on Google Maps)

⁶² 38°07'06.8"N 13°21'38.7"E (the coordinate on Google Maps)

context and influence the current state of urban mobility. These insights are essential for comprehensively understanding urban dynamics and sustainable mobility policies.

3.9 Research Strategy

Research strategy is a part of the method of research (Denscombe, 2012). It is always asked in public administration and public management research (O'Sullivan et al., 2017). To conduct quality research, the research strategy must be disclosed. Without disclosure of the research strategy, transparency and credibility may be inaccurate. It can also hinder the replication and verification of the study, which are crucial for building a robust body of knowledge. Additionally, without disclosing the research strategy, it becomes difficult for other researchers to assess the validity and reliability of the research methods. According to Denscombe (2012), it is necessary to specify the research strategy for social science research, including public administration and public management. Students and scientists often employ various kinds of strategies in social research.

The case study is one of the research strategies (Yin, 2003; van Thiel, 2014). A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003, p. 13). Other definitions say that "the case study is a research strategy in which one or several cases of the subject of study are examined in an everyday, real-life setting" (van Thiel, 2014, p. 86). In particular, a case study emphasizes real life as the primary point in many fields, such as programs, events, processes, and activities (Creswell, 2014). As a note, real life should have a unique characteristic (O'Sullivan et al., 2017).

At least, according to Thomas (2021), a case study is characterized by (1) focusing on a selected case, (2) an in-depth understanding of an issue, and (3) collecting data in many different ways (e.g., observations, interviews, and secondary data). In addition, Yin (2003) stated that the case study can be used to understand individual, group, and organizational phenomena deeply. In the broader context, the case study

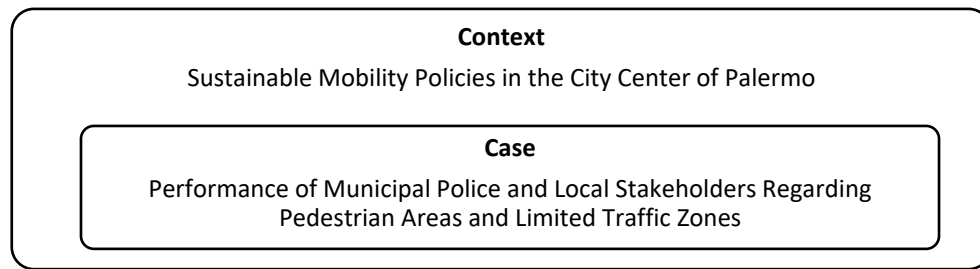
as a research strategy is suitable for analyzing phenomena within a specific local area (see Bianchi, 2021, 2022).

This research employs a case study in the local area, focusing on pedestrian areas and limited traffic zones. It relates to the municipal police performance. As their performance is closely linked to their organizational and institutional contexts, this study is not confined to the entities of individual officers. Furthermore, this research covers local stakeholders who interact with municipal police in pedestrian areas and limited-traffic zones. Additionally, the case in this research also refers to the interactions among relevant stakeholders with or without municipal police in pedestrian areas and limited traffic zones.

It is crucial to acknowledge that individual, organizational, and inter-institutional phenomena are intricately interconnected. For instance, the performance of municipal police officers while patrolling pedestrian areas may be influenced by internal factors such as work ethic and discretionary roles. Their performance may also be affected by both the municipal police agency (e.g., commanders' directives and municipal police department tasks) and broader societal factors (e.g., urban mobility behavior and environmental perceptions). Otherwise, the performance of municipal police may influence the commander's decisions (e.g., patrol time per officer and supporting equipment) as an organizational sphere and social awareness regarding urban mobility as an inter-institutional sphere. Accordingly, this study incorporates individual, organizational, and inter-institutional perspectives. In other words, the case is viewed as a holistic inquiry, including multilevel spheres that may affect the quality of a local area.

The figure below illustrates the context and case that underpin the research conducted in this thesis.

Figure 3.11 Context and Case of Research



Source: Author's elaboration

Basically, the research case is the performance of municipal police and related stakeholders in pedestrian areas and limited traffic zones. This refers to circumstances and conditions when the municipal police enforce regulations and interact with relevant stakeholders. In this research, the term sustainable mobility policies focuses on pedestrian areas and limited traffic zones in the city center of Palermo. This research focuses on downtown areas where sustainable mobility issues (e.g., unauthorized vehicle circulation and congestion) have existed daily for many years. This case meets with what Yin (2003) said that one of the rationales of the single case study is a typical case. According to Yin (2003), a typical case refers to circumstances and conditions of every day. The performance of municipal police in pedestrian areas and limited traffic zones is considered as a typical case in Palermo.

Although this study is applied research using practical methods for performance measurement, performance management, and performance governance, it may indirectly contribute to developing a street-level bureaucracy theory. In accordance with Lipsky (1980), performance measures are among the bases of the street-level bureaucracy theory. Meanwhile, in the modern public administration regime, performance research, including performance measurement, in the public sector shifts toward performance management and governance (Bianchi and Hall, 2023). Building on this foundation, the research may advance street-level bureaucracy theory, particularly through the lens of performance management and governance.

Furthermore, addressing the case through applied research is imperative. The longer it remains unaddressed, the more issues will emerge. Conversely, prompt solutions

will mitigate the likelihood of recurrence. Moreover, to address the unintended consequences of the solutions, system dynamics for performance management and governance is employed as a learning-oriented method (Bianchi et al., 2019). The DPM approach, which covers the organizational domain, and the DPG approach, which covers the inter-institutional domain, may address the unintended consequences of sustainable mobility policies in Palermo's city center. In principle, applying the DPM and DPG approaches can pursue sustainable outcomes (Bianchi, 2016, 2021, 2022). As mentioned in the previous sub-chapter, the performance of municipal police during patrols is closely intertwined with organizational and inter-institutional dynamics, making them challenging to disentangle in the case analysis. Combining the DPM and DPG approaches may strengthen outcomes.

There are several situations and conditions related to this research. Firstly, the municipal government of Palermo has implemented sustainable mobility policies based on the general urban traffic plans (i.e., PGTU). It is currently related to the SUMP, which integrates international, national, regional, and local plans. The SUMP is only for European Union (EU) countries. Each city in the EU has specific additional objectives. Specifically, the SUMP in Palermo is different from other cities in Italy. The mandatory minimum macro-objectives of the SUMP may be the same, but the specific additional objectives are not the same. Second, the municipal police are authorized to control these policies over time. If the performance of municipal police is good, then the quality of pedestrian areas and limited traffic zones may also be suitable. Third, the problem-solving strategy to perform municipal police and related stakeholders is based on local considerations. Local strategy is necessary because each city's culture and problems are different. This is why this research uses a case study covering related systems. According to O'Sullivan et al. (2017, p. 66), "the case study may focus on the case as a whole".

Although a single case study is frequently utilized in the social sciences (Yin, 2003), it is unavoidable for public policy and management research. Public policy and public management research always focus on such problem-solving aspects. It does not matter how many cases there are. The main point is solving the problem and contributing to the relevant theory. Naturally, it depends on the research questions

and the research objectives. A single case study may serve as the basis for designing multiple cases in the same context but with different units of analysis in the following research.

The case study uses a holistic approach (van Thiel, 2014) with in-depth analysis (Creswell, 2014) that is suitable for system dynamics logic, which is a holistic view. Furthermore, “an individual case study of a phenomenon can provide research depth” (O’Sullivan et al., 2017, p. 66), “renders richly detailed and extensive descriptions” (van Thiel, 2014, p. 87). It refers to an in-depth understanding of one case or more (Thomas, 2021).

This research uses a case study as a research strategy to complete the system dynamics as a research method approach. Case study design assists in data collection by providing insight into system dynamics. According to Creswell (2014), researchers collect data through various procedures over a period of time in a case study design. Moreover, the system dynamics method relies on multiple data sources for each analysis. For instance, if time-series data is available on a problem to be studied, then the time-series data is used in data analysis. If time-series data is not available, then mental data sourced from interviews or observations are used (Sterman, 2000). If available, time-series data, interviews, and observations can be used in parallel. In this research, the case study design combines various data sources regarding sustainable mobility issues in Palermo.

This research does not use an ideal system dynamics process, which consists of describing the system, converting the description to level and rate equations, simulating the model, designing alternative policies and structures, educating and debating, and implementing changes in policies and structures (Forrester, 1994, p. 245). Basically, system dynamics combines action and research as part of operations research. In general, system dynamics integrates action and research by computer simulations to model complex systems and test different scenarios. Nevertheless, this research does not involve more mathematical and analytical methods as a general primary characteristic of operational research. This research

only adopts a mental model representing a causal mechanism. The mental model is the first and foremost part of the system dynamics approach.

System dynamics and case studies can be integrated because the two are interrelated for empirical evidence and explanatory purposes. A case study can describe a system (Forrester, 1994) because it works to explore the phenomenon (Yin, 2003). This means that it can contribute to system dynamics. At the very least, embedding a case study design in system dynamics strengthens the description of the system. A case study is used as a methodological strategy to strengthen system dynamics. Ultimately, this leads to a profound understanding of the system. Since this research employs a feedback view approach, comprehending the system is essential.

3.10 Data Analysis and Collection

Data and information sources used in the case study are relevant to the information and data sources explicitly used in the system dynamics method. One of the information sources in system dynamics is observation (Forrester, 1980). Observation refers to the real-life of the system. Such open or semi-structured interviews are currently essential sources of information for modeling system dynamics (Eker & Zimmermann, 2016). As remarked by Eker and Zimmermann (2016), such news, organizational reports, and popular articles can be used as a source of information for modeling. Such focus group discussions, group model building (Vennix, 1996), and other forms can be used to develop model in the future. This means that current system dynamics modeling can use various qualitative data sources. Multiple sources of data and information can be used simultaneously to ensure that the system is not misunderstood.

The table below provides a concise overview of the principal sources of data and information utilized in this study.

Table 3.2 Main Sources of Data and Information

Main Sources	Detail
Observation	<i>Via Maqueda</i>
	<i>Via Vittorio Emanuele</i>
	<i>Via Ruggiero Settimo</i>
	<i>Via Orologio</i>
	<i>Via Bara All'Olivella</i>
	<i>Via Giovanni Meli</i>
	<i>Via del Celso</i>
	<i>Piazza Olivella</i>
	<i>Piazza San Domenico</i>
	<i>Piazza Giovanni Meli</i>
	<i>Piazza Vittorio Bottego</i>
	<i>Piazza delle Stigmate</i>
	<i>Piazza Fonderia</i>
	<i>Piazza Giulio Cesare</i>
	<i>Piazza Bologna</i>
Interview (Government Actors)	Mayor of Palermo
	Head of Urban Mobility Office
	Head of the Municipal District 1
	Municipal Police Commander
	Municipal Police Officers (6 people)
Interview (Non-Government Actors/Stakeholders)	Residents (22 people) (car drivers, motorcyclists, cyclists, scooterists, and pedestrians)
	Tourists (8 people) (pedestrians)
	Cyclist and pedestrian community (4 people)
	Passenger transport drivers (3 people)
	Urbanist (1 person)
	Students (3 people)

Source: Author's elaboration

Table 3.2 depicts various main sources of data and information used simultaneously. The primary data sources consist of interviews with 51 participants. Interviewees from municipal police and other government actors were chosen purposively, while interviewees from non-government actors were chosen accidentally. The number of interviewees was determined by the primary information needs and finalized upon reaching data saturation. Stave et al. (2024, p. 7) stated that “saturation is reached when additional data is unlikely to yield new information, allowing the modeler to advance to the model formalization stage with confidence”. Interviews were conducted by using both with and without an interview guide. The interview

process was conducted in Italian and English. Interviewees answered questions using English and Italian.

Regarding research consent, each participant received a detailed explanation of the study's objectives, procedures, and their rights. It includes the option to withdraw at any stage. Participants who provided consent proceeded with the research, while those who declined were not included. To safeguard privacy, confidentiality was maintained by anonymizing all data and securing records, ensuring that individual identities remained protected throughout the study.

Furthermore, observations were conducted at 15 purposively selected locations. The observation process was conducted routinely in pedestrian areas and limited traffic zones. In addition to the main data source, several other data sources are listed in the following table.

Table 3.3 Additional Sources of Data and Information

Additional Sources	Detail
Official Document	SUMP Documents
	Relevant Government Regulations
	Relevant Municipal Government Regulations
Official Website	https://www.comune.palermo.it/
	https://pums.cittametropolitana.pa.it/
	https://www.comune.palermo.it/pums/
Mass Media	Local Mass Media
	<i>Mobilita Palermo, Palermo Today, Palermo Live, Giornale di Sicilia, Dieci Media</i>
Social media	<i>Mobilita Palermo</i> (Facebook and Instagram)
	<i>Palermo Sostenibile</i> (Instagram)
	<i>Associazione Comitati Civivi Palermo</i> (Facebook)
	<i>Palermo pedonale e ciclabile</i> (Facebook and Instagram)
	<i>Famiglie in Piazza</i> (Facebook and Instagram)
	<i>“Comitato” per una mobilita davvero sostenibile anche a Palermo</i> (Whatsapp Group)

Source: Author's elaboration

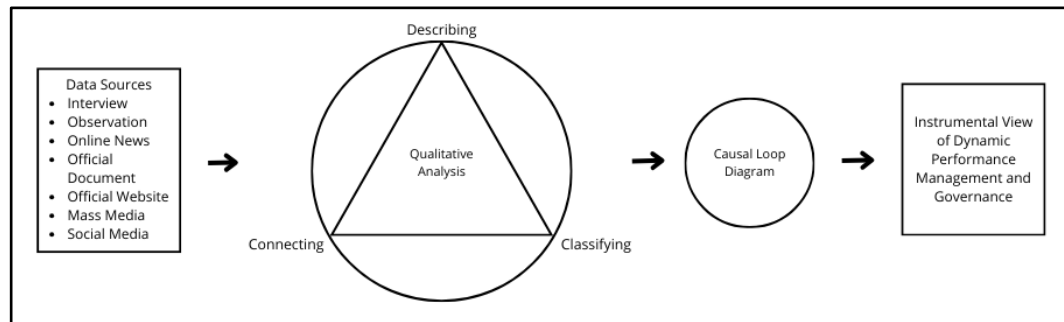
Table 3.3 shows additional sources used to support primary data sources. Additional sources include official documents, official websites, mass media, and social media. Additional sources are part of triangulating information obtained from primary sources. Information obtained from interviews and observations is increasingly

accurate with the addition of information from various sources. Such triangulation of multiple sources is necessary for a case study (van Thiel, 2014). “Triangulation refers to the use of different data collection techniques within one study in order to ensure that the data are telling you what you think they are telling you” (Saunders et al., 2007, p. 139).

Triangulation is necessary for this study to explore and confirm the information and data. For example, when municipal police were interviewed, they stated that they patrol the street *via Giovanni Meli* every afternoon. At other times, when residents were interviewed, they said they never saw patrolmen in the location every afternoon. Thus, observations were conducted periodically to ensure the actual situation. Various additional data sources are searched to ensure correct data and information. It is necessary to obtain a lot of information from other sources about the reason for this. Data and information sources were added to ensure that the information was correct. All primary data and information were obtained between 2022 and early 2025.

After all the data and information were collected, they were analyzed qualitatively. This study integrates data analysis commonly used in qualitative research with the system dynamics method using the instrumental view of DPM. This integration was applied since the available data and information sources were suitable. Qualitative analysis using a circular process is relevant to the principle of closed loops in system dynamics. As a first process, data analysis used a qualitative approach. During this process, themes and variable names were obtained. This process supports the identification of variable names within the causal loop diagram. The following processes apply the instrumental view of DPM/DPG. Qualitative data analysis using a circular approach, compatible with the DPM/DPG view, is adopted. The qualitative approach facilitates subsequent analysis using the instrumental view of DPM/DPG. The following figure illustrates the systematic process from data collection to DPM/DPG modeling.

Figure 3.12 Circular Qualitative Analysis Integrated with the Instrumental View of Dynamic Performance Management and Governance



Source: Adapted from Dey (1993, p. 32)

Figure 3.12 illustrates the data analysis process, starting from data collection to DPM/DPG modeling. As shown in Figure 3.12, the first step is data collection from various sources, including interviews, observations, online news, official documents, official websites, mass media, and social media. The second step is data analysis. In this step, the initial process begins by describing the information and data. Furthermore, the information and data were connected. At the same time, the information and data were classified. Description, classification, and connection processes were repeated until data and information were saturated. The third step is an analysis through the application of causal loop diagrams. At this step, all relevant variables are systematically linked through identified causal relationships. The fourth step is the application of the instrumental view of DPM/DPG, including trade-off analysis based on time and space. The systematic data process enhances the optimization of research related to performance management and governance in the public sector.

Chapter 4

General Description

This chapter describes the context of Palermo's city center and sustainable mobility policies. Also, this chapter undertakes stakeholder mapping in relation to the research focus.

4.1 Palermo and Its City Center

Palermo is the capital of the Sicily region, located in southern Italy. It is a metropolitan city with a high population density. According to the 2025 statistical report published by ISTAT (*Istituto Nazionale di Statistica*), the population of the metropolitan city (or Province) of Palermo is 1,194,439 people⁶³. A total of 625,956 people⁶⁴ live in the city of Palermo. This number positions Palermo and its city center as the most populous city in the Sicily region.

The geographical area of Palermo city spans 160.59 km² according to ISTAT (*Istituto Nazionale di Statistica*)⁶⁵. It encompasses both land and sea. The map below delineates the areas of Palermo and its districts, including the city center.

Based on the following figure, Palermo city has eight districts (an administrative division) geographically⁶⁶. The district is referred to as a *Circonscrizione* locally. Each district possesses distinct geographical characteristics and functions. For instance, District 8 is a port area. District 7 is a coastal tourism area, including Mondello Beach as one of the favorite beach tourism spots. Districts 1, 2, 7, and 8 are directly adjacent to the sea. Districts 5 and 6 are located near the mountain area.

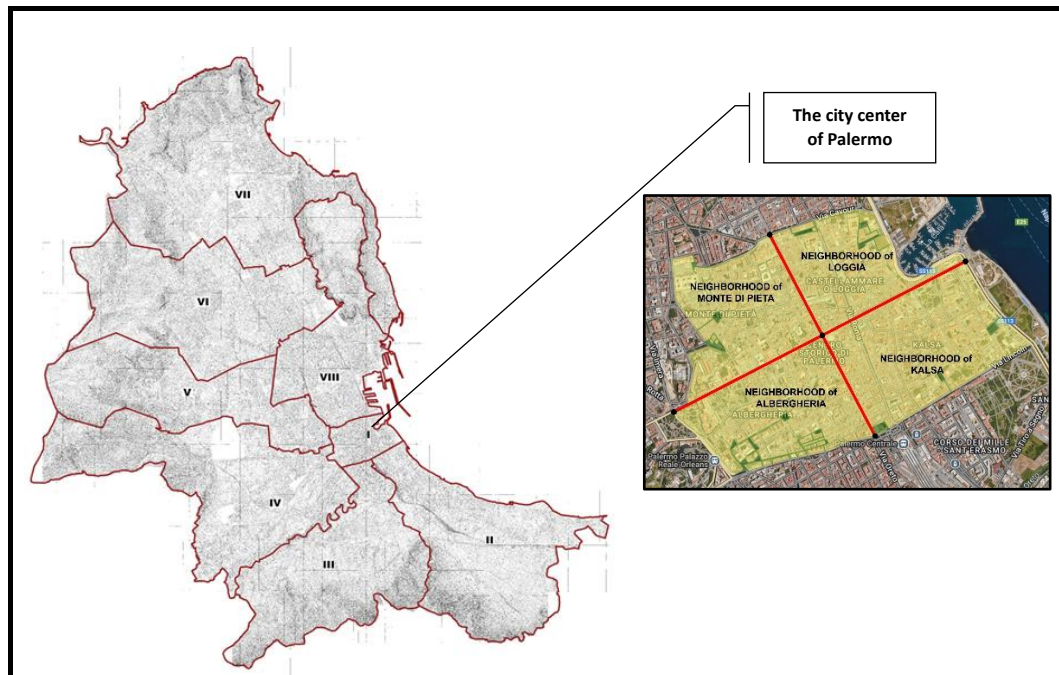
⁶³ More information can be found at <https://demo.istat.it/app/?l=en&a=2025&i=D7B>

⁶⁴ More information can be found at <https://demo.istat.it/app/?l=en&a=2025&i=D7B>

⁶⁵ More information can be found at <https://www.istat.it/classificazione/principali-statistiche-geografiche-sui-comuni/>

⁶⁶ Some information can be found at <https://en.wikipedia.org/wiki/Palermo>.

Figure 4.1 Map of Palermo City



Source: Modified by the Author from <https://www.comune.palermo.it/>

The city center is in District 1. District 1 comprises four neighborhoods, namely *Kalsa* (or *Tribunali*), *Loggia* (or *Castellammare*), *Monte di Pietà* (or *Il Capo*), and *Albergheria* (or *Palazzo Reale*). Districts 2, 3, 4, 5, and 8 that directly border District 1 are also part of the city center. This means that the city center encompasses District 1 and several surrounding areas. Figure 4.1 illustrates that the city center is strategically located and borders several districts. The city center of Palermo has various functions, which are explained in the following points.

4.1.1 Administrative Center of Multilevel Government

The city center of Palermo plays a crucial role as the administrative and political center of various government levels, comprising the regional government of Sicily, the metropolitan city government of Palermo, the municipal government of Palermo, and the administrative function of District 1.

The offices of the President of the Sicily region and the Parliament of Sicily are in the city center. Both offices hold significant importance in the Sicily region. This indicates that the administrative and political affairs of all provinces (e.g., Trapani, Agrigento, Caltanissetta, Enna, Syracuse, and Ragusa) and other metropolitan cities

(e.g., Catania and Messina) in Sicily are centralized in Palermo's city center. Additionally, national and international meetings are frequently held at these two essential offices.

The city center of Palermo is also the principal area of the metropolitan city of Palermo. The administrative building of the metropolitan city is in the city center. It serves as the administrative hub for dozens of towns⁶⁷ in the surrounding areas, among them Alimena, Bagheria, Monreale, and Cefalù. Administratively classified as a metropolitan area—more than just a city, Palermo is among the strategic urban areas in Italy, reflecting its importance in local government affairs.

Primarily, the city center serves as the administrative hub of the municipal government of Palermo. All major government and political buildings, including the mayor's office, the *Consiglio Comunale* (legislative body) office, and the *Giunta Comunale* (executive body) office, are located in the city center. Also, the city center serves as the administrative hub for all districts, with District 1 being of particular significance.

Other government buildings, such as the branch offices of the military police and state police, are also located in the city center. They play a role as administrative offices in the Sicilian region generally and the municipal government of Palermo, specifically.

4.1.2 Public and Private Services Core

As the administrative center, the city center embodies the core of public service provided by the various government offices. Government offices at all levels serve as places of administrative service based on their respective authorities. In addition to administrative services, which are primarily provided by specific governmental organizations, emergency public services, such as healthcare and firefighting, also operate daily. These emergency services actively deliver door-to-door assistance to residents.

⁶⁷ There are 82 towns or *comuni*.

Alongside public services provided by various governmental organizations, private sector organizations also offer public services. For instance, *Poste Italiane*, a state-owned enterprise, serves postal services. Various companies, including private companies and municipally owned corporations, provide electricity, water supply, waste management, and freight services. They offer both in-office and door-to-door services to clients upon request and need.

Additionally, various banks, including UniCredit, Intesa Sanpaolo, and *Banco Nazionale del Lavoro*, offer services throughout the city center. Other private entities also provide services, including property management and tourism assistance. Specialized organizations such as *Centro Assistenza Fiscale* (CAF), Tax Assistance Centres, and Patronato, which provide support to workers and immigrants, offer assistance to residents in the city center.

4.1.3 Center of Education, Social and Religious Activities

The city center of Palermo serves as a hub for educational activities. Various schools at different levels, including kindergartens, elementary schools, junior high schools, and senior high schools, operate in and around the city center. The various faculties (e.g., the Faculty of Political Sciences and International Relations, and the Faculty of Law) and the Rector's Office of the University of Palermo (Unipa) are also located in the city center. Meanwhile, the main campus of Unipa is located near the city center.

Also, the city center of Palermo and its surroundings serve as a hub for social activities. Various public spaces provide opportunities for social interaction, family recreation, and local gatherings. Activities such as volunteering and community events often take place in the city center. One of the main centers for these activities is *Foro Italico*, a large public space in Palermo. Generally, *Foro Italico* functions as a hub for sports activities. Interestingly, the city center is home to buskers or street performers who frequently deliver high-quality performances, captivating visitors with their talent. They remain active throughout the day and, sometimes, late into the night. Their presence has become an integral part of all social activities in the city center.

Additionally, many churches and mosques are in the city center. Catholic Christians and Muslims routinely worship there. Similarly, other religions, such as Hinduism, Buddhism, and Folk Religion, may also have places of worship around the city center. Muslims regularly participate in many activities, including prayer and donation, at the mosque throughout the day and into the evening. At least ten mosques in the city center regularly facilitate these activities. The presence of these religious activities highlights the city center as a place of worship for adherents of various religions and beliefs.

4.1.4 Cultural and Historical Landmark

Palermo holds significant cultural and historical importance, contributing to its role as a prominent city worldwide. Approval of the *Palace of Arab-Norman Palermo*, located in the city center, as a UNESCO ‘World Heritage’ Site⁶⁸ indicates that this place is a cultural and historical landmark. Surrounding the Arab-Norman Palermo, there are other significant cultural and historical places, such as the Palermo Cathedral, the Church of *San Giovanni degli Eremiti*, and the Baroque Square (i.e., *Quattro Canti*⁶⁹). The surrounding buildings of the historical places reflect a blend of medieval cultural heritage. All cultural and historical landmarks are significant attractions for both local and international tourists.

In addition to its cultural and historical landmarks, the city center is home to many significant attractions, including concerts, festivals, exhibitions, events, artworks, opera houses (e.g., Massimo Theater and Politeama Theater), and museums (e.g., Modern Art Gallery of Sant’Anna, Regional Archeological Museum of Antonio Salinas and Mafia Museum). Specifically, the annual Festival of *Santa Rosalia*, held around the city center, is a major tourist attraction. Also, the annual Easter celebrations attract significant attention from both residents and tourists.

Considering the significance of cultural and historical landmarks, the city center of Palermo is recognized as a prominent tourist destination. According to SISTAN⁷⁰

⁶⁸ More information can be found at <https://whc.unesco.org/en/decisions/6378>.

⁶⁹ More information about *Quattro Canti* can be found at [https://it.wikipedia.org/wiki/Quattro_Canti_\(Palermo\)](https://it.wikipedia.org/wiki/Quattro_Canti_(Palermo))

⁷⁰ More information can be found at https://www.sistan.it/index.php?id=197&tx_wfqbe_pi1%5Bsoggetto%5D=7571.

(*Sistema Statistico Nazionale*), tourist arrivals in Palermo increased by 55.8% from 2020 to 2021. In 2022, there was a further increase of 76.5% compared to 2021⁷¹. Visiting tourists can contribute to the city's image, thereby enhancing Palermo's economic vitality.

4.1.5 Commercial Zone

Three renowned markets—*Ballarò*, *Capo*, and *Vucciria*—are in the city center. They operate from morning until night, with extended hours during the summer. These three traditional markets have existed for centuries, establishing themselves as commercial zones with a long history. Apart from being commercial zones, these three markets serve as cultural icons of Palermo city and, more broadly, of the Sicily region. They frequently attract local and international tourists.

In addition to traditional markets, restaurants, bars, food shops, mini markets, merchants, artisans, and hawkers sell their goods along the streets of the city center. These commercial activities are visible along the famous streets of *via Maqueda* and *via Vittorio Emanuele*. In particular, the street *via Roma* features various shopping centers offering a range of clothing, bags, and jewelry. There are also famous supermarkets or groceries such as Lidl, Famila, and Conad in the city center.

Moreover, hotels, hostels, and apartments provide accommodation services in the city center, making it a preferred choice for tourists. Most of these hotels and hostels partner with popular accommodation platforms or sites, including Booking.com, Airbnb, and Agoda. This partnership enhances their accessibility and quality of services. Their presence, encompassing all business and entrepreneurial activities mentioned previously, enhances the role of the city center as a commercial zone.

4.1.6 Residential Area

Like other residential districts, the city center also serves as a residential area. However, compared to other districts, District 1 is densely populated. A total of 26,810 people live in District 1, and the population density is 10,612/km² in the city

⁷¹ More information can be found at https://www.comune.palermo.it/js/server/uploads/statistica/_02012024092611.pdf and <https://www.comune.palermo.it/palermo-statistica.php?sez=187&sel=7&per=2022&cap=6>

center⁷². District 1 is characterized by a large number of apartments and very narrow streets. Despite having a small area, District 1 is home to thousands of residents. The residents of this area include both native Palermitans and immigrants.

As a residential area, the city center attracts a diverse range of immigrants, which may lead to increased population density. In fact, Palermo has emerged as a home for immigrants⁷³ from a few countries in South Asia (e.g., Bangladesh and Sri Lanka) and North Africa (e.g., Tunisia and Morocco). The largest groups of immigrants include Romanians, Ghanaians, and Filipinos. Besides, Palermo has undergone significant urbanization, drawing populations from the surrounding towns. The growing number of immigrants and urban migrants may contribute, specifically, to the population in the city center.

4.1.7 Mobility Hub

The most important aspect of the city center is its role as a mobility hub. The central station and main bus terminal are in the city center, facilitating regional connectivity. Considering the mobility hub, bus and tram stops are conveniently located near the bus terminal and central station, providing connections to local and regional transport. Dozens of regional transport routes (e.g., buses provided by many companies and trains provided by Trenitalia) and local public transport routes (e.g., AMAT Palermo buses and trams) operate daily in and around the city center. The transport services reflect a busy and congested transportation system.

Moreover, other passenger transport services are available, including taxis, three-wheeled vehicles (e.g., Ape Tour Taxies), and animal-powered transport (e.g., horse carriages). Among the types of transportation, there are tourist train services and city-sightseeing buses that operate daily, passing through the city center. Various private companies operate the passenger transportation services. Additionally, e-

⁷² <https://www.citypopulation.de/en/italy/palermocity/>

⁷³ More information can be found at <https://www.comune.palermo.it/bilancio-sociale.php?anno=2019&id=1590&lev=2&cap=1686> and https://palermohub.opendatasicilia.it/stranieri_residenti_subregions_dot_2020.html#10/38.1119/13.2440

bikes and e-scooters are available for rent around the city. This indicates that many actors are involved in the transportation system operating in the city of Palermo.

As a mobility hub, the city center of Palermo offers connections through both water and land transportation, resulting in a highly varied transportation system. Palermo has a very busy port serving ships and cruises. The port, located near the city center, serves regional and international routes. Accordingly, Palermo is a strategically crucial maritime area in the Mediterranean Sea.

In summary, the city center integrates various transportation modes, including (1) linking local and international routes, (2) facilitating land and water transportation, and (3) providing personal vehicles, passenger vehicles, and public transportation. Most importantly, pedestrian areas and LTZs, which are the primary focus of sustainable mobility, are integrated into the mobility hub. Accordingly, sustainable mobility policies are a necessity.

4.2 Description of Sustainable Mobility Policies

In Palermo, sustainable mobility policies were initiated in 2013 according to the regulation of '*deliberazione consiliare n. 365 del 29/10/2013*' concerning '*Piano Generale del Traffico Urbano*' (PGTU). The PGTU is a local framework plan for urban mobility and traffic. This plan provides a detailed description of the objectives and targets that can be achieved in the present and future, including the strategies and measures. The PGTU outlines a comprehensive process for implementing interventions successfully. It is more than a document, representing the emergence of municipal government and society's efforts to overcome the urban mobility issues.

The PGTU is a local initiative that follows European mobility standards. It follows the 'green paper' in terms of 'Towards a New Culture for Urban Mobility' issued by the Commission of the European Communities in 2007⁷⁴. The following table provides a detailed overview of the interventions and objectives.

⁷⁴ https://ec.europa.eu/commission/presscorner/detail/en/MEMO_07_379

Table 4.1 Interventions and Objectives of the PGTU

Interventions	Objectives
Intervention to improve pedestrian	Encourage pedestrian activity in urban areas (e.g., squares and streets), particularly in spaces or places with historical, architectural, and monumental significance
	Promote pedestrian mobility in the initial and final stages of using public transport or private vehicles
	Enhance the safety and accessibility of pedestrian routes, including those integrated into the road and street network, such as sidewalks and green areas
Intervention to improve public transport	Enhance the efficiency and effectiveness of public transportation compared to private cars
	Increase the accessibility and comfort of urban transport
	Reduce waiting times at bus and tram stops
	Enhance the connectivity of public transport with parking facilities
Intervention for the movement of private vehicles	Separate traffic types, such as transit, entry/exit, and internal movements, by assigning them to designated alternative routes
	Improve the flow of motorized vehicle traffic by ensuring the efficient use of roads or streets and by distributing traffic across alternative routes
	Improve road or street spaces and traffic signs
Intervention on the parking of private vehicles	Adjust parking regulations to align with overall traffic issues
	Relocate parking away from roads or streets designated for through traffic to improve vehicle circulation
	Implement parking restrictions by installing the necessary horizontal and vertical signage in compliance with the traffic code (<i>Nuovo Codice della Strada/NCdS</i>)
	Maximize parking provision in neighboring streets
Intervention for road safety and traffic moderation	Enforce proper road user behavior by implementing a comprehensive road safety action program
	Reduce road fatalities and accidents
Intervention for cycle lanes	Promote the use of bicycles beyond leisure activities, such as commuting to work or school
	Develop appropriate initiatives to establish bicycle parking areas, strategically placed along existing cycling routes and near essential places, such as stations, offices, and entertainment venues
Intervention for the development of Intelligent Transport Systems (ITS)	Implement specific methods and technologies in urban mobility
	Develop an integrated environment for various transport systems and all mobility-related information
	Enhance the management of traffic light intersections to reduce congestion and facilitate the activation of information flows for users

Source: Tabulated by the Author from PGTU 2013

Based on Table 4.1, the PGTU encompasses a broad range of interventions related to the general urban mobility plan. Each intervention has a distinct objective. Seven interventions are the primary focus of urban mobility, with those related to pedestrians being the most prominent in the sustainable mobility agenda. Therefore, this study specifically investigates interventions related to pedestrians, such as pedestrian areas and LTZs. Other interventions shown in Table 4.1 are not investigated in detail.

Considering urban mobility issues, the municipal government has implemented pedestrian areas and Limited Traffic Zones (LTZs). These two interventions are being implemented not only in the city center but also in other strategic areas of Palermo (e.g., shopping centers and residential areas). Pedestrian areas serve multiple purposes, including enhancing pedestrian access, reducing pollution, and preserving historic monuments. LTZs may reduce traffic congestion, minimize traffic flow, limit the circulation of motorized vehicles, and create designated lanes for slow-moving vehicles. In the PGTU, regulations regarding pedestrian areas and LTZs are interrelated to other interventions, specifically those concerning bicycle lanes and parking areas.

To maximize the interventions in the PGTU, the municipal government of Palermo began approving the cognitive framework for the SUMP in 2018, a year after the Italian government adopted the SUMP⁷⁵ guidelines in 2017. Palermo's municipal government has approved the guidelines and has prepared the SUMP documents since 2018. As of this year, the PGTU has been converted into the SUMP, whose instructions are regulated and determined by the Ministry of Infrastructure and Transport, Italy. Specific guidelines and documents approved by Palermo's municipal government include identifying key challenges, setting objectives and targets for sustainable mobility, defining measures and actions to achieve those objectives, and establishing a monitoring and evaluation framework. The SUMP documents provide a comprehensive roadmap for improving mobility and

⁷⁵ The current SUMP documents were introduced by the European Union in 2019, and the initial documents were published in 2013.

transportation in Palermo. These documents ensure a more sustainable and efficient urban mobility system.

Based on the Degree of the Ministry of Infrastructure and Transportation on 4 August 2017 regarding the guidelines for sustainable urban mobility plans, the Ministry of Infrastructure and Transport encourages metropolitan areas (e.g., Milan, Rome, and Palermo) to develop sustainable mobility systems. This degree states that municipal governments must prioritize enhancing accessibility to urban and peri-urban areas through high-quality mobility and transport systems. Additionally, municipal governments should focus on improving the usability of public spaces from environmental, economic, and social perspectives.

The documents of the SUMP in Palermo are guidelines and a strategic reference framework for developing a sustainable mobility system in the medium and long term. Various interventions and measures are implemented in accordance with the instruments and terms of reference. The interventions stipulated in the SUMP serve as a guide for the municipal government of Palermo and related stakeholders in designing and implementing sustainable mobility policies. The interventions or policies include developing an extensive cycling network, promoting public transportation, and enhancing active mobility infrastructure. Additionally, the SUMP emphasizes the integration of different modes of transportation, such as car-and-bike sharing. It aims to reduce reliance on private cars and decrease carbon emissions in the city.

The general concept of Sustainable Urban Mobility Plans (SUMP) is comprehensive. It was designed to serve as a reference for all countries, particularly those in European Union member states, that ratify it. According to COM(2013) 913 of the European Commission⁷⁶, it is essential for municipal or local governments to consider several elements of sustainable mobility plans. The following table provides a detailed explanation of these elements.

⁷⁶ [EUR-Lex - 52013DC0913 - EN - EUR-Lex \(europa.eu\)](#).

Table 4.2 General Concept of SUMPs

1	Goals and Objectives
	A sustainable urban mobility plan has as its central goal improving the accessibility of urban areas and providing high-quality and sustainable mobility and transport to, through, and within the urban area. It regards the needs of the 'functioning city' and its hinterland rather than a municipal administrative region.
2	Long-term Vision and Clear Implementation Plan
	A sustainable urban mobility plan presents or is linked to an existing long-term strategy for the future development of the urban area and, in this context, for the future development of transport and mobility infrastructure and services. A sustainable urban mobility plan equally includes a delivery plan for the short-term implementation of the strategy
3	Assessment of Current and Future Performance
	The development of sustainable urban mobility should build on a careful assessment of the present and future performance of the urban transport system.
4	Balanced and Integrated Development of All Modes
	A sustainable urban mobility plan fosters a balanced development of all relevant transport modes while encouraging a shift towards more sustainable modes. The plan puts forward an integrated set of technical, infrastructure, policy-based, and soft measures to improve performance and cost-effectiveness with regard to the declared goal and specific objectives.
5	Horizontal and vertical integration
	The development and implementation of a sustainable urban mobility plan follows an integrated approach with a high level of cooperation, coordination, and consultation between the different levels of government and relevant authorities. The local planning authority should put in place appropriate structures and procedures.
6	Participatory Approach
	A sustainable urban mobility plan follows a transparent and participatory approach.
7	Monitoring, Review, Reporting
	The implementation of a sustainable urban mobility plan should be closely monitored.
8	Quality Assurance
	Local Planning Authorities should have mechanisms to ensure the quality and validate compliance of the sustainable urban mobility plan with the requirements of the Sustainable Urban Mobility Plan concept.

Source: European Commission (2013), Annex 1 of COM(2013) 913, in terms of a concept for sustainable urban mobility plans

The municipal government of Palermo, which adopted the SUMP in 2018 under "*deliberazione n. 198 del 20/12/2018*", has attempted to approve a sustainable urban mobility plan based on "*deliberazione n. 198 del 07/03/2019*". This regulation includes reference and alternative plan scenarios (base and enhanced scenarios). In these scenarios, the short-term target is 2025, and the long-term target is 2030. The regulation, in principle, outlines scenarios for medium- and long-term plans. The scenarios outlined in the regulation are crucial for ensuring the effective implementation of the policies. By considering future impacts and challenges, the scenarios facilitate proactive decision-making and resource allocation, thereby maximizing long-term benefits and minimizing potential risks.

All current regulations regarding sustainable mobility in Palermo refer to the Ministry of Infrastructure and Transport's regulations, such as "*Decreto Ministeriale n. 397 del 04/8/2017*" and other relevant national regulations. The SUMP, initiated in Palermo in 2018/2019, has the following objectives.

Figure 4.2 Objectives of the SUMP in Palermo

A. Effectiveness and Efficiency of the Mobility System Mandatory minimum macro-objectives: A1. Improvement of local public transport; A2. Modal rebalancing of mobility; A3. Reduction of congestion; A4. Improved accessibility of people and goods; A5. Improvement of the integration between the development of the mobility system and the structure and development of the territory; A6. Improvement of the quality of road and urban space Specific additional objectives: A7. Improve the attractiveness of collective public transport; A8. Improve the attractiveness of shared transport; A9. Improve the economic performance of local public transport; A10. Reduce road congestion	B. Energy and Environmental Sustainability Mandatory minimum macro-objectives: B1. Reduction in the consumption of traditional fuels other than alternative fuels; B2. Improved air quality; B3. Reduction of noise pollution Specific additional objectives: B4. Improve the attractiveness of cycle-pedestrian transport; B5. Improve the energy and environmental performance of the passenger and freight vehicle fleet
C. Safety of Road Mobility Mandatory minimum macro-objectives: C1. Reduction of road accidents; C2. Significant reduction in the general number of accidents with deaths and injuries; C3. Significant reduction in social costs resulting from accidents; C4. Significant reduction in the number of accidents with deaths and injuries among vulnerable users Specific additional objectives: C5. Improve the safety of vehicular traffic; C6. Improve the safety of pedestrians and cyclists	D. Socio-economic Sustainability Mandatory minimum macro-objectives: D1. Improvement of social inclusion; D2. Increased citizen satisfaction; D3. Increase in the employment rate; D4. Reduction of mobility costs Specific additional objectives: D5. Ensure accessibility to people with reduced mobility; D6. Improve the safety of pedestrians and cyclists

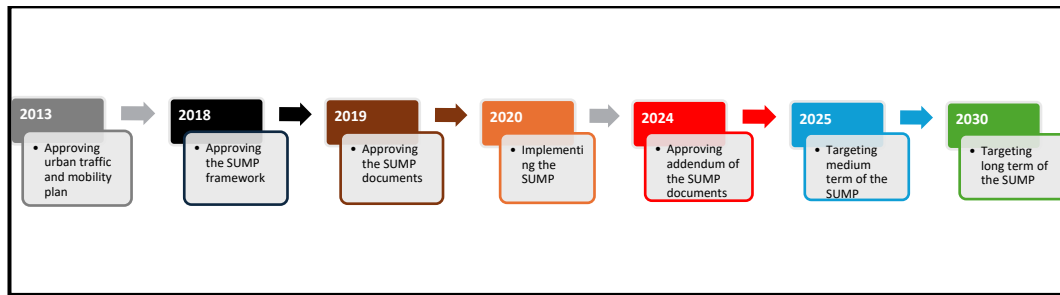
Source: Palermo's Municipal Government Regulation of "*deliberazione n. 198 del 07/03/2019*" about adopting SUMP in Palermo referred to the Ministerial Degree of the Ministry of Infrastructure and Transport on 04/08/2017

Concerning the efforts of the municipal government of Palermo, the SUMP aims to integrate existing municipal government documents such as the general traffic plan (i.e., PGTU), air environment plan, and acoustic zoning plan. By incorporating these regulations, the SUMP documents contain a comprehensive view and a sustainable mobility plan for Palermo. This sustainable mobility plan considers not just traffic but also citizen satisfaction. Figure 4.2 shows the overall objectives adopted by the municipal government. The mandatory minimum macro-objectives are national targets that the municipal government is required to implement. Meanwhile, the specific additional objectives are local targets tailored to the needs of each local area.

There are several objectives related to pedestrian areas and limited traffic zones, namely improving the attractiveness of collective public transport (A.7), improving the attractiveness of shared transport (A.8), improving the economic performance of local public transport (A.9), reducing road congestion (A.10), improving the attractiveness of cycle-pedestrian transport (B4), improving the energy and environmental performance of the passenger and freight vehicle fleet (B5), improving the safety of vehicular traffic (C.5), improving the safety of pedestrians and cyclists (C.6), ensuring accessibility to people with reduced mobility (D.5), improving the safety of pedestrians and cyclists (D.6). Certainly, all the objectives must be achieved by 2030.

To enhance interventions in the SUMP and achieve medium-term targets by 2025 and long-term targets by 2030, the municipal government of Palermo established an addendum to the SUMP in 2024. The addendum pertains to changes in interventions in two specific areas: the prioritization of tram system projects and the expansion of bicycle lanes. Both points are strategic interventions that improve the quality of urban mobility. Accordingly, the SUMP focuses on local strategic interests based on a development vision for the current and future years. For more information, the following figure illustrates the timeline of the SUMP in Palermo, covering past, present, and future periods.

Figure 4.3 Road Map of Sustainable Mobility Policies in Palermo



Source: Author's elaboration

Figure 4.3 shows seven processes relating to the specific year or period. These six processes are marked with different colors. The first process started in 2013 (grey). It includes the period from 2013 to 2017. During this period, sustainable mobility policies refer to the approval and implementation of the General Urban Traffic Plan (PGTU). The second process is in 2018 (black). This year, the local authority approved the SUMP framework. The third process is in 2019 (brown). This year, the local authority approved the SUMP documents. The fourth process is in 2020 (orange). This process refers to implementing the SUMP from 2020 to 2024. The fifth process is in 2024 (red). This year, the local authority revised the SUMP documents. Next, the sixth process is in 2025 (blue), which is the medium-term target. The last is the seventh process in 2030 (green). This year is the long-term target.

Based on Figure 4.3, it can be concluded that the period from 2013 to 2018 constitutes the initiative stage of sustainable mobility policies in Palermo. The initiative stage refers to the period when the local authority initiated and implemented sustainable mobility policies based on the PGTU. The period from 2018 to 2019 is identified as the learning stage. This period refers to when the municipal authority evaluated the PGTU and adopted the SUMP. The period from 2020 to 2025 is referred to as the development stage. In this period, the local authority has designed and developed the SUMP following the latest guidelines. The period from 2025 to 2030 is designated as the optimized stage of sustainable mobility policies. In this period, it is targeted for optimization, leading to the achievement of intended outcomes.

Between 2013 and 2024, the municipal government of Palermo implemented various regulations, compiled relevant documents, and undertook various interventions. During this period, interventions in pedestrian areas and limited traffic zones are comprehensively regulated in the PGTU and SUMP. This means that the interventions are efforts in which the municipal government of Palermo has long intervened. Unfortunately, the problems related to pedestrian areas and limited traffic zones have not been resolved optimally.

Recently, the municipal government of Palermo has implemented various interventions to support pedestrian areas and reduce the flow of private vehicles in the city center. For instance, in the street *via Maqueda*⁷⁷, *via Vittorio Emanuele*⁷⁸ and *via Ruggiero Settimo*⁷⁹, the municipality regulates these three streets with special provisions. Based on various existing rules⁸⁰, at least three essential provisions are regulated by the local authority on these three streets. First, pedestrians can access all three streets for 24 hours. Second, micromobility vehicles such as bikes, e-bikes, and e-scooters (rent and private micromobility) can pass through the three streets at certain times and in certain areas. For example, micromobility vehicles are prohibited from passing from 10 am to 10 pm on weekdays along the street *via Ruggiero Settimo*. However, the three streets have different rules. Detailed provisions can be seen on the traffic signs installed in various areas. Third, all vehicles are prohibited from passing through the three streets except for certain permitted vehicles, including police cars, ambulances, fire engines, goods vehicles, and vehicles belonging to residents accessing their designated parking areas. Such goods vehicles can only pass through at certain times.

In addition, the local authority prohibits the use of public lands for parking lots. The local authority has installed signs prohibiting parking for 24 hours on many public

⁷⁷ 38°07'16.1"N 13°21'28.5"E (the coordinate on Google Maps)

⁷⁸ 38°06'56.4"N 13°21'41.0"E (the coordinate on Google Maps)

⁷⁹ 38°07'16.7"N 13°21'28.1"E (the coordinate on Google Maps)

⁸⁰ For more information, the regulations regarding pedestrian areas and limited traffic zones are available in various regulations. The regulations consist of *nr. 956 del 25/07/2019*, *nr. 557 del 27/07/2020*, *nr. 865 del 04/08/2021*, *nr. 869 del 04/08/2021*, *nr.1660 del 13/12/2023*, *nr.1688 del 20/12/2023*, and *modifica e integrazione all'OD 1688 del 20/12/2023*. It may also be available for other regulations that are not mentioned.

lands. It is necessary to intervene since citizens often use public lands as a parking lot. For instance, in *Piazza Olivella*⁸¹, *Piazza San Domenico*⁸², *Piazza Giovanni Meli*,⁸³ and *Piazza Vittorio Bottego*⁸⁴, the local authority has installed 24-hour no-parking signs in the areas. Preventing parking bans on various public lands is carried out to support sustainable mobility policies. Public land should not be used for personal interests without permission. For parking areas, the local authority has designated certain areas that can be used by motorcyclists and car drivers to park their vehicles.

Specifically, in the city center, or the downtown area, and its surrounding areas, the municipal government has marked all streets and public lands according to their respective uses. These efforts are carried out because downtown Palermo and its surrounding areas are strategic areas with various functions. These functions include historical areas, mobility hubs, business centers, social activities, meeting points, and resident zones. Therefore, many visitors visit downtown Palermo and its surrounding areas. Especially on weekends, the number of visitors tends to increase compared to weekdays. Downtown Palermo and its surrounding areas have become cultural and social icons for the people of Palermo.

When visiting the city center, some visitors opt for public transportation, while others use private vehicles. As a note, a significant number of visitors appear to prefer using private vehicles over public transportation. Using private cars is undoubtedly an essential problem. The increasing number of private cars may impact vehicle circulation in pedestrian areas and limited traffic zones, thereby affecting pedestrian accessibility. Also, the rise in private cars has the potential to exacerbate congestion. Therefore, interventions carried out by the local authority periodically are a necessity. Achieving sustainable mobility in Palermo, particularly in the downtown area and its surrounding neighborhoods, appears challenging without effective interventions.

⁸¹ 38°07'14.2"N 13°21'37.0"E (the coordinate on Google Maps)

⁸² 38°07'07.2"N 13°21'47.0"E (the coordinate on Google Maps)

⁸³ 38°07'09.3"N 13°21'51.3"E (the coordinate on Google Maps)

⁸⁴ 38°07'04.8"N 13°21'43.9"E (the coordinate on Google Maps)

4.3 Issues in Pedestrian Areas and Limited Traffic Zones (LTZs)

A pedestrian area, locally called *area pedonale*, is an urban space, such as a square, street, or road, designated for pedestrians' free and safe movement (PGTU 2013). In this area, vehicle circulation is prohibited or restricted to authorized vehicles. In other words, according to the Italian Law No. 285 of 1992 regarding the New Highway Code and the Italian Law No. 177 of 2024 regarding the Revision of the New Highway Code, the pedestrian area is a zone where vehicular circulation is prohibited, except for emergency service vehicles, bicycles, and vehicles serving individuals with limited or impaired motor skills. According to the law, exemptions may be granted for zero-emission vehicles.

A Limited Traffic Zone (LTZ), locally known as *Zona a Traffico Limitato (ZTL)*, is a street or road in an urban area designated to restrict vehicular traffic, particularly private vehicles, with exceptions for those equipped with low-emission engines (PGTU 2013). Other definitions, according to the Italian Law No. 285 of 1992 regarding the New Highway Code and the Italian Law No. 177 of 2024 regarding the Revision of the New Highway Code, LTZ is an area where access and vehicular circulation are restricted to specified hours.

Unfortunately, the situation and conditions in pedestrian areas and limited traffic zones do not align with the proper conditions, as mentioned in the definitions provided in the preceding two paragraphs. In the downtown area of Palermo, pedestrian areas and limited traffic zones have relatively similar emerging issues. The issues frequently arise throughout the year, occurring almost every hour⁸⁵ or day⁸⁶. At least, the four photos in the figures below represent the daily reality.

⁸⁵ Specifically, during morning commuting hours and the afternoon rush hour.

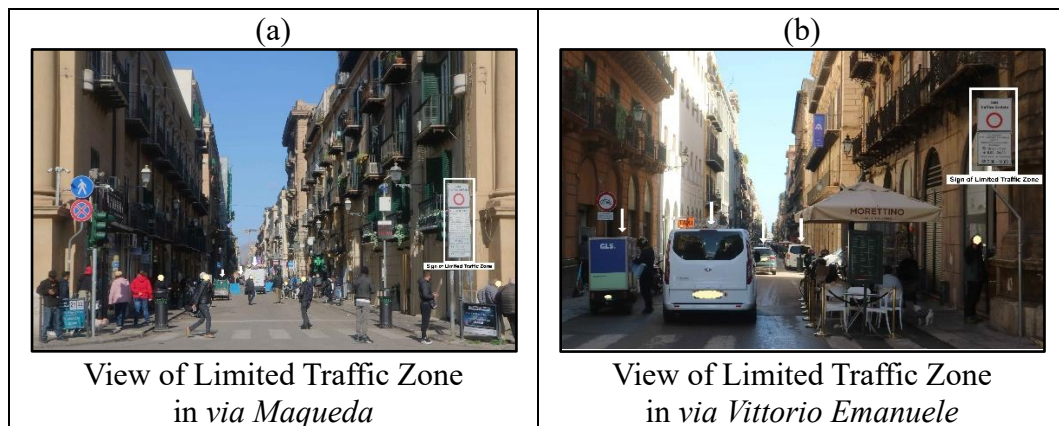
⁸⁶ During holidays and weekends, the issue of vehicles parking and passing in restricted areas is becoming increasingly concerning.

Figure 4.4 Representative View of Pedestrian Areas



Source: The Author's Research Documentation in 2025 (The author took the photos)

Figure 4.5 Representative View of Limited Traffic Zones



Source: The Author's Research Documentation in 2025 (The author took the photos)

Figure 4.4 illustrates the conditions in pedestrian areas, specifically in the street *via Giovanni Meli* (Figure 4.4a) and *Piazza Fonderia* (Figure 4.4b). Figure 4.4 (a and b) clearly illustrates private car drivers (and motorcyclists) parking and passing through the streets despite a visible pedestrian area sign. The figures show that car drivers are indifferent to the restrictions. Additionally, the figures indicate that there are no individuals who genuinely care about the issues. These figures represent the reality in other pedestrian areas within the city center.

Figure 4.5 illustrates the conditions in limited traffic zones, specifically in the street *via Maqueda* (Figure 4.5a) and *via Vittorio Emanuele* (Figure 4.5b). Figure 4.5 (a and b) clearly illustrates private cars, taxis, three-wheeled vehicles, and small straight trucks parking and passing through the streets despite a visible limited

traffic zone sign. These photos⁸⁷ illustrate the persistent passage of unauthorized vehicles through limited traffic zones despite posted signage. These situations and conditions persist throughout the entire day.

Figures 4.4 and 4.5 directly and implicitly depict the emerging issues in pedestrian areas and limited traffic zones in the city center of Palermo. At a minimum, these issues include unauthorized vehicle circulation, availability of public space, and citizen satisfaction.

The primary issue in pedestrian areas and limited traffic zones is the high volume of unauthorized vehicle circulation. This refers to all vehicles prohibited from passing or parking without authority. The vehicles include passenger cars, goods vehicles, minicars, three-wheeled vehicles, two-wheeled vehicles, quadricycles, light-duty vehicles (e.g., vans and minibusses), and heavy-duty vehicles (e.g., trucks and buses). This includes micro-mobility vehicles such as bikes, e-bikes, and e-scooters, both personal and company-owned (e.g., Lime and Bird).

Types of vehicles allowed to pass through pedestrian areas⁸⁸ consist of vehicles serving people with disabilities, police cars, ambulances, fire engines (in emergencies), authorized goods vehicles (box trucks), and private vehicles of residents who go to their garages. Technically, the vehicles permitted to pass are subject to specific provisions. However, each type of vehicle that has authorization tends to differ in its specifications. For instance, authorized goods vehicles are only allowed to pass and park from 8.30 am to 10.30 am⁸⁹ around *Cassaro Basso*⁹⁰. Such ambulances can pass through whenever needed.

⁸⁷ These photos were captured between 11:00 pm and 12:00 pm. According to local regulations, special vehicles such as small straight trucks can pass only between 7:00 pm and 10:00 pm. This means these vehicles are prohibited from passing after 10:00 pm. Additionally, taxis are allowed to park exclusively in designated locations; however, based on these photos, it has been observed that taxi drivers often park in limited traffic zones without adhering to these restrictions.

⁸⁸ This is based on the regulation of *OD Nr: 1688 dell 20/12/2023*

⁸⁹ This is based on the regulation of *OD Nr: 869 dell 04/08/2021*

⁹⁰ 38°07'06.0"N 13°22'04.5"E (the coordinate on Google Maps)

Other types of vehicles are allowed, if authorized, to pass through limited traffic zones⁹¹ consist of taxis, ape tour taxis, horse carriages, and sightseeing bus tours. As passenger vehicles, these vehicles can pick up, drop off, and deliver passengers. Privately owned, company-owned, and government-owned cars are permitted to pass if they have the necessary authorization. Especially for private vehicles, the main requirement is to have a permit called a *Zone a Traffico Limitato* (ZTL) pass. Limited traffic zones indicate restrictions on vehicular passage. This means that limited traffic zones differ from public streets or roads where all vehicles can pass without special rules.

Micromobility vehicles, including bicycles, e-bikes, and e-scooters, can pass only during designated times and days⁹². For example, in the street *via Vittorio Emanuele* from *Palermo Cassaro Basso* to *via Roma*, e-scooters can pass from 5 am to 10 am every day. Meanwhile, bikes and e-bikes can pass 24 hours on weekdays and from 5 am to 10 am on weekends or holidays. Next, in the street *via Maqueda* from *via Cavour* to *Piazza Villena*, bikes, e-bikes, and e-scooters can only pass from 5 am to 10 am daily. Without authority, all micromobility vehicles are prohibited from passing through pedestrian areas and limited traffic zones.

In addition to regulations governing vehicles permitted to pass, there are rules regarding vehicles that may park. In principle, all types of private cars are prohibited from parking in restricted traffic areas. Parking is allowed in legally designated areas marked with appropriate parking signs. Exceptions are made for specific vehicles, such as ambulances and fire trucks, which are permitted to park in restricted areas. If private vehicles are found parked in these restricted areas, they constitute a violation. Therefore, the presence of numerous private vehicles in restricted traffic areas indicates the existence of violations.

Certain factors may lead to an increase in the number of vehicles in restricted areas. One of them is the exception for residents' private vehicles to cross to their garages. This exception is a challenge to the sustainability of pedestrian areas. For example,

⁹¹ This is based on *OD Nr. 955 dell 25/7/2019*, *OD Nr. 957 dell 25/7/2019* and *deliberazione di G.C. N. 169 del 26/08/2022*

⁹² This is based on the regulation of *OD Nr. 1688 dell 20/12/2023*

in *Piazza Fonderia*, as part of the pedestrian area, the municipal government agencies have installed concrete balls to block private vehicles from crossing. A few days later, residents around *Piazza Fonderia* removed the concrete balls because they could not cross to their garages. According to them, they can cross their garages based on other regulations. The exception of certain private vehicles that can pass poses a challenge for reducing cars in restricted areas.

The limited parking area may also influence the increasing number of vehicles in prohibited areas. For example, legal parking areas may not be able to accommodate more cars, making it difficult for drivers to find legal parking spaces. Car drivers often experience difficulties in parking their cars due to a lack of alternative options. The lack of designated legal parking areas is an urgent issue that requires attention from the municipal government. This issue, however, is not explicitly included in this thesis. Adding legal parking spaces is certainly not the primary task and responsibility of municipal police. Indeed, all factors that can increase vehicle circulation in restricted areas should be addressed immediately to reduce the workload of the municipal police.

The secondary issue is the availability of public space. Available public spaces refer to areas or spaces that facilitate pedestrian mobility. Public spaces, including squares, streets, and roads, are designed to allow people to stay, pass through, and spend time there. The United Nations, through UN-Habitat, said that streets as public spaces support the urban future (UN-Habitat, 2013). Streets, as public spaces, are designed to allow pedestrians to access them without obstacles or restrictions. All streets designated as pedestrian areas and limited traffic zones are public spaces in Palermo. The beneficiaries of public spaces are pedestrians and authorized vehicle users. Public spaces do not mean that anyone can use them. The provisions are adjusted to the relevant regulations.

If there are many unauthorized vehicles in public spaces, public spaces will not be available optimally. Each pedestrian area and limited traffic zone has provisions

regarding the amount of public space that must be available for beneficiaries⁹³. For instance,⁹⁴ a minimum of 3.50 meters of space must be available along the street *via Maqueda* and *via Vittorio Emanuele*, allowing pedestrians and certain permitted vehicles to access them. Overall, public spaces for mobility in the street *via Maqueda* and *via Vittorio Emanuele* are 11 meters wide. A few meters can be used for authorized commercial activities.

Changes in public spaces for mobility depend on the number of vehicles passing or parking at certain times. A high volume of vehicles passing and parking along the streets can reduce public spaces. For instance, along the street *via Maqueda* from *Piazza Giulio Cesare/Corso Tukory* to *Piazza Villena (Quattro Canti)*, if a car measuring 1.50 meters wide and 3.75 meters long passes, the available space for pedestrians will reduce according to the width of the car. This assumption is based on the street being in average condition with no commercial activity on either side. This issue becomes even more concerning when commercial activities are present on both sides of the street. The larger the size of a vehicle passing or parking, the smaller the space available for pedestrians will be. It can be concluded that the circulation of illegal vehicles has an impact on the availability of public spaces.

Commercial activities along the pedestrian areas may also alter the availability of public spaces for mobility. This occurs because the municipal government permits the use of part of the streetside for commercial activities. Commercial activities that use the right and left sides of the street seem to be increasing from year to year. For example, it can be seen in the street *via Bara All'Olivella*⁹⁵ and *via Orologio*⁹⁶. Restaurants and cafes often occupy the most public spaces on the streets, despite the areas being pedestrian. Ultimately, the public space for pedestrians is very narrow due to the numerous chairs and tables lining the streets *via Bara All'Olivella* and *via Orologio*.

⁹³ This word refers to individuals or groups who benefit from pedestrian areas and limited traffic zones.

⁹⁴ This is based on *OD Nr. 1660 del 13/12/2023*

⁹⁵ 38°07'14.6"N 13°21'32.9"E (the coordinate on Google Maps)

⁹⁶ 38°07'13.0"N 13°21'33.0"E (the coordinate on Google Maps)

Change in available public spaces requires direct intervention from the municipal government. Changes in available public spaces caused by authorized commercial activities are a challenge to maximizing public spaces for pedestrian mobility. Such commercial activity in pedestrian areas may positively impact economic growth, but on the other hand, it has a negative effect on urban mobility. This issue requires separate attention and analysis. As a note, this research is specifically related to the duties and functions of municipal police that directly pertain to urban mobility regulations. Further comprehensive studies are needed for all determinants of available public spaces.

The next issue is citizen satisfaction, which pertains to the contentment and comfort experienced by pedestrians, cyclists, and authorized vehicle users regarding sustainable mobility policies. Citizen satisfaction encompasses both personal and local community satisfaction. Personal satisfaction refers to the individual level (e.g., residents and tourists), while local community satisfaction pertains to collective satisfaction within a community or association (e.g., neighborhood committees and cycling associations).

Cyclists' associations consistently pressure the municipal government when dissatisfied. Additionally, they campaign to raise awareness of the concept of sustainable mobility among the residents. Local community satisfaction is a collective measure; thus, community satisfaction reflects the satisfaction of all its members. One or two dissatisfied members can encourage action from the entire association's members. Pressure from cycling associations indicates widespread dissatisfaction among residents.

Personal satisfaction may be slightly different from local community satisfaction. Personal satisfaction encompasses all residents and tourists who engage in individual activities in the city center. Personal satisfaction can be known through short interviews with residents or tourists. If many residents or tourists continue to protest, it may indicate widespread personal dissatisfaction. In fact, based on the author's investigations, many residents and tourists frequently protest the lack of public space due to the presence of unauthorized vehicles and activities.

Personal satisfaction can be observed in netizen comments regarding sustainable mobility on social media and mass media. One can be reached on the *Mobilita Palermo* website⁹⁷ and the social media⁹⁸ of *Mobilita Palermo*. Citizens often individually upload photos and videos related to various problems in pedestrian areas on *Mobilita Palermo*'s social media. Additionally, many citizens have commented critically on the website and social media of *Mobilita Palermo*. The more negative comments on photos and videos uploaded regarding urban mobility, the more dissatisfied they are. Negative comments are expressed almost every day on *Mobilita Palermo*'s social media. Generally, negative comments from citizens regarding urban mobility can be found on various social media accounts and platforms.

4.4 Efforts and Initiatives Addressing Mobility Violations

The efforts and initiatives discussed in this section encompass actions taken by the government and local stakeholders. The following points outline all measures aimed at reducing mobility violations and promoting more sustainable mobility behavior.

4.4.1 Conducting Police Patrols

The most common effort addressing mobility access violations in pedestrian areas and LTZs is through municipal police patrols (see Figure 4.6a). Municipal police officers conduct routine patrols from early morning until midnight. They operate in groups, with at least two officers per patrol. These patrols are conducted in shifts, ensuring continuous monitoring as one team hands over responsibilities to the next. Regarding the shifts, their superiors determine the patrol schedule for each officer daily. During patrols, municipal police officers either pass through the urban mobility area to observe the situation or stop at specific locations to monitor and enforce compliance with regulations. Generally, patrol officers use cars rather than motorcycles or bicycles.

⁹⁷ <https://palermo.mobilita.org/>

⁹⁸ https://www.facebook.com/Palermo.Mobilita/?locale=it_IT or <https://www.instagram.com/mobilita.palermo/>

Figure 4.6 Police Patrols



Source: The Author's Research Documentation in 2025 (The author took the photos)

In certain situations, such as social events and cultural festivals in and around the city center, municipal police officers perform intensive patrols to ensure order and legal compliance. Moreover, in the event of critical issues such as violence or terrorism, patrols are conducted collaboratively by the municipal police, the metropolitan police, and the state police (see Figure 4.6b). These collaborative patrols aim to ensure a safe and secure environment in the city center. Such collaboration encourages compliance among private vehicle users, including those using micromobility vehicles. Unfortunately, these joint patrol efforts are infrequently carried out.

Whether patrols are conducted individually by the municipal police or collaboratively with other police agencies, both serve as government-led efforts to uphold the law and maintain public order regarding urban mobility. Regardless of the patrol efforts, all must be carried out effectively to address the challenges of sustainable mobility. Specifically, the municipal police, which have full authority to enforce local regulations in pedestrian areas and LTZs, should patrol optimally.

4.4.2 Installing Pedestrian Barriers

Municipal government agencies involved in the sustainable mobility agenda, such as the *Giunta Comunale*, the Urban Planning Agency, and the Public Works Agency, regularly install pedestrian barriers in designated areas. These barriers include concrete blocks, benches, concrete planters, and small iron fences. Municipal government agencies typically place pedestrian barriers at the entrances and exits connecting pedestrian areas and LTZs. This effort aims at preventing private

vehicles from passing through. The two figures below illustrate the installation and construction of pedestrian barriers in designated areas.

Figure 4.7 Pedestrian Barriers



Source: The Author's Research Documentation in 2025 (The author took the photos)

Once installed or constructed, the municipal police are responsible for monitoring them. Additionally, residents, communities, and other local stakeholders in the surrounding area are expected to oversee compliance voluntarily. Moreover, public spaces or squares designated as pedestrian areas serve as places for social activities such as family recreation and community gatherings. These activities may directly contribute to the prevention of mobility violations.

If properly installed and managed, pedestrian barriers serve multiple functions (e.g., physical infrastructure and safety symbols). For drivers, pedestrian barriers serve to mitigate the risk of incidents involving pedestrians. For pedestrians, pedestrian barriers enhance both comfort and safety. In addition to ensuring pedestrian safety and comfort, they can also attract visitors for leisure activities. This may foster collective social awareness, promoting responsible use of public spaces and optimizing pedestrian areas. One of the primary challenges associated with pedestrian barriers is vandalism to property. Acts of vandalism can diminish the intended function of these barriers, potentially allowing private vehicles to pass illegally. Hence, the installation of concrete blocks, benches, planters, and small iron fences should be supported by social awareness to ensure their effective utilization.

4.4.3 Organizing Community Forums

Community forums are volunteer initiatives led by community-based organizations and residents, typically held in public spaces or squares. At specific meetings, they invited municipal government representatives, generally represented by a member of the *Giunta Comunale*. At least, they hold face-to-face forums once a month. The following two figures depict a group of people gathering in a designated space for forums. Both figures depict residents and community-based organizations, such as cycling and pedestrian associations, discussing mobility violations and the sustainability of sustainable mobility policies.

Figure 4.8 Community Forums



Source: The Author's Research Documentation in 2025 (The author took photo 'a' and downloaded photo 'b' from Facebook of *Palermo Pedonale e Ciclabile*)

Although the number of participants, based on the two figures above, was relatively small compared to the total number of residents in the area, the forums were important initiatives that deserve support. Forum organizers typically encourage citizen participation through social media and brochures. Attendance may depend on citizens' awareness of the sustainable mobility agenda. Increasing the frequency of forums and support from various stakeholders, such as education and religious institutions, may encourage more active participation from residents.

Community forums play a crucial role in sustainability transitions. Although those forums operate independently of municipal government authority, they can support the design and implementation of sustainable mobility policies. Given the government's limited resources, community forums can provide additional support. For example, while the municipal police control pedestrian barriers, community

members, within their capacity, can help municipal police in controlling those pedestrian barriers. This effort ensures that the intended outcomes are achieved as effectively as possible.

4.4.4 Promoting Social and Ecological Initiatives

Figure 4.9a depicts a community-based organization, called *Famiglie in Piazza*, engaging in social activities in a public space to promote the sustainable mobility agenda. Their initiatives include placing baby trolleys at pedestrian access points to prevent unauthorized private vehicles, educating children on the sustainable mobility agenda, and facilitating experience-sharing among participants (the majority of whom are mothers). These activities engage various private and public institutions as partners. This initiative has been conducted monthly since early 2025.

Figure 4.9b also depicts a social initiative that promotes environmental awareness. This activity includes presentations on environmental issues and their solutions. A community-based organization, *Palermo Pedonale e Ciclabile*, conducted the initiative. Like *Famiglie in Piazza*, *Palermo Pedonale e Ciclabile* conducted its activities in a public space or square. However, while mothers and their children dominantly attended *Famiglie in Piazza's* activities, adults primarily attended *Palermo Pedonale e Ciclabile's* activities.

Figure 4.9 Social and Ecological Initiatives



Source: The Author's Research Documentation in 2025 (The author took photo 'a' and downloaded photo 'b' from Facebook of *Palermo Pedonale e Ciclabile*)

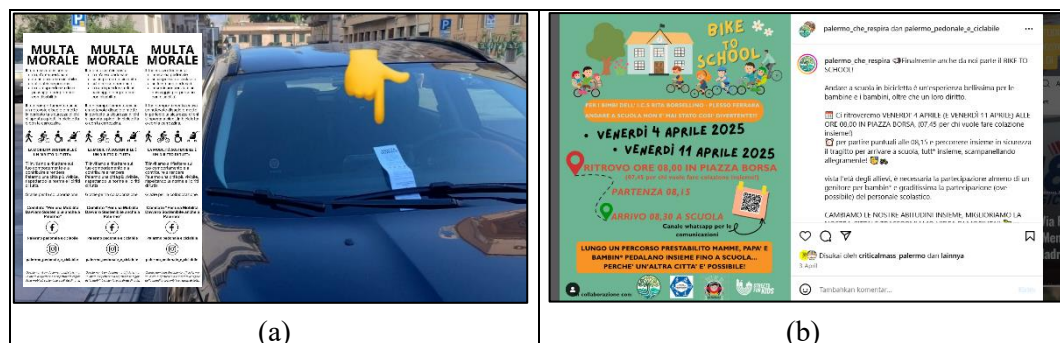
The social initiatives undertaken by both community-based organizations exemplify active efforts to support sustainable mobility policies. All initiatives supporting the ecological transition should be encouraged, whether organized by community-based organizations or other entities. The two figures above only depict a few social initiatives. Other activities may take place in the city center. All social initiatives that promote a sustainable mobility agenda may reduce mobility violations and increase better mobility behavior.

4.4.5 Mobilizing Sustainable Mobility Campaigns

Figure 4.10a depicts a sustainable mobility campaign using brochures or flyers. Activists involved in the campaign attach brochures to car windows, aiming to raise awareness among drivers who violate mobility rules. The campaign is conducted randomly, targeting all violators. While this action may not immediately alter behavior, it serves as a reminder for violators to reflect on their mistakes.

Figure 4.10b depicts a campaign conducted directly in pedestrian areas and LTZs, involving children. This initiative fosters early awareness of the sustainable mobility agenda among children. Indirectly, it also conveys a broader message, encouraging society to prioritize environmentally friendly mobility. A direct campaign may serve as a stimulus, inspiring individuals to be more respectful of sustainable mobility efforts. Shifting the sustainability mindset requires massive and active campaigns.

Figure 4.10 Sustainable Mobility Campaigns



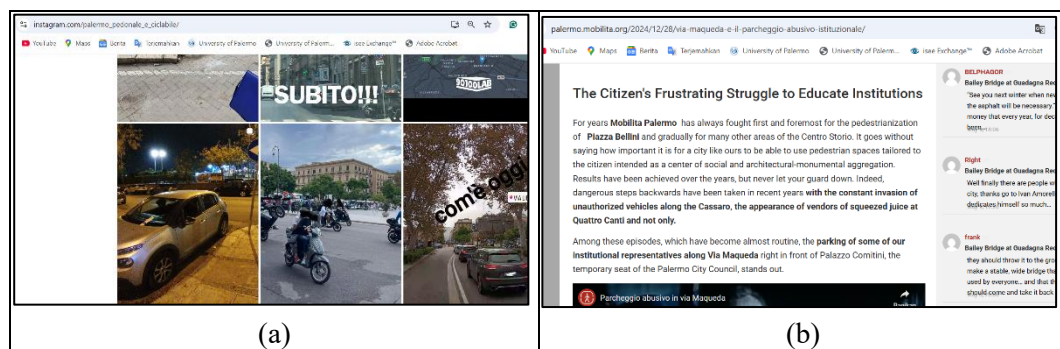
Source: The Author's Research Documentation in 2025 (The author downloaded photo 'a' from Facebook of *Palermo pedonale e ciclabile* and captured photo 'b' from Instagram of *Palermo Che Respira*)

The two campaigns shown in the figures differ in approach but share the same objective. Other types of campaigns, whether involving large or small numbers of people, can also be carried out actively. Most importantly, every campaign should convey a positive message to the public. Towards sustainable mobility in the ecological transition requires various forms and types of campaigns.

4.4.6 Advocating for Issues via Social Media and Websites

Advocacy for sustainable mobility issues can be conducted via social media and websites. Figure 4.11a illustrates advocacy through social media, while Figure 4.11b demonstrates advocacy through websites. Both convey the same message. The first message criticizes the municipal government for its lack of strict enforcement. The second message addresses violators, urging them to refrain from further infractions. The third message serves as a general warning to all individuals to avoid violations. Beyond the two media shown in the figures, other platforms can be utilized. All accessible digital platforms can be used, including TikTok, Twitter, and other relevant websites.

Figure 4.11 Advocacy through Social Media and Websites



Source: The Author's Research Documentation in 2025 (The Author captured photo 'a' from Instagram of *Palermo pedonale e ciclabile* and captured photo 'b' from Palermo Mobilita website)

Advocacy for sustainable mobility issues is conducted not only by organizations and groups, but also by individuals committed to addressing the problem. In fact, many individuals use their personal social media accounts to engage in public advocacy. This form of advocacy can occur at any time and in any location, making efforts based on digital platforms more flexible and capable of reaching a broader audience. Indeed, print and online

media, fulfilling their journalistic responsibilities, are expected to deliver their messages to the public effectively.

Widespread advocacy through social media and news websites can have a positive impact on the sustainable mobility agenda. Logically, increased advocacy leads to a larger audience, and a broader audience may enhance collective awareness. Therefore, actively utilizing social media and websites is one of the efforts or initiatives in advancing sustainable mobility. This effort is likely to achieve the intended outcomes in line with expectations and targets.

4.5 Municipal Police of Palermo

The municipal police agency is one of the municipal government agencies in Palermo. The primary function of municipal police⁹⁹ is to supervise citizens' compliance with municipal government regulations and interventions. The regulations and interventions cover traffic, local trade, environmental matters, and public order. Thus, municipal police are responsible for overseeing various matters, particularly those related to urban mobility within the municipal area. Their responsibilities encompass¹⁰⁰ the prevention and detection of traffic violations, the investigation of street accidents, the planning and execution of services aimed at regulating traffic, the provision of escorts for traffic safety, and the oversight and control of street usage.

Aside from activities directly related to mobility issues, according to “*decreto legislativo nr. 285 del 30/04/1992*”, municipal police carry out various activities daily. The activities¹⁰¹ include the management of traffic signs, the security of municipal police offices, the responsibility for administrative and financial sanctions, the collection of highway code fines, the control of vehicular emissions, the regulation of commercial activities, the oversight of public areas, the

⁹⁹ This refers to *consiglio comunale nr. 100 del 02/05/1996*

¹⁰⁰ This refers to *decreto legislativo nr. 285 del 30/04/1992*

¹⁰¹ More information can be found at <https://www.comune.palermo.it/struttura-amministrativa.php?lev=2&id=271>

supervision of urban livability, the monitoring of public transport services, and the protection of municipal officials.

Due to the diverse functions of the municipal police agency in Palermo, it is organized into various departments or service units. One such unit is the Administrative Sanctions Service Unit¹⁰², which is responsible for imposing administrative penalties on violators in pedestrian areas and limited traffic zones, including issuing sanctions for unauthorized parking. Municipal police officers assigned to this service unit routinely conduct patrols. The purpose is to enforce local laws and address mobility issues. To support the patrol function, a unit known as the Video Control Service Unit for Limited Traffic Zones (LTZs)¹⁰³ has been established. This unit manages and controls the use of traffic or surveillance cameras. Furthermore, to support the use of traffic cameras, a service unit known as the Data Processing Center and Technology Innovation¹⁰⁴ has been established. Various other service units provide mutual support¹⁰⁵.

In principle, the municipal police agency covers an organization (i.e., all departments or service units) and an individual (i.e., all municipal police officers) entity. Organizationally, the municipal police agency comprises a commander, a deputy commander, and various departments, including both specialized and general services. Individually, municipal police encompass all officers across various units personally. In this study, municipal police officers are more associated with those who interact directly with citizens in providing benefits and sanctions related to sustainable mobility. In other words, those who serve as patrolmen in relation to urban mobility issues.

¹⁰²The original name is *Ufficio Sanzioni Amministrative Accessorie* (<https://www.comune.palermo.it/struttura-amministrativa.php?lev=4&id=2986>).

¹⁰³ The original name is *Ufficio Video Controllo Z.T.L. (Zona a Traffico Limitato)* (<https://www.comune.palermo.it/struttura-amministrativa.php?lev=4&id=2984>).

¹⁰⁴ The original name *Ufficio C.E.D. (Centro Elaborazione Dati) e Innovazione Tecnologica* (<https://www.comune.palermo.it/struttura-amministrativa.php?lev=4&id=2985>)

¹⁰⁵ More information can be tracked at https://www.comune.palermo.it/amministrazione/unita_organizzativa/area-della-polizia-municipale/

Regarding organizational structure, each municipal police officer is assigned to a specific department or service unit within the organization. Their role varies, depending on the services and responsibilities. Accordingly, municipal police officers can be, at least, classified into four distinct roles. It includes administrative, technical, support, and frontline roles. Table 4.3 explains, and Figure 4.12 illustrates, the various roles within the municipal police agency.

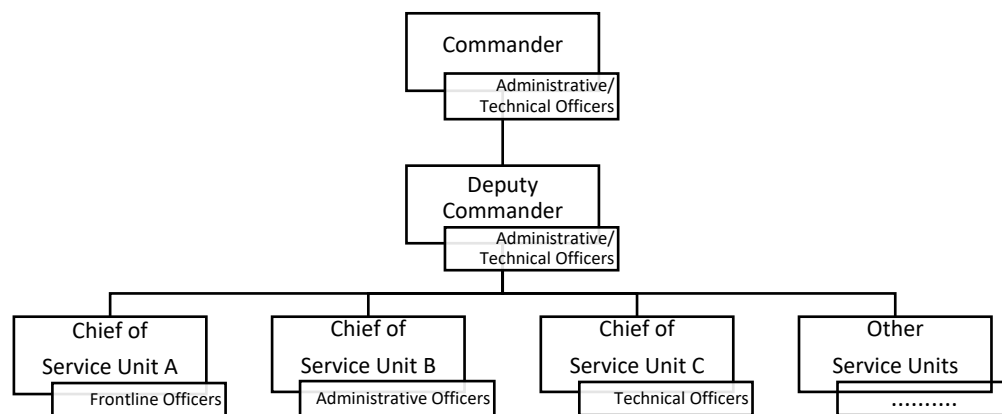
Table 4.3 Positions and Responsibilities within Municipal Police Agency

Positions	Responsibilities	Roles
Commander	Coordination and control functions of the Corps' activities	Administrative role
Deputy Commander	Coordination, control, and monitoring functions of the activities under the responsibility of the service	Administrative role
Service Units/ Support Offices	ZTL Video Control Unit (<i>U.O. Video Controllo Z.T.L.</i>) 1. Investigation and reporting of transits of unauthorized vehicles entering the ZTL 2. Management of the configuration of the gate activation times and days	Administrative role
	Traffic and Ordinary Mobility Office (<i>Ufficio Traffico e Mobilità ordinaria</i>) 1. Traffic monitoring and parking systems 2. Quality control of public transport systems	Administrative role
	Operational Command - Central Communications Unit (<i>U.O. Centrale Comunicazioni – Comando Operativo</i>) 1. Providing operational support to patrol units in the execution of assigned duties 2. Distributing reports in real time	Supporting role
	Unit of Data Processing Center and Technological Innovation (<i>U.O. C.E.D. e Innovazione Tecnologica</i>) 1. Uploading, processing, and transmitting traffic violation data from automated flows 2. Uploading, development, and transmission of traffic violation reports drawn up by operators	Technical role
	Administrative Sanctions Office (<i>U.O. Ufficio Sanzioni Amministrative Accessorie</i>) 1. Administrative detention and seizure of vehicles for violations 2. Management of the procedure for seized or administratively detained vehicles	Frontline role
	Traffic Police Unit (<i>U.O. Polizia Stradale</i>) 1. Preventing and investigating traffic violations 2. Designing and implementing traffic regulation services	Frontline role

Source: Adapted by the author from available information (official information) at https://www.comune.palermo.it/amministrazione/unita_organizzativa/are-a-della-polizia-municipale/

Based on Table 4.3, the roles of every officer can be mapped to various units. Figure 4.12 below shows that urban mobility tasks involve a range of service units and designated roles across departments. Therefore, the performance of municipal police officers serving as frontline agents—often referred to as street-level bureaucrats—cannot be fully disentangled from the departments or service units that provide technical and administrative support.

Figure 4.12 Mapping Organizational Framework of Municipal Police



Source: Author's elaboration¹⁰⁶

Figure 4.12 does not represent a formal organizational structure. It merely depicts the roles of municipal police officers in the context of sustainable mobility issues. Administrative and technical officers may work in the secretariat offices of the commander and the deputy commander. Also, administrative and technical officers are in specific service units. The figure illustrates that a municipal police agency comprises multiple service units and positions in terms of sustainable mobility policies. Each unit encompasses various roles. For illustration, Service Unit A represents the frontline officers' unit, while Service Units B and C represent other services and officers.

¹⁰⁶ The figure follows the information shown in Table 4.3. The author does not present an organizational structure of municipal police agencies, as not all departments or service units are involved in urban mobility functions. Instead, the figure focuses specifically on urban mobility, emphasizing the role of front-line officers and the units or departments that support front-line officers. The terms “service units a, b, c, etc.” refer to the roles listed in Table 4.3.

As shown in Table 4.3 and Figure 4.12, the four roles of municipal police officers are interpreted in various ways. The first and most crucial service unit is the frontline officers (e.g., Traffic Police Unit). They conduct routine patrols and engage directly with citizens in the street. The second, administrative officers (e.g., ZTL Video Control Unit), also known as the back office, are responsible for managing administrative tasks within the office. Technical officers (Unit of Data Processing Center and Technological Innovation) possess specialized knowledge and skills in specific technical areas. Other officers (e.g., Central Communications Unit), as supporting officers, assist and ensure the smooth operation of specific processes.

Municipal police officers who patrol pedestrian areas and limited traffic zones are fully responsible for achieving the SUMP goals. Their performance reflects the organization's performance in terms of urban mobility. This means that they represent the municipal police agency, which is tasked with enforcing local laws. The municipal police officers tasked with patrolling have a heavy workload. They indirectly represent the entire municipal police corps. They represent what their commander or deputy commander wants. Indeed, achieving the SUMP goals cannot be attributed solely to the patrol function. Other municipal police departments or service units may be needed to achieve the SUMP goals, such as police officers who work to utilize traffic cameras in the control room.

The municipal police officer in charge of the control room, responsible for controlling traffic cameras, is also responsible for implementing the SUMP and enforcing related regulations. Currently, the municipal police agency of Palermo has one control room¹⁰⁷ that functions to control hundreds of traffic cameras installed in various locations. Dozens of municipal police officers are on duty in the control room. The municipal police officers in the control room differ from those who patrol restricted traffic zones. However, they still coordinate with each other to maximize the SUMP. Therefore, it is challenging to distinguish the performance

¹⁰⁷ More information can be found at <https://www.comune.palermo.it/palermo-informazione-dettaglio.php?id=38535&tipo=1>

outcomes of municipal police officers who conduct patrols from those of the other municipal police corps, including officers on duty in the control room.

Utilizing facilities such as traffic cameras may influence the effectiveness of the municipal police in addressing urban mobility. Additionally, the performance of the municipal police in relation to urban mobility may also be enhanced by increasing the frequency of patrols. This study discusses both approaches for analyzing the performance of municipal police. As the street-level bureaucracy theory is used to analyze the issues, the thesis primarily focuses on the municipal police officers who conduct patrols. Municipal police assigned to other duties that are still related to the SUMP remain integral to the discussion, whilst municipal police officers assigned to tasks unrelated to urban mobility are not within the scope of this thesis. Nevertheless, all of them are part of the overall performance management system of the municipal police agency.

Although municipal police who oversee traffic cameras do not interact directly with citizens, as those who patrol do, they issue fines to violators. They utilize technology, such as traffic cameras and control rooms, to enhance effectiveness. Their activities are to monitor traffic cameras in the control room. If mobility violators are identified in the control room, they will be fined. A formal letter will be sent to the violator's address. The use of technology may be quite helpful in achieving the SUMP. Municipal police officers who interact directly with citizens on the street and in public areas may find it easier to do their job by maximizing the use of traffic cameras. The assumption is that increased use of traffic cameras and expanded control rooms will positively impact the achievement of SUMP objectives. As the attainment of these efforts increases, the workload on police patrols will consequently decrease.

In practice, municipal police officers who interact directly with citizens often work in teams of at least two personnel and, sometimes, operate independently. The decision to patrol individually or in teams is dictated by instructions from their superiors and is influenced by the availability of personnel and supporting resources. Regardless of their mode of operation, all patrolling officers serve as

representatives of the municipal police. Unfortunately, the number of officers assigned to patrol duties is insufficient relative to their workload. Official data obtained from the municipal police office shows that only approximately 200 officers patrol the city daily. However, these officers do not patrol simultaneously; they operate in shifts. Consequently, the number of municipal police officers patrolling at any given time is limited.

Municipal police officers utilize two distinct approaches during patrols: soft and hard approaches. The soft approach involves monitoring areas without imposing sanctions on violators, whilst the hard approach entails directly sanctioning violators. The soft approach focuses on preventive actions, while the hard approach emphasizes mitigation efforts. Municipal police officers assigned to monitoring areas without imposing sanctions tend to adopt a more relaxed demeanor. They do this patrol approach based on directions from their superiors or on their discretion. Their role is primarily to observe areas and issue warnings to violators. These warnings do not include administrative sanctions, such as fines; instead, they provide prohibitive messages. Although these warnings may stop the violations, they are often ineffective in the long term. Violators sometimes resume their infractions once the patrolmen leave.

Municipal police officers responsible for issuing fines to violators need to collaborate with private companies that provide truck rental services for transporting vehicles. When a violation occurs, municipal police officers contact these private companies to tow the cars to a designated location. Unauthorized vehicles may remain in prohibited areas without the involvement of the private sector. This underscores the necessity of collaborative efforts between police patrols and the private sector to ensure effective enforcement.

Another observed issue is that municipal police often use cars when patrolling pedestrian areas and limited traffic zones. As a result, they cannot access narrow streets that cars cannot pass. For instance, around *Piazza del Gran Cancelliere*¹⁰⁸,

¹⁰⁸ 38°06'58.3"N13°21'33.5"E (the coordinate on Google Maps)

many vehicles are parked daily, despite a 24-hour parking ban. Police cars accessing *Piazza del Gran Cancelliere* are difficult because the street is narrow. Tow trucks also seem to have difficulty accessing the surrounding area. In the end, violations in the local area are challenging to overcome. Based on the observations, many cars are parked illegally without supervision or sanctions from the municipal police.

Although patrolling by bicycle or motorbike is highly anticipated, it remains less common than patrolling by car. Utilizing motorbikes or bicycles for patrols could be more effective as they can access a broader range of areas. In Palermo, for instance, many streets, particularly in historical districts, are inaccessible by car. Therefore, employing various vehicles suitable for patrolling is highly desirable. The selection of police vehicles should be tailored to the specific needs and conditions of the patrol areas. For example, bicycles should be used for patrolling pedestrian areas, as they are not only effective for navigating narrow streets but also support pedestrian zones.

The supporting facilities utilized by the municipal police may not be adequate to achieve the objectives of the SUMP. Hence, the municipal government agencies have implemented various interventions, such as pedestrian constraints and traffic signs, in coordination with the municipal police. This implies that other municipal government agencies are involved in supporting the role of the municipal police. The local authority has also engaged in multi-sector cooperation to improve infrastructure, including collaboration with Trenitalia (FS Group), a state-owned company in Italy. Many actions and initiatives from other public and private institutions, including community-based organizations, may strengthen the municipal government's capacities to sustain and promote sustainable mobility.

4.6 Stakeholders in the City Center

Stakeholders in the city center of Palermo are highly diverse, encompassing the European Union as an international organization, government agencies, public organizations, business institutions, community-based organizations, and residents. Given the city center's status as a mobility hub and center of significant activities (e.g., historical areas, commercial zones, and public services), the daily presence of

multiple stakeholders, including tourists, is unavoidable in pedestrian areas LTZs. They perform activities in accordance with their respective roles and responsibilities. Consequently, these stakeholders play a pivotal role in sustaining the sustainable mobility agenda. All individuals, groups, and organizations involved in or engaged with the urban mobility agenda within or around the city center are recognized as stakeholders.

Government actors encompass municipal, provincial (or metropolitan), regional, and central levels. The municipal government refers to the Mayor, *the Giunta Comunale*, and various municipal government agencies (e.g., the Municipal Police, the Urban Planning Agency, and the Public Works Agency). The provincial government refers specifically to the metropolitan police. The regional government of Sicily refers specifically to the local police. The central government includes the state police and military police. Although the metropolitan police, local police, state police, and military police are not directly responsible for local law enforcement, they sometimes conduct joint patrols with the municipal police in accordance with their respective roles and responsibilities.

Public organizations encompass non-profit agencies, public service organizations, and other organizations owned by public entities. Non-profit agencies refer to volunteers affiliated with government agencies, such as *Associazione Nazionale della Polizia di Stato* (ANPS), the National Association of the State Police, and *Associazione Nazionale Carabinieri* (ANC), the National Association of the Military Police. Additionally, non-profit agencies refer to volunteers affiliated with non-governmental organizations, such as those associated with religious (e.g., mosques and churches) and social (e.g., the United Nations High Commissioner for Refugees and *Comunità di Sant'egidio*¹⁰⁹) activities. These non-profit organizations frequently operate and initiate activities in the city center. Public service organizations (e.g., healthcare and fire agencies) are part of the sustainable mobility issues. Schools at various levels and universities, including the University of

¹⁰⁹ Its main activities focus on the poor and peace issues.

Palermo (Unipa), are also recognized as public entities that contribute to addressing mobility issues.

Business institutions refer to the municipally owned corporations (e.g., AMAT Palermo for public transportation services and RAP Palermo for urban waste management) and a state-owned enterprise, Trenitalia. Meanwhile, all private organizations providing services and goods, such as banks, passenger transport providers, and micromobility providers, in the city center of Palermo are included in the business institutions. This includes other business entities such as hotels, restaurants, shops, cafes, bars, minimarkets, groceries, and pharmacies. All local traders and enterprises, such as artisans, merchants, and street vendors, are categorized as business institutions in the city center. Business institutions encompass a range of profit-oriented activities undertaken by organizations and individuals.

Community-based organizations encompass all organizations owned by local communities or associations, including cycling communities, skateboard communities, busker communities, beggar communities, worker associations, and family communities. This includes neighborhood committees affiliated with the district's administrative function. In addition, residents refer to stakeholders individually. Additionally, local visitors and tourists can be considered stakeholders in the city center.

The international organizations, government agencies, public organizations, business agencies, community-based organizations, and residents mentioned previously are directly and indirectly involved in addressing pedestrian areas and LTZs. The table below provides a detailed description of the main stakeholders, including their activities and roles.

Table 4.4 Stakeholders in the City Center of Palermo

Stakeholders	Activities	Role
Government Agencies		
Mayor	Legitimize the regulations regarding sustainable mobility	Key actor
<i>Consiglio Comunale</i>	Regulate the regulations regarding sustainable mobility	Key actor
<i>Giunta Comunale</i>	Regulate the rules regarding sustainable mobility	Key actor
Municipal Police	Enforce the regulations and rules in the pedestrian areas and LTZs	Key actor
Municipal Government Agencies ▪ Urban Planning Agency ▪ Public Works Agency	Design and implement interventions in the pedestrian areas and LTZs	Key actor
Metropolitan Police of Palermo	Enforce laws related to the duties and responsibilities of the metropolitan city of Palermo in the city center	Relevant actor
Local Police of the Sicily Region	Enforce laws related to the duties and responsibilities of the Sicily region in the city center	Relevant actor
President of the Sicily Region	Coordinate and be responsible for the local and national interests in the urban areas	Relevant actor
State Police	Enforce laws related to the duties and responsibilities of the Italian government in the city center	Relevant actor
Military Police	Enforce laws related to the duties and responsibilities of the Italian government in the city center	Relevant actor
Ministry of Infrastructure and Transport	Support the local public transport system	Relevant actor
Public, Private, and Non-Governmental Agencies		
European Union	Support and invest in the local public transport system	Relevant actor
<i>Associazione Nazionale della Polizia di Stato</i> (ANPS) and <i>Associazione Nazionale Carabinieri</i> (ANC)	Assist the government agencies in executing specific duties and responsibilities	Relevant actor
Trenitali	Facilitate and support the local and regional public transport system	Relevant actor

AMAT Palermo	Facilitate and operate the local public transport system	Key actor
Public Organizations	Participate and engage in the sustainable mobility agenda	Key actor
▪ Schools ▪ Universities ▪ Religious Organizations ▪ Social Organizations ▪ Museum ▪ Healthcare Agencies ▪ Fire Agency ▪ Other Public Organizations		
Private Institutions	Participate and engage in the sustainable mobility agenda	Key actor
▪ Passenger Transport Providers ▪ Micromobility Vehicle Providers ▪ Local Businesses and Entrepreneurs ▪ Media ▪ Other Private Companies		
Community-based Organizations	Participate and engage in the sustainable mobility agenda	Key actor
▪ Cycling Associations ▪ Family Communities		
Neighborhood Committees	Participate and engage in the sustainable mobility agenda	Key actor
Residents	Participate and engage in the sustainable mobility agenda	Key actor

Source: Author's elaboration

The key stakeholders (or actors)¹¹⁰ are individuals or organizations that are responsible and actively engage in the sustainable mobility agenda. For instance, the *Giunta Comunale* is responsible for regulating interventions, and the municipal police are responsible for enforcing the regulations. Other examples, community-based organizations and residents actively engage in the sustainable mobility agenda. All stakeholders classified as key actors play a crucial role in determining the sustainability of mobility policies in Palermo.

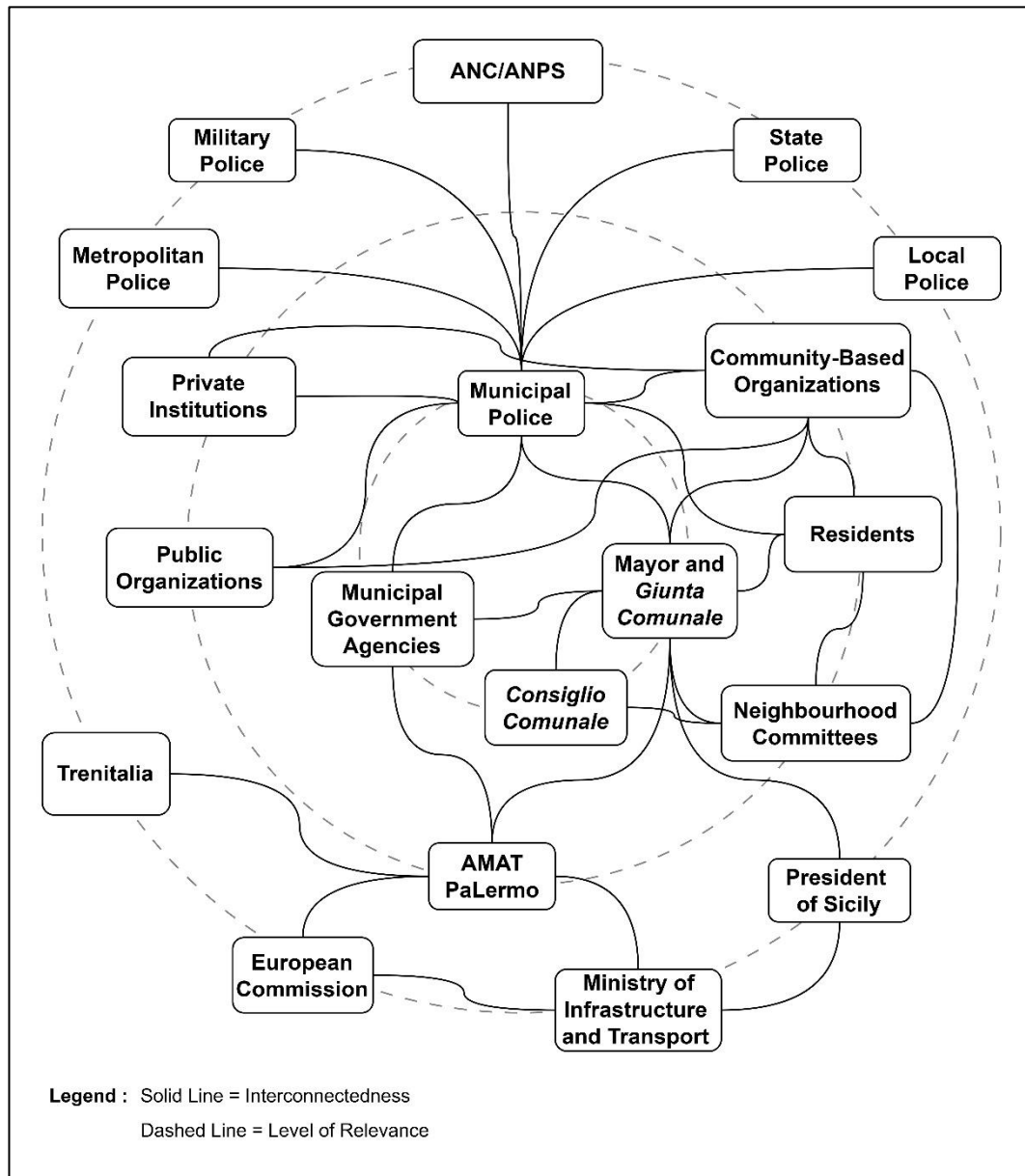
¹¹⁰ The term “key actor”, adopted from Gomes et al. (2024), refers to stakeholders engaged in “the process of dealing with and finding solutions for wicked problems” (p. 16). However, in this thesis, the term applies specifically to those with direct involvement in the local setting. Individuals or entities not directly engaged in the local area are classified as relevant actors.

The relevant actors refer to organizations that support sustainable mobility policies in Palermo. They play a role in the city center based on their respective interests, but are not entirely responsible for sustainable mobility policies. For instance, the state police and military police patrol routinely in pedestrian areas and LTZs, but are not responsible for imposing sanctions on mobility violations. However, their routine patrols may prevent mobility violations from occurring. Moreover, under certain conditions (e.g., crime and terrorism issues), the municipal police and other law enforcement agencies collaborate in patrols. This collaboration supports municipal police activities to enforce sustainable mobility regulations in Palermo.

Both key and relevant actors may contribute to addressing the sustainable mobility agenda. All of them operate, work, participate, and support the same issues regarding sustainable mobility. The difference lies in their levels of relevance, which vary. Due to the varying levels of relevance, a network of stakeholders is established in this thesis. The network is based on the stakeholder roles to understand and map their contribution. Furthermore, mapping this stakeholder's network is necessary to depict each actor's position visually. Specifically, mapping the stakeholders' network is crucial for understanding the position of the municipal police and other relevant actors in the city center of Palermo.

The following figure, associated with Table 4.3, shows the stakeholders' network in the city center of Palermo. As a note, some organization names are grouped into specific terms to reduce the number of variables in the figure. For example, the term 'public organizations' refers to all entities owned by the public, while the term 'private institutions' encompasses all business and entrepreneurial affairs.

Figure 4.13 Stakeholders Network in the City Center of Palermo



Source: Author's elaboration

The inner-dashed lines represent key actors who have the authority to design, implement, and enforce regulations regarding sustainable mobility. The circle refers to the municipal government, comprising the Mayor, the *Giunta Comunale*, the *Consiglio Comunale*, the municipal police, and various municipal government agencies. They hold responsibilities that other institutions or organizations do not share. The mayor of Palermo holds the primary responsibility for legitimizing regulations, a duty that cannot be delegated to other organizations. The municipal

police are authorized to enforce these regulations, which cannot be delegated to other organizations.

The middle-dashed lines represent key actors who actively engage and play essential roles, extending beyond municipal government agencies. The circle refers to local governance. This dashed line encompasses a diverse range of organizations and individuals. They are public organizations, private institutions, community-based organizations, neighborhood committees, and residents. This includes AMAT Palermo as a single authority in providing local public transport. AMAT Palermo is excluded from the category of 'private institutions' due to its special role.

The outer-dashed line represents relevant actors. This refers to multiple governance structures that support, coordinate, and facilitate resources, based on their respective responsibilities and interests, in addressing sustainable mobility issues. They include the metropolitan police, local police, state police, military police, the ANC/ANPS, the President of Sicily, Trenitalia, the Ministry of Infrastructure and Transport, and the European Commission (European Union).

Moreover, the solid line represents the network's interconnectedness. Solid lines have various meanings, consisting of coordination, cooperation, and collaboration. For instance, a link from the Mayor and the *Giunta Comunale* to municipal police represents coordination. A link from AMAT Palermo to Trenitalia represents a form of cooperation or partnership. A link from the municipal police to the metropolitan police represents collaboration. Overall, these links describe a network of stakeholders.

Based on Figure 4.13, municipal police, as a street-level bureaucracy with the authority to enforce local regulations, become leading actors in the network. Municipal police are connected to various key and relevant actors. The involvement of multiple actors who support sustainable mobility is necessary to strengthen the strategic roles of the municipal police. This may lead to achieving sustainable mobility goals in the local areas. The stakeholders' network is expected to have a positive impact on sustainable mobility policies.

Chapter 5

Findings

This chapter addresses three central themes related to the research questions. First, it examines how municipal police performance is enhanced at the individual level. Second, it considers how municipal police performance is strengthened at the organizational level. Third, it analyzes the improvement of municipal police and local stakeholders' performance at the inter-institutional level. The first and second themes are explained through an integrated analysis within the DPM approach, applying the mitigation strategy, while the third theme is analyzed through the DPG approach, employing the preventive strategy.

5.1 Enhancing the Performance of Municipal Police in Sustaining Sustainable Mobility Policies: A Mitigation Strategy

5.1.1 Introducing Performance of Municipal Police in Restricted Traffic Zones (RTZs)

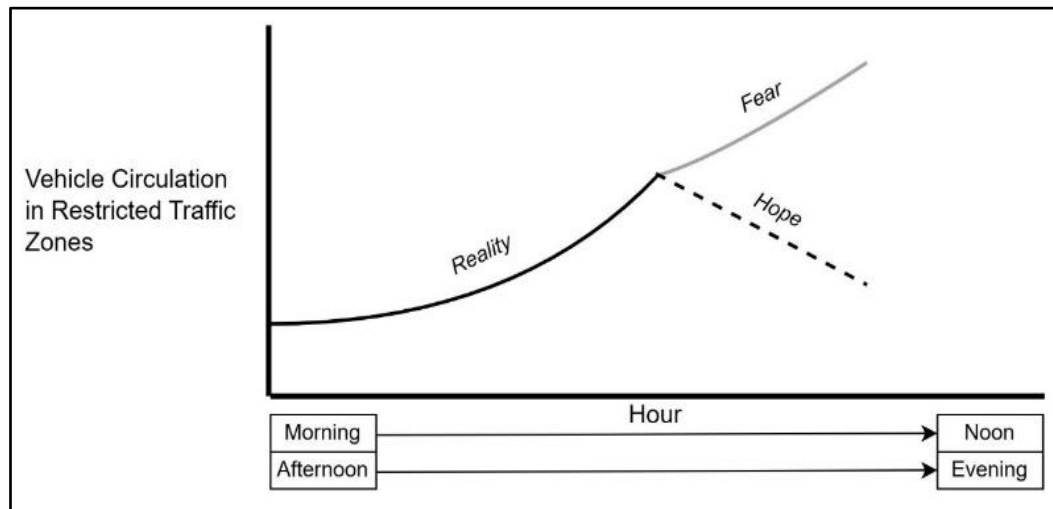
This research found that vehicle circulation in Restricted Traffic Zones (RTZs)—including both pedestrian areas and limited traffic zones—has increased every hour of the day. The increase is particularly noticeable from morning to noon and from afternoon to evening. Vehicle circulation pertains to the unauthorized passage and parking of vehicles. They are cars, motorcycles, mopeds, and micromobility vehicles. These vehicles include passenger vehicles such as taxis, ape tour taxis, horse carriages, and shared transport (car-and-bike sharing), which are unauthorized for passage and parking in RTZs.

The following picture depicts reality, hope, and fear concerning unauthorized vehicle circulation. Based on Figure 5.1, the time refers to an hour¹¹¹, illustrating from morning (e.g., 6 am) to noon (i.e., 12 pm) and from afternoon (e.g., 2 pm) to evening (8 pm). The solid black line represents the reality that unfolds over time,

¹¹¹ Hour as a unit of time is used as an illustration because, based on observed facts, vehicle circulation occurs in hours rather than days. For instance, unauthorized private vehicles frequently pass during the day in pedestrian areas and limited traffic zones. At night, from 11:00 pm to 5:00 am, unauthorized vehicles rarely pass. The same situation often occurs at the same time the next day. This means that the span of hours during the day becomes a significant issue related to unauthorized vehicle circulation.

specifically in hours. In the absence of law enforcement from municipal police, undesirable situations may arise. This is represented by a solid gray line indicating fear. Conversely, when municipal police enforce the law, desirable situations may arise. This is represented by a dotted black line indicating hope.

Figure 5.1 Describing the Reality of Vehicle Circulation in Restricted Traffic Zones



Source: Author's elaboration

Without any improvement in the performance of the municipal police in enforcing regulations, fear may persist every hour of the day, extending to every day of the month and every month of the year. As enforcement officers, the municipal police conducting patrols are tasked with changing the reality line to the hope line in the figure. This subchapter explains the analysis based on the individual approach of the municipal police in addressing the unauthorized vehicle circulation in pedestrian areas and limited traffic zones, referring to the street-level bureaucracy theory.

The theory of street-level bureaucracy, as described by Lipsky (1980), refers to the role of individual workers, such as municipal police officers. In this subchapter, a key issue is the decisions made by these officers when they enforce the regulations on pedestrian areas and limited traffic zones. These decisions may directly impact policy outputs and outcomes, which constitute the daily duties and responsibilities of municipal police officers. In other words, municipal police, as law enforcement

officers, play a crucial role in determining the quality of sustainable mobility policies. They have the authority to achieve good performance by maximizing outputs (Thomann, 2015) and creating positive outcomes (Hupe & Hill, 2007b). According to Hupe and Hill (2007), it is essential for professional workers to focus on realizing outcomes rather than just outputs. In recent years, performance management in the public sector has extended beyond mere output. However, the outputs and outcomes of municipal police officers' actions remain interconnected. Achieving outputs with maximum value leads to the desired outcomes.

Based on the theoretical perspective of street-level bureaucracy, achieving the output (e.g., the number of sanctioned violators) and the outcome (e.g., change in pollution) of sustainable mobility policies depends on the discretion¹¹² exercised by municipal police (i.e., patrol officers). Discretionary roles are part of the duties and functions of street-level bureaucrats (Lipsky, 1980). Therefore, the discretion exercised by municipal police officers reflects their performance. Increased discretion can lead to a reduction in sanctioned violators, which may result in an increase in vehicles within restricted traffic zones. “If street-level discretion is unavoidable” (Zang, 2016, p. 614), it should be done correctly. This means that the discretion carried out by patrolmen should not negatively impact sustainable mobility policies. Therefore, outcomes of discretion require attention in public administration studies (Scott, 1997; Visser & Kruijen, 2021).

Furthermore, municipal police, as part of the street-level bureaucracy, have the authority to manage the allocation of patrol time per designated pedestrian areas and limited traffic zones. Patrol officers may allocate more time to specific locations than to other locations. Following their authority, patrol officers can allocate more time to patrolling specific locations over others. Lipsky (1980) paid attention to the ratio of workers to time. Increasing the allocated patrol time may enhance the intended outcomes of municipal police performance. However, increasing the allocated patrol time may have other impacts, such as mental and physical

¹¹² This study defines discretion as neglecting rather than punishing unauthorized vehicles passing through or parking in the RTZ.

exhaustion. This side effect should be considered in time allocation to anticipate and mitigate potential more significant consequences.

As individual entities, municipal police resources include the authority to exercise discretion over violators and allocate patrol time in specific locations. Both resources may be capable of enhancing intended outputs if managed wisely. For instance, the time allocated to patrol should be balanced—neither too high nor too low—to avoid unwanted effects. At certain times, such as when many violations occur, the time allocated may be increased as needed. Indeed, such inputs must be maximized to achieve the intended outputs, ultimately leading to the intended outcomes.

In addition, in conformity with Lipsky (1980), organizational factors can affect street-level bureaucrats' performance. For example, municipal police officers may be understaffed to perform their duties and functions. Increasing the number of municipal police officers patrolling may improve the performance of municipal police officers on the 'street'. Increasing the number of municipal police officers is the duty and responsibility of the municipal police agency, as one of the municipal governmental agencies of Palermo. The efforts of the municipal police agency may improve patrolmen's performance and pursue sustainable mobility policy goals.

Adding the number of traffic cameras as an organizational resource may influence the reduction of financial resources. Additionally, increasing the number of new patrol officers appears to be delayed, requiring at least one year to recruit new police officers. Consequently, organizational resources intended to support municipal police performance face their own challenges. This subchapter aims to frame how strategic resources of the municipal police agency can support the performance of municipal police officers.

Studies of street-level bureaucrats should include organizational environments (Chang & Brewer, 2023). Accordingly, the current study of street-level bureaucrats extends beyond the personal job of municipal police officers. Hence, an organizational control system is not confined to individuals but also encompasses the organizational level in a broader sense. The organizational control system for

municipal police officers, at the individual level, is part of the organizational control system for the municipal police agency at the organizational level. Organizational control systems include individual, group, and organizational goals (Flamholtz, 1979). Municipal police officers on patrol work not only for their individual goals but also for the goals of the municipal police agency as a government organization. The success or failure of municipal police officers in achieving organizational goals is not only an issue related to the municipal police officers' performance. The success or failure of municipal police officers on patrol may be closely related to the available resources of the municipal police agency. For example, municipal police officers may have a heavy workload enforcing the regulation in one location. Thus, they cannot patrol many areas in one workday. In this case, the municipal police agency needs to provide resources that can support the duties and responsibilities of patrol officers. "Organizations have to choose what resources to provide" (Lipsky, 1980, p. 73) the performance of street-level bureaucrats.

5.1.2 Main Causal Loop for Enhancing Performance Outputs of Municipal Police at the Individual Level

In the public sector, performance output cannot be measured profit-oriented (Lipsky, 1980) or market transactions (Rua, 2023). In the public administration provision, according to Dooren et al. (2015, p. 23), the output is "products or services that come out of the production process, regardless of whether they are consumed or not". Since street-level bureaucrats are legitimized to deliver public services (Chang & Brewer, 2023), municipal police officers are responsible for providing services rather than products. Accordingly, these officers must be capable of offering excellent service to citizens. Service provision in the public sector differs from transactions between a vendor and a client in the private sector, where service quality often depends on payment. In contrast, public servants, including municipal police officers, must serve all citizens without discrimination. In cases of mobility violations, police officers should enforce the regulations impartially, regardless of the offender's identity.

Since municipal police officers enforce local laws, this subchapter outlines their duties in sanctioning mobility violators in RTZs. In providing services, police

officers should prioritize imposing sanctions on violators. If residents or tourists are sanctioned for violating urban mobility rules, it will benefit all citizens. The more sanctions given to violators in pedestrian areas, the more pedestrians feel the benefits. The street-level bureaucrats can deliver benefits and sanctions (Lipsky, 1980). Increasing the number of sanctioned violators should be considered as a key performance output. This indicates that performance output is measured by the number of violators who receive sanctions or punishments. The patrol officers are responsible for imposing sanctions on residents or tourists who violate regulations. Unfortunately, patrol officers sometimes fail to sanction violators as required.

The fewer violators sanctioned by patrol officers indicate minimal output achievement. Conversely, increasing the number of violators sanctioned reflects the intended output. In other words, a decrease in violators who were not sanctioned reflects unintended output. Output describes the effect of a particular process or activity arising from variables directly connected in a causal relationship. The performance output results from the causal effect of one or more variables. In this context, output is not understood in the same manner as the classical input-output process. Input-output models are less concerned about cause-and-effect relationships (Bianchi, 2016). Emphasizing cause-and-effect relationships between relevant variables is essential for an organizational control system or a performance management system. Both intended and unintended outputs are generated comprehensively from the system's performance. Outputs may be produced by one or more variables, which, in turn, can influence the outcomes. Subsequently, the outcomes will be feedback on the related variables, continuously affecting the outputs. The system perspective is used in understanding the outputs because “the lack of framing linkages between outputs and outcomes in performance measurement can lead to a breakdown” (Bianchi, 2016, p. 20).

The discretion exercised by patrol officers is pivotal in determining the main output (i.e., the number of sanctioned violators). Violators must not be granted discretion over their actions; ideally, they should be sanctioned for each violation as a direct consequence of their behavior. Offenders may persist in offenses without such consequences, making patrol officers encounter many violators daily. By

consistently sanctioning violators, patrol officers can establish a deterrent effect, reinforcing the importance of adherence to regulations regarding sustainable mobility. In a broader context, this approach ensures that the enforcement process remains fair and unbiased, contributing to a more orderly and compliant society. Conversely, granting discretion to violators may prevent the potential for physical violence stemming from anger directed at patrol officers by the violators. There are both positive and negative aspects to the discretionary role of municipal police.

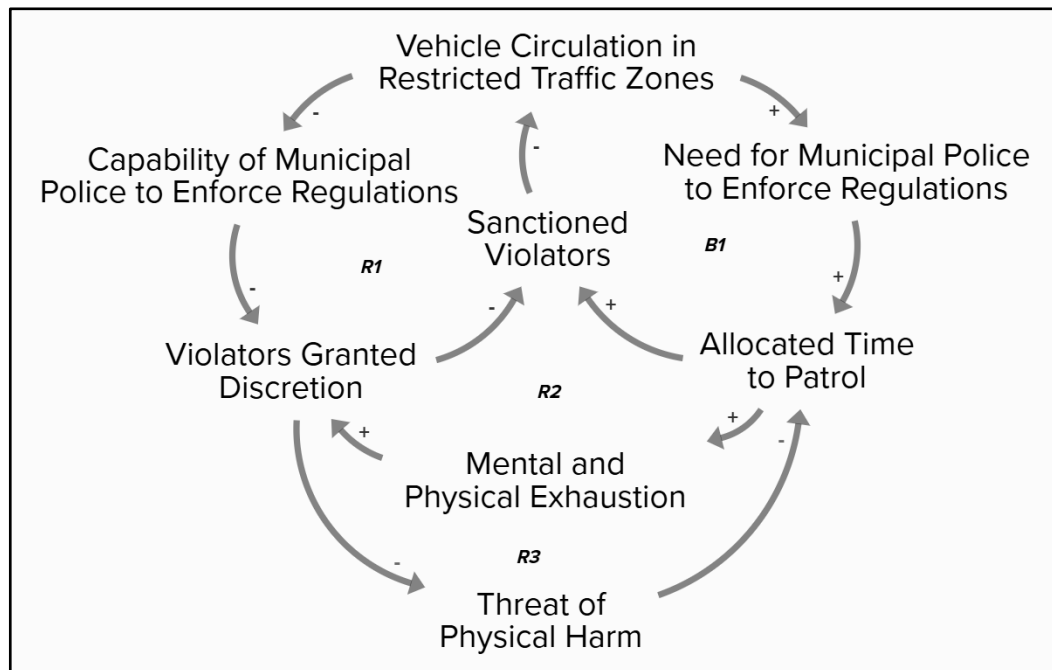
In addition to the discretionary role, the allocated time for patrolling also plays a crucial role in determining the main output. The frequency with which municipal police officers patrol specific places may significantly impact the likelihood of violations occurring in the same areas. The increased patrol presence can pressure potential violators psychologically, deterring them from engaging in illegal activities. This action may lead to a substantial reduction in mobility violations over time. Regular patrolling not only enhances the visibility of law enforcement but also reinforces the perception of a vigilant and responsive police force. As a result, individuals contemplating unlawful actions may be prevented by the heightened risk of being sanctioned. By strategically allocating patrol time, municipal police may reduce violations and promote a culture of compliance with local regulations.

There may be other causes and effects of reduced discretion and proactive patrolling. On the one hand, reduced discretion and proactive patrolling may have positive impacts, such as increased compliance with regulations and enhanced public safety. On the other hand, they may have negative impacts, such as potential over-policing and particular group pushback¹¹³. The last two paragraphs provide a general overview of the significant impact of less discretion and proactive patrolling on achieving outputs and outcomes in urban mobility. Overall, the interplay between reduced discretion and proactive patrolling highlights the importance of balanced law enforcement strategies.

¹¹³ Based on interviews, certain anonymous groups disapproved of excessive police action in issuing sanctions.

This thesis's scope is limited to the causal relationship between discretionary role and allocated patrol time with sanctioned violators as the main output. This limitation is applied to the simplicity of interventions. As previously mentioned, the number of sanctioned violators is the primary performance output for patrol officers. This output reflects the imposition of sanctions instead of the provision of benefits. As street-level bureaucrats, patrol officers differ from other professionals, such as doctors. Doctors' main performance output (e.g., the number of patients examined) is more oriented towards providing benefits than sanctions. This explanation merely offers an overview, indicating that municipal police have distinct roles and performance outputs. The causal loop below illustrates how discretion and allocated patrol time are linked to sanctioned violators as the primary performance output and other relevant outputs.

Figure 5.2 Main Causal Loop Regarding Municipal Police Performance at the Individual Level



Source: Author's elaboration

Figure 5.2 comprises four loops: one balancing loop and three reinforcing loops. Each of these loops includes its respective variables, totaling eight variables. Each of these seven variables possesses a detailed and distinct significance.

- The first variable is the sanctioned violators. It refers to individuals penalized for violating local regulations on pedestrian areas and limited traffic zones. The sanctions can include fines, penalties, or other legal consequences imposed by patrol officers who enforce these regulations.
- The second variable is the vehicle circulation in restricted traffic zones. It refers to the movement of vehicles within designated areas with limited access, including pedestrian areas and limited traffic zones in the city center. These zones are enforced by the municipal police, who monitor and control vehicle circulation to ensure compliance with local regulations. Vehicle circulation includes cars, motorcycles, mopeds, and micromobility vehicles.
- The third variable is the capability of municipal police to enforce regulations. It refers to the technical and strategic ability of the municipal police to enforce local regulations effectively. The capability includes responding (e.g., delayed response) to violations. An increase in delayed response is equivalent to a decrease in the capability of the municipal police. The capability encompasses all actions that police officers should have executed against violators, but they do not execute the violators. This includes situations where police officers merely monitor areas rather than enforce the regulations against violators.
- The fourth variable is the violators' granted discretion. It refers to individuals who violate local regulations but do not receive sanctions or penalties. In this situation, patrol officers use their discretionary role to impose sanctions or penalties. In practice, patrol officers either ignore or forgive the violators.
- The fifth variable is the mental and physical exhaustion. It refers to the depletion of personal resources experienced by patrol officers due to the demands of their duties. The mental and physical exhaustion includes stress, emotional burnout, muscle fatigue, and joint pain. In this situation, the municipal police are experiencing an overload of patrol duties.
- The sixth variable is the allocated time to patrol. It refers to the specific time designated for each patrol officer to enforce the regulations rather than monitor the situation within their assigned areas. The allocated patrol time follows regular working hours per day.

- The seventh variable is the need for municipal police to enforce regulations. It is synonymous with the demand to enforce regulations for patrol officers. This represents a response to illegal activities occurring in restricted traffic zones.
- The eighth variable is the threat of physical harm. It refers to any situation where a police officer perceives an imminent risk of being injured or attacked.

The causal loop labeled B1 represents a balancing loop, encompassing the sanctioned violators, the vehicle circulation in restricted traffic zones, the need for municipal police to enforce regulations, and the allocated time to patrol. This balancing loop emerges from forming four causal links: three positive and one negative. An odd number of negative causal links signifies a balancing loop. In this feedback loop, the single negative polarity indicates an odd number. In contrast, the other variables portray a positive polarity, indicated by a plus sign. To achieve the desired objective within this loop, one can consider an external variable that positively correlates with the allocated time to patrol. By increasing the allocated time for patrol, it may be possible to regulate the B1 loop to reach the desired goal.

The relationship between the variable of sanctioned violators and vehicle circulation in restricted traffic zones describes negative polarity. This means that an increase in the sanctioning of violators in a particular area correlates with a decrease in the number of violators, subsequently reducing private vehicle circulation. To illustrate with factual evidence, on a particular day, approximately 15 private cars were parked illegally around the *Piazza Giulio Cesare*¹¹⁴ during specific hours. At that time, the municipal police issued fines to all vehicles parked illegally in the location. As a result, no more private cars were parked illegally. Conversely, when patrol officers did not impose sanctions on violators, the number of cars parked illegally in the area persisted.

The relationship between the variable of vehicle circulation in restricted traffic zones and the need for municipal police to enforce regulations portrays positive polarity. An increase in illegal vehicle circulation necessitates a corresponding increase in the patrol efforts of police officers. This statement describes a positive

¹¹⁴ 38°06'36.7"N 13°21'57.4"E (the coordinate on Google Maps)

causal link. This phenomenon can be observed in *Piazza Giulio Cesare*. It demonstrates that the higher the number of cars parked illegally in *Piazza Giulio Cesare* at a given time, the greater the need for police officers to patrol the area. If illegal parking persists in *Piazza Giulio Cesare* over several days, the demand for police patrols in the area will increase. The need for police patrols is higher in areas where violations frequently occur compared to areas where violations are rare. The variable of the need for police officers to patrol functions as information rather than a material entity.

The variable representing the police officers' need to enforce regulations has a positive relationship with the variable of allocated time to patrol. The greater the need for police officers to patrol, the more time municipal police may spend on patrol duties. The allocated time for patrols may be increased if there is a significant need. As the demand for police patrols increases, the allocated time to patrol should also be adjusted accordingly. For instance, in areas such as the street *via Maqueda*¹¹⁵ and *via Vittorio Emanuele*¹¹⁶, the time spent on police patrols is greater at specific times. Under normal circumstances, police patrols are conducted two to three times per day (e.g., in the morning and evening) in these areas. However, if there is information about particular activities such as exhibitions or cultural events, the allocated time for patrol increases to more than three times throughout the day.

In turn, the variable representing police time allocated to enforcement has a positive relationship with the variable of sanctioned violators. An increase in the time police enforce regulations corresponds to an increase in the number of violators who receive sanctions. For example, the number of traffic violators (e.g., individuals parking in prohibited areas) sanctioned around *Piazza Olivella*¹¹⁷ depends on the time spent enforcing regulations in that area. It can be said that the more time dedicated to imposing sanctions, the higher the number of violators sanctioned. Otherwise, the number of people parking in pedestrian areas or on public land will decrease. When municipal police actively enforce regulations, the number of

¹¹⁵ 38°07'08.4"N 13°21'33.5"E (the coordinate on Google Maps)

¹¹⁶ 38°06'55.8"N 13°21'39.6"E (the coordinate on Google Maps)

¹¹⁷ 38°07'14.6"N 13°21'36.6"E (the coordinate on Google Maps)

illegally parked vehicles decreases. Conversely, when the municipal police do not enforce regulations, the number of illegally parked vehicles increases.

The causal loop labeled R1 describes a reinforcing loop, connecting the sanctioned violators, the vehicle circulation in restricted traffic zones, the capability of municipal police to enforce regulations, and the violators granted discretion. Additionally, the variable of sanctioned violators and vehicle circulation in restricted traffic zones is part of the B1 loop. The reinforcing loop occurs because all four causal links delineate negative polarity, an even number of negative links. The absence of an odd number of negative causal links in a causal loop indicates a reinforcing loop.

The link between the vehicle circulation in restricted traffic zones and the capability of municipal police to enforce regulations depicts negative polarity. If vehicle circulation in certain areas increases, the capability of municipal police will decrease. This polarity indicates an opposite direction or inverse relationship. Offenders, such as illegal car drivers and scooter riders, are frequently present along the street *via Vittorio Emanuele*¹¹⁸ throughout the day, demonstrating high vehicle circulation. When the number of vehicles in circulation increases, while the number of patrol officers remains limited, the patrol officers become overwhelmed in issuing sanctions. Consequently, their capabilities, including response time and location range, are reduced, making it challenging to enforce regulations effectively.

The link between the capability of municipal police to enforce regulations and the violators granted discretion depicts negative polarity. There is an opposite direction. If the capability of patrol officers decreases due to the high number of vehicles in circulation, the number of violators granted discretion will increase. This is an unexpected situation in sustaining sustainable mobility. This situation frequently occurs along the street *via Vittorio Emanuele* and *via Giovanni Meli*¹¹⁹. Although

¹¹⁸ This street runs in the city center, from east (*Porta Nuova*) to west (*Porta Felice*), for about 2 kilometers.

¹¹⁹ This street is located in the city center, connecting *Piazza Fonderia* and *Piazza San Domenico*, and spans approximately 300 meters in length.

municipal police routinely patrol the pedestrian areas of *via Giovanni Meli*, the circulation of private cars passing through and parking remains prevalent. Due to the large number of vehicles, municipal police officers are unable to sanction all violators at these locations. This indicates that the number of violators granted discretion is increasing.

In turn, the link between the violators granted discretion and the sanctioned violators also shows negative polarity. When municipal police grant discretion to violators, it is equivalent to not sanctioning them. Therefore, as more discretion is granted to violators, fewer are sanctioned. This indicates the opposite direction. The link plays a crucial role within this loop. However, the link pertains to significant daily occurrences in pedestrian areas and restricted traffic zones. This loop illustrates that police officers tend to monitor rather than enforce regulations¹²⁰. Consequently, the undesirable situation of ignoring and forgiving violators, as a form of violators being granted discretion, frequently occurs. Actions that do not enforce the regulations (e.g., ignored violators and forgiven violators¹²¹) against violators are considered a form of discretion exercised by police officers towards violators. Patrolmen who merely monitor without imposing sanctions are engaging in discretionary action. For example, along the street *via Ruggiero Settimo*¹²², municipal police officers are more likely to monitor the area rather than impose sanctions on violators. Consequently, violations, such as scooter riders crossing the street without proper authorization, frequently occur.

Regarding the link between violators granted discretion and sanctioned violators, two critical situations occur implicitly but are not explicitly stated in the causal loop.

¹²⁰ In this thesis, it is understood that monitoring actions are a form of discretion, as police officers do not impose sanctions on violators. Therefore, monitoring actions are excluded from being categorized as patrol actions. Conversely, patrol actions refer to enforcement actions. This distinction is intended to differentiate between patrols that enforce regulations and those that do not. Patrols that do not enforce regulations are equivalent to monitoring actions.

¹²¹ The distinction between forgiven and ignored violators lies in the situation and conditions. Forgiven violators are defined as those whom the patrolman observes directly and subsequently issues a warning without imposing a sanction. Ignored violators are those whom the patrolman observes directly but neither warns nor sanctions.

¹²² 38°07'27.4"N 13°21'21.2"E (the coordinate on Google Maps)

- The greater the number of monitoring actions, the higher the likelihood that violators will be forgiven or not sanctioned. In fact, municipal police who patrol the street *via Maqueda* and its intersections or T-junctions often focus on monitoring rather than enforcing sanctions. Patrolmen typically issue warnings to violators, considering this effort as part of direct education rather than punishment. Violators, such as those who park in a prohibited area, often leave after receiving a warning. Subsequently, the patrolmen also leave and continue their patrol activities. Unfortunately, these violators tend to re-commit violations once the patrolmen have left. For instance, at several T-junctions and intersections along the northern part of *via Maqueda*, residents who park in prohibited areas and are forgiven by patrolmen often return to park in restricted areas once the municipal police leave. In other words, when the municipal police move to another location, the violators persist in committing the same infractions. This indicates that if patrolmen merely forgive violators without imposing sanctions, the number of existing violators will continue to rise.
- The greater the number of monitoring actions, the higher the likelihood that violators will be ignored or not sanctioned. The increasing number of ignored violators encourages existing violators to continue to proliferate. For example, in a long street between *Piazza San Domenico*¹²³ and *Piazza Fonderia*¹²⁴, illegally parked cars can be seen every hour and every day. Patrolmen neglect to address violations occurring in the area, often passing by despite infractions around *Piazza San Domenico* and *Piazza Fonderia*. The increasing number of car drivers parking in pedestrian areas between *Piazza San Domenico* and *Piazza Fonderia* encourages other drivers to do the same. Consequently, new violators will continue to proliferate throughout the day, assuming no warnings or sanctions exist. Ignored violators seem to have a greater impact on existing violators, demonstrating that patrolmen do not take any action against them. If patrolmen frequently ignore violators, the risk of continued violations will increase.

¹²³ 38°07'07.5"N 13°21'47.4"E (the coordinate on Google Maps)

¹²⁴ 38°07'09.9"N 13°21'57.9"E (the coordinate on Google Maps)

The causal loop labeled R2 also describes a reinforcing loop. The reinforcing loop is formed because the number of minus signs is even, and the others are plus signs. This indicates a reinforcing symbol. The variables associated with this loop are mental and physical exhaustion, violators granted discretion, sanctioned violators, vehicle circulation in restricted traffic zones, need for municipal police to enforce regulations, and allocated time to patrol. The variables of sanctioned violators, vehicle circulation in restricted traffic zones, need for municipal police to enforce regulations, and allocated time to patrol are associated with the B1 loop, while the variable of violators granted discretion is associated with the R1 loop. Thus, the primary variable in this loop is mental and physical exhaustion, which is associated with its cause and effect.

The link between the variables of allocated patrol time and mental and physical exhaustion delineates a positive polarity. This implies that an increase in allocated patrol time corresponds to a rise in mental and physical exhaustion¹²⁵. It indicates the same direction. For example, municipal police officers patrolling busy areas such as *Piazza San Domenico* and *Piazza Fonderia* may experience higher fatigue levels due to the extended hours spent patrolling for mobility violations. The longer police officers patrol, the more mental and physical exhaustion they accumulate.

Next, the link between the variables of physical exhaustion and violators granted discretion also shows a positive polarity. As mental and physical exhaustion increases, the likelihood of granting discretion to violators may also rise. This statement can be attributed to the previous link, the relationship between allocated patrol time and mental and physical exhaustion. Due to the high allocated patrol time per day, increasing exhaustion can negatively impact the effective enforcement of traffic regulations, potentially leading to more violators being forgiven or ignored. Thus, allocated patrol time is the cause of exhaustion, and the granting of discretion to violators is the effect. The high number of mobility violations

¹²⁵ This argument is based on the results of research conducted by Homer (1985) using the system dynamics method. The study concluded that the number of hours worked per week negatively impacts worker burnout. This means that the more hours worked, the greater the worker's level of fatigue.

occurring around *Piazza San Domenico* and *Piazza Fonderia* is attributable to the mental and physical exhaustion of police officers.

The causal loop, signed as R3, also illustrates a reinforcing loop. The reinforcing loop is formed because the number of minus signs is even, and the others are plus signs. In other words, there are two minus signs and two plus signs. This indicates a reinforcing symbol. The variables associated with this loop are allocated time to patrol, mental and physical exhaustion, violators granted discretion, and threat of physical harm. The variable of allocated time to patrol is associated with the B1 loop. The variable of violators granted discretion is associated with the R1 loop. The variable of mental and physical exhaustion discretion is associated with the R2 loop. Thus, the primary variable in this loop is the threat of physical harm, which is associated with its cause and effect.

The link between the violators granted discretion and the threat of physical harm shows negative polarity. This implies that increasing the number of violators granted discretion may decrease the threat of physical harm. The link indicates the opposite direction. Although specific evidence supporting this argument was not identified during the research process, the threat remains likely to occur. This may be predicated on incidents that have occurred in other cases. For example, a young man injured two municipal police officers while they were on patrol in the city of Rome. Similar incidents have been frequently reported in online media across Italy¹²⁶. The situation that occurred in Rome has the potential to occur in Palermo¹²⁷.

Next, the link between the threat of physical harm and allocated time to patrol also shows a negative polarity. As the threat of physical harm increases, the allocated patrol time may decrease. This statement can be attributed to the previous link, from violators granted discretion to the threat of physical harm. Due to the high threat of physical harm, patrol officers may be cautious, reducing allocated patrol time.

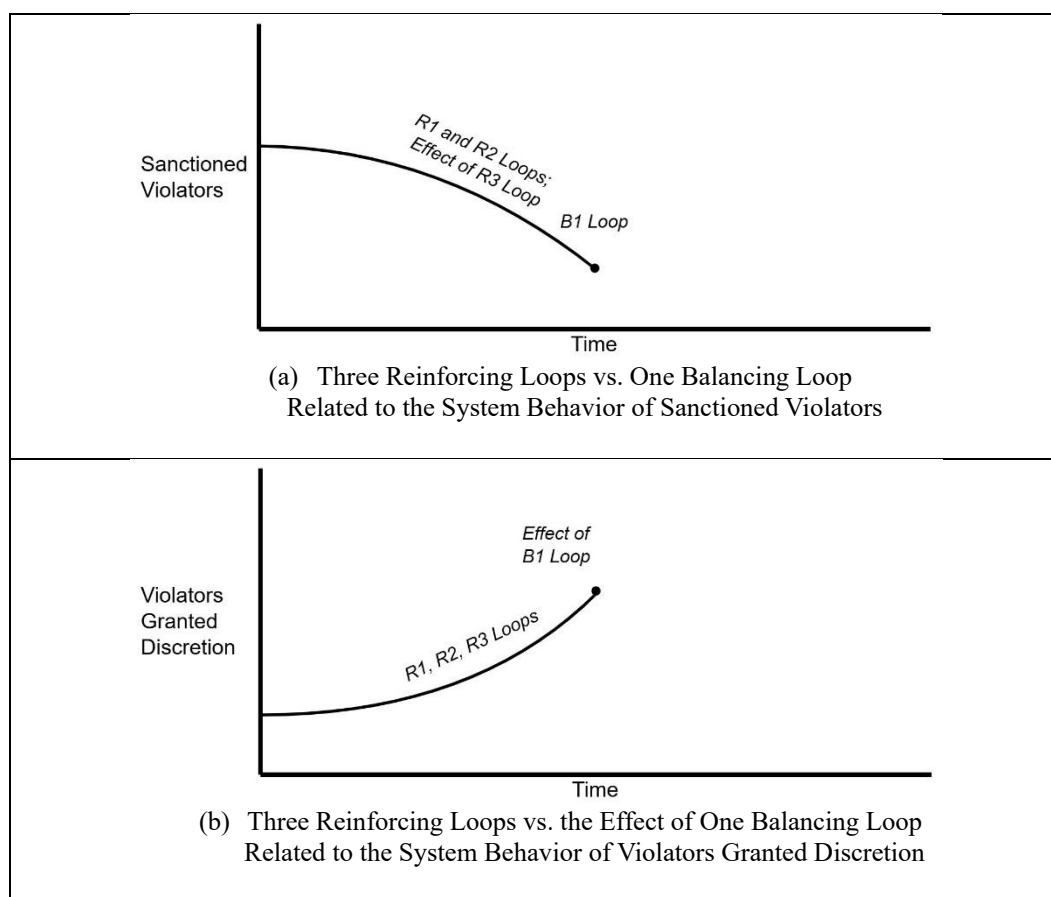
¹²⁶ <https://www.romatoday.it/cronaca/uomo-salta-tetto-auto-vigili-feriti-san-giovanni.html>

¹²⁷ Based on the author's experience, acts of physical violence frequently occurred in the city center of Palermo from 2022 to 2025. Frequent acts of physical violence indicate that residents have the potential to commit similar acts in various situations and conditions.

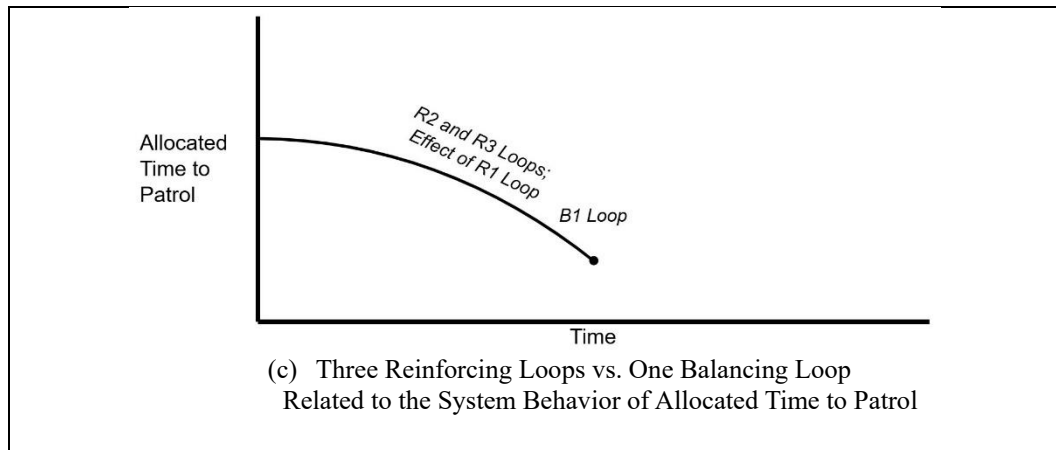
Municipal police officers may initiate a strike¹²⁸ following instances of violence, reducing patrol time.

Furthermore, the figures below analyze system behavior as part of an initial trade-off analysis based on time and space. According to Bianchi (2016), framing trade-offs helps identify system performance and potential policy levers. It is important to note that not all variables presented in Figure 5.2 are detailed in Figure 5.3. The variables in Figure 5.3 illustrate only a few causal mechanisms, which are highlighted as the main variables. However, all variables in Figure 5.2 are inseparable from the system's behavior of the three variables below.

Figure 5.3 System Behavior Regarding the Main Causal Loop at the Individual Level



¹²⁸ Public servants typically go on strike when unexpected events occur.



Source: Author's elaboration

Figure 5.3 (a) depicts the system behavior of sanctioned violators when there are two dominant reinforcing loops (i.e., R1 and R2 Loops) and the effect of one related reinforcing loop (i.e., R2 Loop). Also, there is one balancing loop (i.e., B1 Loop). The reinforcing loops marked with a line represent the current state that needs to be changed, while the balancing loop marked with a period is intended to counterbalance. However, it can be regarded currently that the reinforcing loops are more potent than the balancing loop. This can occur if the R1, R2, and R3 loops are more substantial than the B1 loop. This means that the three reinforcing loops can dominate one balancing loop in the future. Figure 5.3 (a) represents an end result.

Figure 5.3 (b) depicts the system behavior of violators granted discretion when there are three dominant reinforcing loops (i.e., R1, R2, and R3 Loops) and the effect of one related balancing loop (i.e., B1 Loop). The reinforcing loops marked with a line represent the current state that needs to be changed, while the balancing loop marked with a period is intended to counterbalance. However, it can be regarded currently that the three reinforcing loops are more potent than the related balancing loop. This can occur if the R1, R2, and R3 loops dominate system behavior over time. Figure 5.3 (b) represents a strategic resource.

Figure 5.3 (c) depicts the system behavior of allocated time to patrol when there are two dominant reinforcing loops (i.e., R2 and R3 Loops) and the effect of one related reinforcing loop (i.e., R1 Loop). Also, there is one balancing loop (i.e., B1 Loop). The reinforcing loops marked with a line represent the current state that needs to be

changed, while the balancing loop marked with a period is intended to counterbalance. However, it can be regarded currently that the reinforcing loops are more potent than the balancing loop. This can occur if the R1, R2, and R3 loops are more substantial than the B1 loop. This means that the three reinforcing loops can dominate one balancing loop in the future. The system behavior of allocated time to patrol is similar to that of sanctioned violators, but the dominant loops that influence them differ. If there are variables in each of their loops that dominate the state, the system's behavior can differ accordingly. Figure 5.3 (c) represents a strategic resource.

Based on Figure 5.2, the B1 loop is a control mechanism to achieve the desired state. Increasing allocated patrol time may be necessary to maximize the number of sanctioned violators, thereby leading to the intended outcomes. However, the increase in patrol time must be regulated to prevent negative effects on the R1 and R2 loops. Allocated patrol time should be neither excessively high nor excessively low. Instead of acting as a balancing loop, a poorly controlled B1 loop can create an undesirable state.

The R1 loop is an undesirable feedback loop. This loop can reinforce the variable of granting discretion to violators, which is undesirable growth. When discretion towards violators increases, it leads to negative consequences. If the variables within this loop continue reinforcing each other, achieving sanctioned violators becomes increasingly tricky. Reducing the number of violators granted discretion is a potential action and goal to achieve the intended output (i.e., the number of sanctioned violators), leading to the desired outcomes. Another balancing loop may be necessary to align the desired goal with the gap in discretion granted to violators. It is necessary to control the undesirable effects of the R1 loop. Reducing the number of violators granted discretion aims to strengthen the B1 loop.

Similar to the R1 loop, the R2 and R3 loops are undesirable feedback loops. It requires balancing control. Otherwise, such mental and physical exhaustion can negatively impact the short-term and long-term. The R2 loop is a side effect caused by the B1 loop. On the other hand, the R2 loop can have a negative impact on the

R1 and R3 loops and vice versa. The R1, R2, and R3 loops can worsen the state over time if not controlled wisely. Although the R2 loop is a side effect of the B1 loop, the R2 loop can also exert a reciprocal influence on the B1 loop. If the R2 loop strengthens, the R3 loop may also become more substantial. These two loops can strengthen each other.

If the R1, R2, and R3 loops dominate the system, achieving the desired goal through the B1 loop becomes difficult. To achieve the desired goal, the B1 loop must be optimized judiciously to counterbalance the dominating effects of the R2 and R3 loops. If the system behavior in the B1 loop is as expected, then the behavior of the R2 and R3 loops, including the R1 loop, will ideally change. The system behavior in the four loops determines the achievement of the expected number of sanctioned violators and vehicle circulation in restricted traffic zones, leading to increased intermediate and final outcomes. If the B1 loop fails to control the R1, R2, and R3 loops, another balancing loop may be required as a potential counterbalance.

The main causal loop regarding the performance outputs of municipal police in Figure 5.2 is optimized with a balancing loop in Figure 5.4 below. This optimization is necessary because the balancing loop in Figure 5.2 may not be able to dominate the reinforcing loop. The balancing loop is essential to counterbalance the undesirable dominance of the reinforcing loop. The optimized main causal loop regarding the performance outputs of municipal police in Figure 5.4 below is an extension of Figure 5.2.

The diagram illustrates the following causal relationships:

- Vehicle Circulation in Restricted Traffic Zones** (+) → **Need for Municipal Police to Enforce Regulations**
- Need for Municipal Police to Enforce Regulations** (+) → **Allocated Time to Patrol**
- Allocated Time to Patrol** (+) → **Violators Granted Discretion**
- Violators Granted Discretion** (+) → **Gap in Violators Granted Discretion**
- Gap in Violators Granted Discretion** (+) → **Desired Number of Violators Granted Discretion**
- Desired Number of Violators Granted Discretion** (+) → **Violators Granted Discretion**
- Violators Granted Discretion** (-) → **Sanctioned Violators**
- Sanctioned Violators** (-) → **Vehicle Circulation in Restricted Traffic Zones**
- Sanctioned Violators** (+) → **Threat of Physical Harm**
- Threat of Physical Harm** (+) → **Mental and Physical Exhaustion**
- Mental and Physical Exhaustion** (+) → **Allocated Time to Patrol**
- Vehicle Circulation in Restricted Traffic Zones** (-) → **Capability of Municipal Police to Enforce Regulations**
- Capability of Municipal Police to Enforce Regulations** (-) → **Sanctioned Violators**

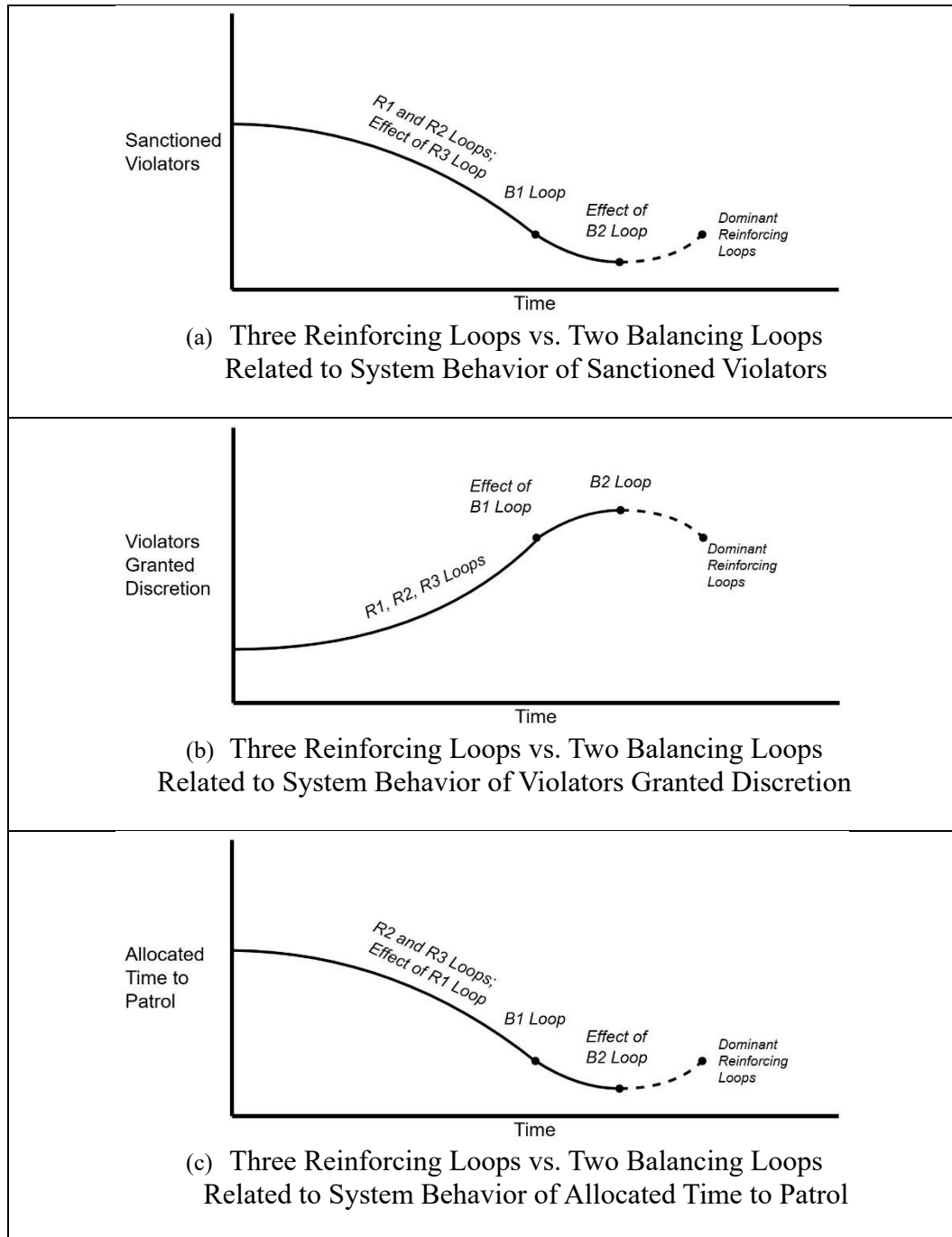
Feedback loops are identified as follows:

- R1:** Vehicle Circulation in Restricted Traffic Zones → Sanctioned Violators → Vehicle Circulation in Restricted Traffic Zones (Negative feedback loop).
- R2:** Sanctioned Violators → Violators Granted Discretion → Sanctioned Violators (Negative feedback loop).
- R3:** Violators Granted Discretion → Threat of Physical Harm → Mental and Physical Exhaustion → Allocated Time to Patrol → Violators Granted Discretion (Positive feedback loop).

The B2 loop is designed to restructure the system's behavior as anticipated. Loop B1, however, appears inadequate for simultaneously controlling the R1, R2, and R3 loops. The presence of the B2 loop serves as a strategy to overcome undesirable conditions arising from the strength of the R1, R2, and R3 loops. If the B1 and B2 loops can counterbalance the state simultaneously, the expected state can be achieved. The B1 and B2 loops serve as inputs (i.e., interventions or actions) in the system to achieve the intended outputs, leading to achieving intended outcomes.

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Figure 5.5 System Behavior Regarding the Optimized Main Causal Loop at the Individual Level



Source: Author's elaboration

Figure 5.5 (a) depicts the system's behavior of sanctioned violators when there is an effect of adding one balancing loop (i.e., B2 Loop). The reinforcing loops marked with a line represent the current state that needs to be changed, while the balancing loop marked with periods is intended to counterbalance in the future. If

the B1 and B2 loops are more substantial than the reinforcing loops, then they can counterbalance the state. This means the two balancing loops may dominate the reinforcing loops. The inputs associated with the two balancing loops must be set and conducted with appropriate interventions. Accordingly, the restructuring scenario should be performed. The number of sanctioned violators should not decrease.

Figure 5.5 (b) depicts the system behavior of violators granted discretion when adding one balancing loop (i.e., B2 Loop). The B2 loop is directly related to the violators granted discretion so that it may directly generate the system behavior. The reinforcing loops marked with a line represent the current state that needs to be changed, while the balancing loop marked with periods is intended to counterbalance in the future. If the B1 and B2 loops are more substantial than the reinforcing loops, then they can counterbalance the state. This can occur if the B1 and B2 loops are more substantial than the reinforcing loops. This means the two balancing loops may dominate the reinforcing loops. This follows the scenario of crisis prevention. The number of violators granted discretion should not increase.

Figure 5.5 (c) depicts the system behavior of allocated time to patrol when there is an effect of adding one balancing loop (i.e., B2 Loop). The B2 loop may generate system behavior changes, as shown in the figure above. The changes can occur if the B1 and B2 loops are more substantial than the reinforcing loops. Accordingly, the restructuring scenario needs to be designed. A significant reduction in allocated patrol time is undesirable.

By optimizing crisis prevention (see Figure 5.5.b) and implementing effective restructuring (see Figure 5.5.c) scenarios, municipal police can significantly enhance long-term outcomes related to sustainable mobility. These strategic approaches aim to reduce vehicle circulation in restricted traffic zones, achieving all intended outcomes. Conversely, unintended outcomes may occur if the scenarios are not implemented optimally. These scenarios address current issues and aim to prevent undesirable situations in the future.

Figure 5.6 illustrates how links from variables related to the organizational level are connected to variables related to the individual level in systems thinking. The key point is that the performance of municipal police officers is related to the performance of the municipal police agency. The figure follows what Flamholtz (1996b) stated that individual goals align with organizational goals. This implies that the performance of municipal police officers is related to the performance of the municipal police agency and vice versa.

Figure 5.6 describes five additional closed loops (B3, B4, B5, B6, and R4) that connect the efforts of the municipal police agency, new patrol officers, financial resources, use of traffic cameras, fined violators, municipal police capability, and vehicle circulation in Restricted Traffic Zones. However, there are two delays connecting the efforts by the municipal police agency with the new patrol officer and between the efforts by the municipal police agency and the use of patrol cameras. This means that no effort can be implemented directly to support the performance of the municipal police. Such use of traffic cameras requires several days for data processing. Such new patrol officers may require several months for their administrative process.

The relationship of each link in the feedback loops is described in detail below:

- The B3 loop depicts that the more efforts by the municipal police agency to intervene, the newer patrol officers; the newer patrol officers, the more municipal police capability; the more municipal police capability, the less violators granted discretion; the less violators granted discretion, the more sanctioned violators; the more sanctioned violators, the less vehicle circulation; in turn, the less vehicle circulation, the less efforts by the municipal police agency to intervene.
- The B4 loop depicts that the more efforts by the municipal police agency to intervene, the more use of traffic cameras; the more use of traffic cameras, the more fined violators; the more fined violators, the less vehicle circulation; in turn, the less vehicle circulation, the less efforts by the municipal police agency to intervene

- The B5 loop depicts that the more financial resources, the more efforts by the municipal police agency to intervene; the more efforts by the municipal police agency to intervene, the newer patrol officers; in turn, the newer patrol officers, the less financial resources.
- The B6 loop depicts that the more financial resources, the more efforts by the municipal police agency to intervene; the more efforts by the municipal police agency to intervene, the more use of traffic cameras; in turn, the more use of traffic cameras, the less financial resources.
- The R4 loop depicts that the more fined violators, the more financial resources; the more financial resources, the more by the municipal police agency to intervene; the more by the municipal police agency to intervene, the more use of traffic cameras; in turn, the more use of traffic cameras, the more fined violators.

In fact, the municipal police agency of Palermo sometimes recruits new municipal police officers to add to the current patrolmen. At least as many as 30 municipal police officers of Palermo were recruited in the year 2023¹²⁹. This effort is one of the concrete steps taken by the municipal police agency and the municipal government of Palermo to maximize the duties and responsibilities of the municipal police officers. Recruitment is related to patrol functions regarding urban mobilities in various locations in Palermo. Adding municipal police officers can assist with the duties and responsibilities of actual municipal police officers. If the number of municipal police officers patrolling increases, sanctioned violators may increase. The critical variable in the B1 loop is new patrolmen. Adding or reducing new patrolmen significantly influences the balancing of the loop. The addition of new patrolmen can also lessen the overwork of actual patrolmen. As an illustration, the workload of 100 municipal police officers is certainly different from that of 130 municipal police officers, after additional personnel.

Unfortunately, the addition of new patrolmen indicates a delay. There has been a delay of several months due to the administrative process. As an illustration, new

¹²⁹ <https://www.comune.palermo.it/palermo-informa-dettaglio.php?id=39039&tipo=1>.

patrolmen recruited in September cannot carry out their duties and functions in September. New patrolmen recruited in September may perform their duties and functions optimally in November (in the next year). A delay of several months while recruiting new patrolmen is a challenge in reducing existing violators. During a delay of several months, existing violators may continue to increase because actual patrolmen are still insufficient. Existing violators may decrease even further after new patrolmen optimize their roles and duties. Even though the municipal police and municipal government of Palermo recruit new patrolmen yearly, existing violators may always exist in large numbers while the recruitment process is ongoing. The municipal police need to regulate or anticipate the delay because the delay related to recruiting new patrolmen will always exist. Administrative and other processes have become standard procedures in recruiting new civil servants.

Additionally, the municipal police agency of Palermo has been using traffic cameras to control traffic and mobility violations in recent years. Until 2023, the municipal police operated at least 800 cameras in various locations in Palermo¹³⁰. This amount will be increased every year according to needs and budget availability. Using traffic cameras is supported by a control room¹³¹ located in the principal office of the municipal police agency. One of the functions of traffic cameras is to monitor mobility and traffic violations in real time. Traffic cameras are considered to reduce the burden of patrolmen's duties. Traffic cameras can cover specific locations that may not be accessible by patrolmen. Conversely, specific locations not controlled by traffic cameras can be monitored by patrolmen. The functions of using cameras and patrols can strengthen each other. Traffic cameras can monitor a particular location in real time, whereas patrolmen may not monitor it in real time. Traffic cameras can also reduce unintended discretion carried out by patrolmen. Traffic cameras will always provide detailed information signals of violations to the control room so that unprofessional actions that patrolmen may carry out can be controlled. The use of traffic cameras may minimize inappropriate discretion.

¹³⁰ <https://www.palermolive.it/con-800-telecamere-la-control-room-monitorera-tutto-cio-che-accade-a-palermo/>.

¹³¹ <https://www.comune.palermo.it/palermo-informa-dettaglio.php?id=38535&tipo=1>.

Unfortunately, the use of traffic cameras also faces delays. Delays related to traffic cameras occur in two conditions. First, newly installed cameras do not guarantee they can be used immediately. Technicians who are responsible for operating traffic cameras need several days to arrange technical matters related to traffic cameras and control rooms. Second, not all cameras installed (actual traffic cameras) are guaranteed to be used daily. There is potential damage to the camera and network disruptions. The use of traffic cameras faces technical problems. In addition, the use of traffic cameras also faces issues related to the skills and professionalism of municipal police officers working in administrative and technical roles. The control room, where information from traffic cameras is processed, requires municipal police officers with high-level data and information processing skills. Capability and professionalism play a vital role in this affair.

Based on Figure 5.6, delays and financial resources are also issues. Using traffic cameras and hiring new patrolmen frequently has delays due to technical and administrative reasons. The availability of financial resources determines the sustainability of using traffic cameras and hiring new patrolmen. The higher the budget for the urban mobility project, the better the opportunity for using traffic cameras and hiring new patrolmen. For delays, the authority needs to reduce the time related to technical and administrative matters. For financial resources, the authority needs to maximize budget allocation and other funding sources so that financial resources are sufficient to carry out municipal police efforts continuously. Delays in intervention (e.g., using traffic cameras and hiring new patrolmen) and financial resources are challenges for the municipal police agency in supporting the performance of municipal police patrolling.

The efforts of the municipal police agency are needed to support the municipal police as policymakers and municipal administration (Sharma & Sachdeva, 1978). Referring to this argument, the municipal police agency, as a local government organization, is responsible for resolving various issues related to implementing urban mobility policies. The role of policymakers and municipal administration has become the role of municipal police officers individually and the municipal police agency organizationally. Both roles are inseparable and interrelated. Both municipal

police as patrol officers and municipal police as administration staff—back-office bureaucrats—play significant roles. For example, patrol officers may receive the latest information regarding traffic and mobility violations from the administration staff working in the control room.

Administratively, the roles and responsibilities of municipal police in handling traffic and mobility violations are directly coordinated within the organizational structure. For example, patrolmen always ask for and receive direction from superiors regarding decisions in certain situations and conditions. Therefore, the efforts of the municipal police agency as an organization can impact the duties and responsibilities of patrolmen individually. Although situational factors are more important than organizational characteristics (Crank, 1992) for patrolmen, structural decisions of police organizations (Matusiak, 2019) greatly determine the goals desired by the municipal police. Situational factors are at risk of encouraging imperfect discretion of patrolmen. The municipal police agency can address the imperfect discretion of patrolmen through structural decisions. The efforts of the municipal police agency are understood as structural decisions that may be able to reduce existing violators. The efforts of the municipal police agency have feedback links that can affect other variables. In addition, the efforts of the municipal police agency are also affected by other variables.

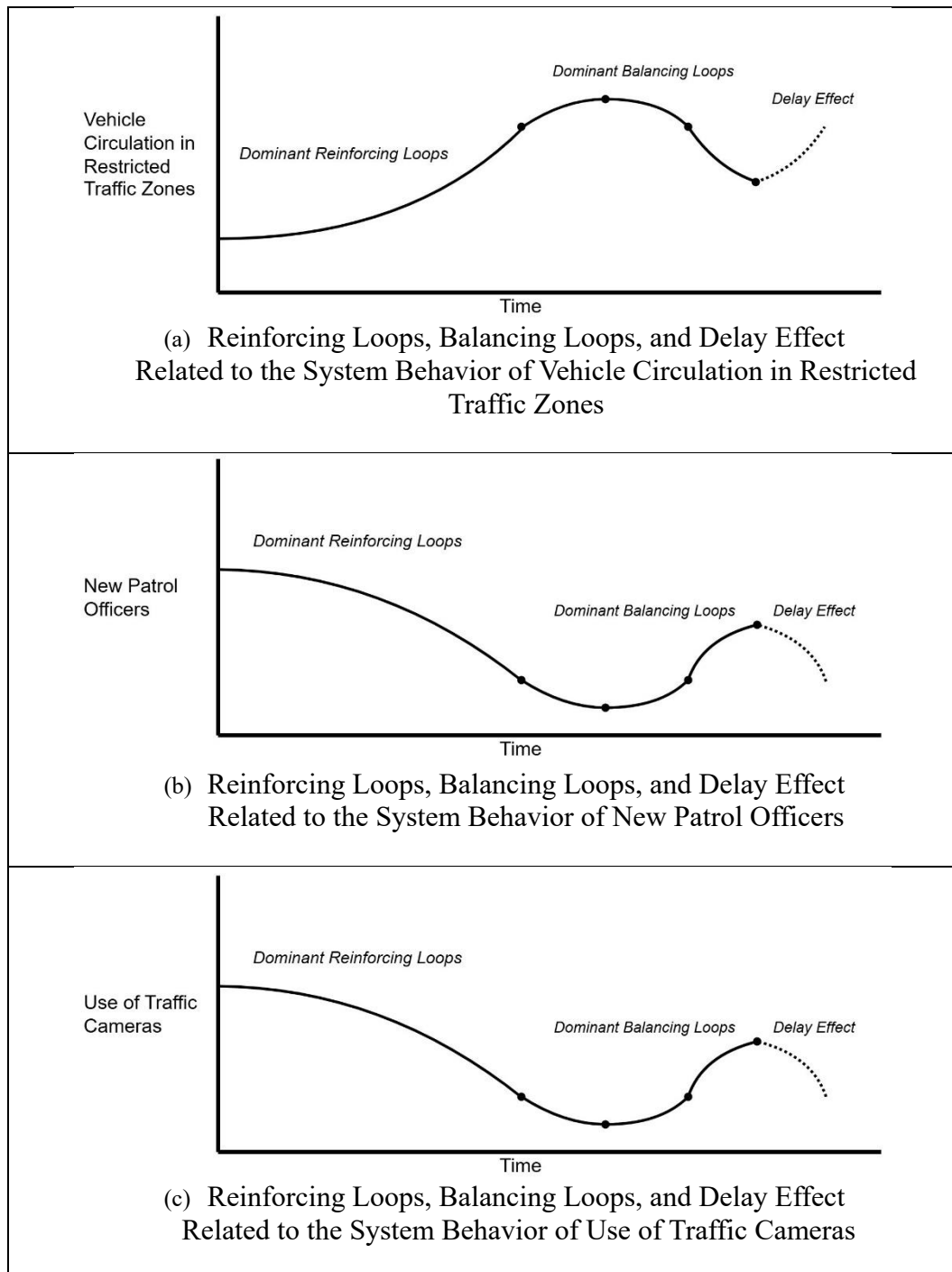
Furthermore, the desired number of patrol officers and the use of traffic cameras should be adjusted to current needs by predicting future requirements. The number of desired patrol officers should not be too high to avoid overcapacity, which can negatively impact the employee budget. The desired use of traffic cameras should consider the range of cameras per area to avoid having an area covered by two cameras while other areas remain uncovered. The standard number of financial resources allocated to sustainable mobility issues is adjusted according to the size of pedestrian areas and limited traffic zones in the city center of Palermo. For example, every 200 meters of street may require a budget of €5,000 per year. This budget includes funds for purchasing or maintaining traffic cameras and covering the operational costs of patrol officers. Pedestrian areas and limited traffic zones where traffic and mobility violations frequently occur may require a larger budget

for purchasing traffic cameras and operating patrol officers. The budget for sustainable mobility may need to be prioritized with a standard amount from now until the next few years. This means that the standard becomes a benchmark. When the sustainable mobility policy has achieved the desired impact, the standard budget allocation for sustainable mobility issues can be reduced.

The most crucial point in this performance management system is how the adjustment time (i.e., delay time) in procuring new patrol officers can be reduced. Additionally, minimizing the delay time in procuring and maintaining traffic cameras is crucial. This includes ensuring that violators' data is processed within one to three days after the violations occur. In doing so, offenders may remain consistently alert and deterred from committing violations. Therefore, officers tasked with processing data in the back office need special attention from the authorities. The more skilled they are, the faster their performance will be. The number of those who work in the back office may also need to be increased.

In Figure 5.6, the extended main causal loop encompasses the B3, B4, B5, B6, and R4 loops. All these loops are directly related to the municipal police agency at the organizational level, continuing to the individual level, and returning to the organizational level. The five additional loops indicate that balancing loops are more dominant than reinforcing loops. In total, there are six balancing loops, while there are four reinforcing loops. The dominant balancing loop may stabilize system behavior in anticipated scenarios concerning crisis prevention and restructuring in the future. The following figure illustrates how a potential scenario could be designed with the support of the municipal police agency.

Figure 5.7 System Behavior Regarding the Extended Main Causal Loop at the Organizational Level



Source: Author's elaboration

Figure 5.7 (a) depicts the system behavior of vehicle circulation in restricted traffic zones, dominated by reinforcing and balancing loops. Initially, the system behavior illustrates dominant reinforcing loops, followed by dominant balancing loops. The

presence of B3, B4, B5, and B6 loops strengthens the balancing loop line in the system. Unfortunately, delays directly related to these four balancing loops can affect changes in the line, as illustrated in the figure. Appropriate inputs in traffic camera use and new patrol officers are needed to change the system's behavior toward goal-seeking.

Figure 5.7 (b) depicts the system's behavior of new patrol officers, and Figure 5.7 (c) depicts the system's behavior of using traffic cameras. Both are dominated by reinforcing and balancing loops. Initially, the system's behavior illustrates dominant reinforcing loops, followed by dominant balancing loops. B3, B4, B5, and B6 loops strengthen the balancing loop lines in Figures 5.7 (b) and 5.7 (c). Unfortunately, delays directly related to these four balancing loops can affect changes in these lines, as illustrated in the figure above. To change the system's behavior toward goal-seeking, appropriate adjustment time concerning interventions or inputs related to the use of traffic cameras and new patrol officers needs to be designed, implemented, and controlled to minimize the effects of the delay. Figures 5.7 (b) and 5.7 (c) represent strategic resources.

Figures 5.7 (b) and 5.7 (c) aim to strengthen the crisis prevention (maintenance strategy) and the restructuring (re-design strategy) scenarios implemented by the municipal agency to support the performance of the municipal police. These additional strategic approaches may decrease vehicle circulation in restricted traffic zones, achieving all intended outcomes. Conversely, if these scenarios are not implemented optimally, unintended outcomes may occur. The dominant reinforcing loops and delay effects need to be controlled. As supporting scenarios at the organizational level, these scenarios may address current issues and aim to prevent undesirable situations in the future.

As illustrated in Figure 5.7, a stabilization scenario may be necessary to maximize the restructuring and crisis prevention scenarios in controlling potential delay effects. The stabilization scenario may be considered to balance the delay time of traffic camera use and new patrol officers. Delays in these two strategic resources

can impact the achievement of goals. Achieving sustainable mobility goals certainly requires ideal strategic resources and adjustment time.

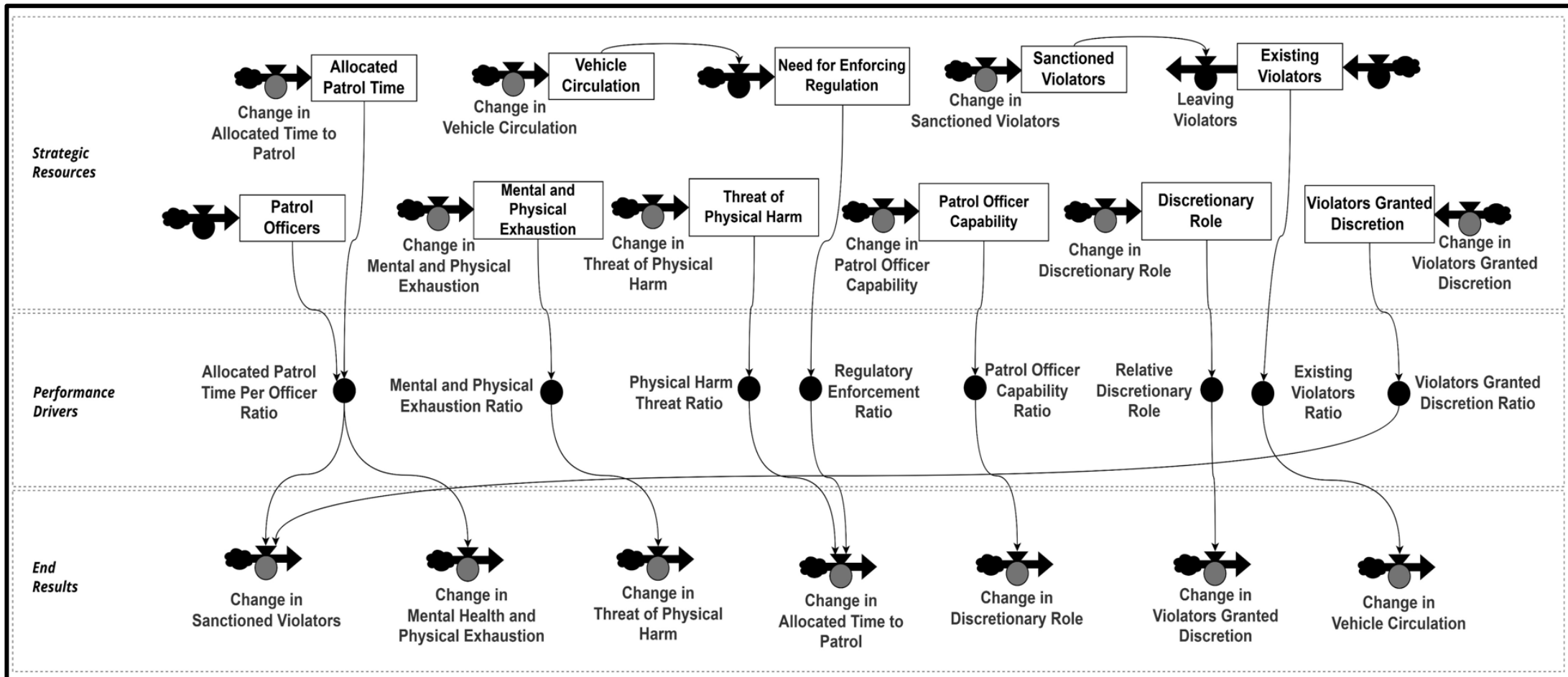
Furthermore, following the scenarios, the DPM charts identify all strategic resources, performance drivers, and end results pertaining to municipal police performance.

5.1.4 Applying Dynamic Performance Management for Enhancing the Municipal Police Performance

Based on the trade-off analysis and performance modes presented in the previous subchapters, it is essential to optimally control strategic resources, performance drivers, and end results. This control pertains to the key strategic resources, performance drivers, and end results that can cultivate the desired system state and facilitate the intended outcomes in the future. Strategic resources must be managed to ensure that desired inputs generate all variables as intended. Such performance drivers, which can directly generate the expected outputs, are crucial. Ultimately, maximum outputs can be attained, and the intended outcomes can be optimal. Outcomes will naturally evolve from the outputs.

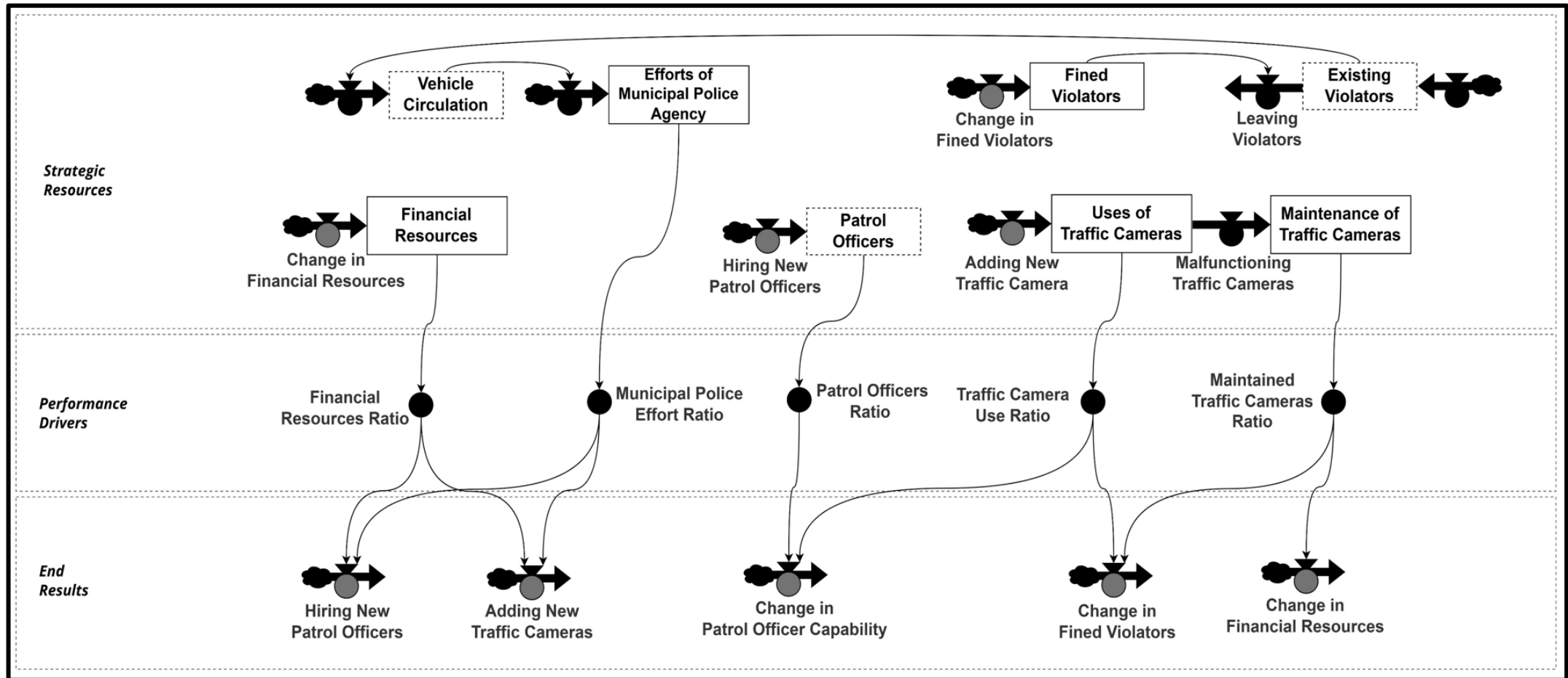
Municipal police, as individual government agents, possess their own strategic resources. These resources are distinct from the organization's strategic resources. The strategic resources of the municipal police refer to their authority, which they can manage directly. Discretionary roles and allocating time for patrol are the main strategic resources for patrol officers. Strategic resources such as patrol cars are not deemed strategic resources of municipal police officers. These patrol cars are strategic resources of an organization, although municipal police utilize them daily. Municipal police officers do not possess the authority to add or remove patrol cars; this authority resides with the municipal police agency. However, all these variables are covered in the DPM approach, which focuses on analyzing the overall performance of the organization as a single unit.

Figure 5.8 (a) DPM Chart for Enhancing Municipal Police Performance



Source: Author's elaboration

Figure 5.8 (b) DPM Chart for Enhancing Municipal Police Performance (continued)



Source: Author's elaboration

In the beginning, in Figure 5.8 (a), applying the DPM approach focuses on the strategic resources, performance drivers, and end results related to municipal police officers as individual agents. In the continuing chart, as shown in Figure 5.8 (b), strategic resources, performance drivers, and end results are more related to the municipal police agency at the organizational level. However, in general, the two DPM charts are interrelated as part of municipal police performance.

In these figures, strategic resources symbolized by the box (the stock symbol) influence performance drivers, depicted as the black circle. Next, performance drivers affect end results, symbolized by the large arrow (the flow symbol). The dark gray end-result symbols denote replications of the same symbols directly connected to strategic resources. Additionally, small arrows from strategic resources to performance drivers and from performance drivers to end results indicate influence or causal effects. In addition, the dotted lines on the DPM charts denote alias or duplicate variables, indicating that these variables are neither new nor independent variables.

Figure 5.8 (a) and 5.8 (b) portray the DPM charts highlighting factors influencing municipal police performance in addressing sustainable mobility challenges in Palermo. The charts demonstrate the interconnections among strategic resources, performance drivers, and end results from a dynamic performance management approach. Both charts adopt an “inside-out” view, framing policy design through the lens of a single organization (Bianchi, 2021, 2022). In this case, the organization refers to the municipal police agency.

As police officers are tasked with enforcing policies (Zacka, 2017; Pasha, 2018; de Boer, 2019), the main outputs of municipal police performance are changes in the number of sanctioned violators labeled ‘Change in Sanctioned Violators’ and changes in the number of fined violators labeled ‘Change in Fined Violators’. Both end results (outputs) may influence strategic resources labeled ‘Sanctioned Violators’ and ‘Fined Violators’. These outputs may contribute to reducing the number of existing violators through the outflow labeled ‘Leaving Violators’, leading to a change in vehicle circulation in Restricted Traffic Zones. This means that the decrease or increase in vehicular circulation within Restricted Traffic Zones

is determined by the enforcement of sanctions and fines imposed by the municipal police on offenders.

Following the mitigation strategy, the reduction of existing violators, identified as the control variable in this study, is attainable solely through municipal police enforcement measures, such as sanctions and fines. Effective implementation of these measures is essential to ensure sustainable performance. To strengthen mitigation, ten key performance drivers should be controlled effectively.

The first performance driver is defined as the variable 'Allocated Patrol Time per Officer Ratio'. This ratio compares the actual number of municipal police officers assigned to patrol with the total patrol time (in hours) allocated per day or month. Accordingly, both patrol officers and allocated patrol time are considered strategic resources. Patrol officers are municipal police personnel assigned to patrol pedestrian areas and limited traffic zones. Allocated patrol time denotes the duration of patrol duties undertaken by each officer, gauged in hours per day or in hours per month. At the individual level, municipal police officers have the authority to regulate allocated patrol time per patrol location. At the organizational level, the municipal police agency determines the deployment of officers across city-center locations, specifying daily patrol assignments. This performance driver may influence end results labeled 'Change in Sanctioned Violators' and 'Change in Mental and Physical Exhaustion,' which in turn affect related strategic resources through inflows.

The second performance driver is defined as the variable 'Patrol Officers Ratio', which compares the actual number of patrol officers with the desired number of patrol officers. The ratio should be adjusted according to enforcement needs. For instance, higher violation potential in the city center requires an increase in the desired number of patrol officers. A shortage of officers during periods of high violations may reduce effectiveness, thereby diminishing patrol capability. Conversely, a higher number of actual patrol officers enhances overall capability in fulfilling patrol duties. Accordingly, the end result, defined as 'Change in Patrol Officer Capability', is influenced by the patrol officers ratio.

The third performance driver is the variable labeled 'Mental and Physical Exhaustion Ratio'. This ratio compares actual mental and physical exhaustion, which refers to the actual conditions occurring at patrol locations and desired mental and physical exhaustion, which refers to a desired state of health. This ratio reflects the degree of fatigue among municipal police officers. Excessive workload may exceed individual work capacity, undermining mental and physical performance. In the context of mobility violation enforcement, officer fatigue increases vulnerability to threats of physical violence from offenders. Reduced concentration due to exhaustion constitutes an additional risk. Consequently, the mental and physical exhaustion ratio influences the end result labeled 'Change in Threat of Physical Harm'.

The fourth performance driver is the variable labeled 'Physical Harm Threat Ratio'. This ratio compares the actual physical harm threat, which refers to the actual threat conditions encountered during patrols and the desired physical harm threat, which refers to a state of zero accident. According to Lipsky (1980, p. 32), "the threat of physical harm is the most dramatic aspect of the threat under which street-level bureaucrats sometimes work". When actual threats exceed the desired level, patrol officers may reduce the time allocated to high-risk locations. Ultimately, the physical harm threat ratio influences the end result called 'Change in Allocated Patrol Time'.

The fifth performance driver is the variable labeled 'Regulatory Enforcement Ratio'. This ratio compares actual regulatory enforcement with desired regulatory enforcement. According to the 2007 Strategic Sustainable Mobility Intervention Plan for the City of Palermo, the municipal government has implemented interventions to support sustainable mobility, including the establishment of pedestrian areas and limited traffic zones. Additional measures encompass improvements to local transportation through the provision of buses managed by AMAT, the enhancement of urban spaces (e.g., *Piazza Ruggero Settimo* and *Piazza Castelnuevo*) in the city center, and the development of parking areas to reduce vehicle access to the central area. These measures have been formulated in the Sustainable Urban Mobility Plan (SUMP) and implemented in recent years. The

regulatory enforcement ratio is a critical indicator for sustaining policy effectiveness. As the number of regulations issued by local authorities increases, the demand for enforcement by municipal police correspondingly rises. This demand necessitates allocating more patrol time. In the case of Palermo, the regulatory enforcement ratio directly influences the end result called 'Change in Allocated Time to Patrol'.

The sixth performance driver is the variable called 'Patrol Officer Capability Ratio', which compares the actual patrol officer capability with the desired capability. Patrol officer capability encompasses the skills, competencies, and operational functions that enable officers to perform patrol duties effectively. The municipal police capability is typically enhanced through structured training and accumulated experience. In this context, actual capability refers to the current level of officers' operational capacity during patrols, while desired capability denotes the organizational expectation that officers impose sanctions and fines on violators without exercising discretionary leniency. Discretion, in this context, refers to permitting violators who warrant sanctions to continue committing infractions. Accordingly, the patrol officer capability ratio may affect the discretionary role, labeled 'Change in Discretionary Role'. As discretionary power should be restrained and curbed (Bovens & Zouridis, 2002), the patrol officer capability ratio should be carefully managed and set.

The seventh performance driver is the variable labeled 'Financial Resources Ratio', which compares actual and desired financial resources. In this context, financial resources refer primarily to revenue generated from fines imposed on vehicle owners who violate traffic and mobility regulations in the Restricted Traffic Zones. Additional resources may come from sustainable mobility initiatives, including European Union funding, such as the National Recovery and Resilience Plan (PNRR), European Regional Development Fund (ERDF), and Horizon Europe, and local budget allocations from the Palermo municipal government. Financial resources comprise internal revenues and external funding streams. Greater financial resources expand the local authority's capacity for interventions. Accordingly, the financial resources ratio can directly influence decisions regarding

the recruitment of new patrol officers (i.e., Hiring New Patrol Officers) and the installation of additional traffic cameras (i.e., Adding New Traffic Cameras).

The eighth performance driver is the variable named 'Municipal Police Effort Ratio', which compares actual municipal police efforts with desired efforts. As the local authority responsible for regulatory enforcement, the municipal police agency is mandated to undertake initiatives to enhance performance. Some interventions include increasing the number of patrol officers and deploying traffic cameras. The municipal police agency plays a pivotal role in sustaining and strengthening these measures. Accordingly, the municipal police effort ratio can directly affect officer recruitment (i.e., Hiring New Patrol Officers) and the installation of additional camera surveillance (i.e., Adding New Traffic Cameras).

The ninth performance driver is the 'Traffic Camera Use Ratio', which compares actual traffic camera utilization with desired usage. Traffic cameras serve as enforcement tools, enabling municipal police to impose fines on violators. Their operation is centralized in the municipal police control room, where violations recorded by the cameras are systematically monitored. The recordings constitute admissible evidence that supports the imposition of fines. In this context, the traffic camera use ratio may influence the end result labeled 'Change in Fined Violators'.

The tenth performance driver is the variable 'Maintained Traffic Cameras Ratio', which compares the actual number of functional cameras with the desired number of damaged units. The presence of damaged or repaired cameras may reduce the effectiveness of fined offenders, as a non-functional camera cannot record violations occurring in its vicinity. Furthermore, repair and maintenance costs associated with damaged cameras can diminish available financial resources. In this analysis, the maintained traffic cameras ratio may influence the end results labeled 'Change in Fined Violators' and 'Change in Financial Resources'.

In addition to the ten performance drivers, three supplementary performance drivers require systematic control. The first is the relative discretionary role, influenced by a strategic resource labeled 'Discretionary Role'. In this context, discretion is exercised flexibly, allowing municipal police under specific circumstances to grant

leniency to violators (e.g., advanced age of the violator, and sudden traffic control measures). Nevertheless, discretionary power ought to be limited. The second is the existing violators ratio (actual level/desired level), which is determined by the variable labeled 'Existing Violators'. The third is the violators granted discretion ratio (actual level/desired level), which is influenced by the variable labeled 'Violators Granted Discretion'. Effective control of these three indicators can support the attainment of the desired goals.

In principle, all ten performance drivers are influenced by strategic resources. Within this analysis, four strategic resources are considered pivotal: 'Patrol Officers', 'Allocated Patrol Time', 'Discretionary Role', and 'Use of Traffic Cameras'. Strengthening these resources is assumed to generate positive effects across other strategic resources. This assumption is supported by four considerations. First, an adequate number of patrol officers enhances the capacity to impose sanctions and fines on violators. Second, sufficient allocated patrol time increases enforcement effectiveness while reducing adverse effects such as fatigue from overwork. Third, proper control of discretionary power ensures that sanctions and fines are applied consistently and equitably. Fourth, the appropriate utilization of traffic cameras expands monitoring capacity, thereby increasing the number of violators fined. Through sustained mitigation measures (i.e., increasing the number of sanctioned violators and increasing the number of fined violators), the number of existing violations can be progressively diminished.

To extend the DPM charts for enhancing the municipal police performance, other strategic resources are likely to be part of the performance management systems. The strategic resources include patrol vehicles (e.g., cars, motorcycles, and bicycles), communication devices (e.g., radios, smartphones), surveillance tools (body cameras, dash cameras), and municipal police stations in restricted traffic zones. All these strategic resources may support the municipal police's capability. The municipal police agency needs to maximize its resources to improve the performance of municipal police, leading to the achievement of sustainable mobility goals.

The following table provides a detailed point of view of the DPM charts in Figure 5.8 (a) and Figure 5.8 (b). Table 5.1 depicts and summarizes the key elements of the DPM charts related to the municipal police performance.

Table 5.1 Critical Success Factors for Enhancing Municipal Police Performance

Variables	Units	Performance Drivers	Benchmarks/Inputs
Strategic Resources			
Allocated patrol time	Hour	Allocated patrol time per officer ratio (allocated patrol time/patrol officers)	Standard patrol time/standard patrol officers
Patrol officers	People	Patrol officers ratio (actual level/desired level)	Desired patrol officers
Mental and physical exhaustion	Dimensionless	Mental and physical exhaustion ratio (actual level/desired level)	Threshold of mental and physical exhaustion (desired level)
Threat of physical harm	Dimensionless	Physical harm threat ratio (actual level/desired level)	Threshold of physical harm threat (desired level)
Need for enforcing regulation	Dimensionless	Regulatory enforcement ratio (actual level/desired level)	Desired regulatory enforcement
Patrol officer capability	Dimensionless	Patrol office capability ratio (actual level/desired level)	Desired patrol officer capability
Financial resources	Euro	Financial resources ratio (actual level/desired level)	Standard of financial resources (desired level)
Efforts of municipal police agency	Dimensionless	Municipal police effort ratio (actual level/desired level)	Desired municipal police effort
Uses of traffic cameras	Cameras	Traffic camera use ratio (actual level/desired level)	Desired traffic camera use
Maintenance of traffic cameras	Cameras	Maintained traffic cameras ratio (actual level/desired level)	Threshold of maintained traffic cameras (desired level)

Discretionary role	Dimensionless	Relative discretionary role (comparison of actual and desired levels)	Threshold of discretionary role (desired level)
Violators granted discretion	People	Violators granted discretion ratio (actual level/desired level)	Threshold of existing violators (desired level)
Existing Violators	People	Existing violators ratio (actual level/desired level)	Threshold of existing violators (desired level)
Sanctioned violators	People	Not applicable	Not applicable
Fined violators	People	Not applicable	Not applicable
Vehicle circulation	Vehicles	Not applicable	Not applicable
End Results (Outputs)			
Change in sanctioned violators	People	Not applicable	Not applicable
Change in fined violators	People	Not applicable	Not applicable
Change in violators granted discretion	People	Not applicable	Not applicable
Change in vehicle circulation	Vehicles	Not applicable	Not applicable
Change in mental health and physical exhaustion	Dimensionless	Not applicable	Not applicable
Change in threat of physical harm	Dimensionless	Not applicable	Not applicable
Change in allocated time to patrol	Hour	Not applicable	Not applicable
Change in financial resources	Euro	Not applicable	Not applicable
Change in discretionary role	Dimensionless	Not applicable	Not applicable
Change in patrol officer capability	Dimensionless	Not applicable	Not applicable

Hiring new patrol officers	People	Not applicable	Not applicable
Adding new traffic cameras	Cameras	Not applicable	Not applicable

Source: Author's elaboration

In sum, the DPM charts for enhancing the performance of municipal police refer to the mitigation strategies or actions. Ideally, mobility violators need to be given the maximum possible sanctions or fines by maximizing the resources of the municipal police at individual and organizational levels. The critical success factors in Table 5.1 serve as a guideline for controlling and managing municipal police performance. Furthermore, preventive measures may be necessary in the future. This means that addressing mobility violations does not solely constitute enforcing regulations on pedestrian areas and limited traffic zones. As for preventive measures that the municipal police and local stakeholders can take, the next subchapters explain effective interventions. Various factors, such as mobility behavior and mobility culture, may cause an increase in the number of existing violators. Preventive strategies involving the local communities may be considered as important rather than mitigation strategies to achieve maximum mobility behavior and culture changes.

5.2 Enhancing the Performance of Municipal Police and/or Local Stakeholders in Sustaining Sustainable Mobility Policies: A Preventive Strategy

5.2.1 Introducing Performance of Municipal Police and/or Local Stakeholders in Restricted Traffic Zones (RTZs)

This study found that local stakeholders' actions support the performance of municipal police in reducing mobility access violations in pedestrian areas and limited traffic zones. The local stakeholders include residents, local community associations, and private companies. Involving various stakeholders ensures that municipal police receive support through various efforts, such as available facilities and infrastructures, to handle the challenges of sustainable mobility policies. In line with Rice (2013), the actions of street-level bureaucrats exist in the macro-level or inter-institutional context. In other words, according to Andreotti et al., (2024),

street-level bureaucracy is related to the organizational and institutional level, and it can exist at the inter-institutional level (i.e., community level). This means that the performance of the municipal police intersects with various stakeholders, both those who support the efforts (e.g., cyclists and pedestrian communities) and those who are against them (e.g., mobility offenders).

The support of local stakeholders varies. For example, when the municipal police issue fines to private cars that park in pedestrian areas or limited traffic zones, the municipal police officers collaborate with the company that owns the tow trucks to transport the cars. With this collaboration, patrol officers can maximize the number of sanctioned violators, ensuring that enforcement actions are swift and efficient. The collaborative efforts of municipal police officers and private companies make enforcing traffic and mobility regulations more effective. Without such collaboration, police officers may struggle to maximize the number of sanctioned violators.

For another example, increasing the number of vehicles parked in pedestrian areas encourages pro-sustainable mobility groups, such as cyclists and pedestrian communities, to advocate offenders. The advocacy actions of cyclists and pedestrian communities can support the performance of patrol officers at the inter-institutional level. In other words, the efforts of the municipal police in reducing mobility violators are supported by cyclists and pedestrian communities. With support from local stakeholders, the workload of the municipal police may decrease over time.

However, local stakeholders' efforts face challenges. The study also found that the more infrastructures (e.g., concrete balls) of sustainable mobility, the higher the potential for damage. In several locations, concrete balls and benches functioning as pedestrian barriers were damaged by vandals. Vandals may worsen mobility behavior. In fact, initially, car drivers cannot pass through certain areas due to several concrete ball barriers in pedestrian areas. Once vandals damage these barriers, car drivers can pass through again. Local stakeholders, such as particular residents and visitors, may also engage in vandalism.

This subchapter aims to specifically analyze the performance of municipal police with the support of various stakeholders. This includes situations where municipal police and relevant stakeholders address mobility violators together. It is crucial to recognize that the success of sustainable mobility policies hinges not only on the enforcement of regulations by municipal police but also on the collaborative efforts of all stakeholders involved. Collaborative efforts may help the resource scarcity of municipal police. According to Thomann (2015, p. 180), “resource scarcity leads street-level bureaucrats to perform deficiently”. Currently, the municipal police still face a lack of supporting resources. If local stakeholders do not support them, their performance may be ineffective. The support of local stakeholders for the performance of municipal police is crucial in pedestrian areas and limited traffic zones. Accordingly, in agreement with Bianchi and Hall (2023), performance management regimes include institutional and inter-institutional domains.

Also, this subchapter analyzes situations where various local stakeholders interact and act without the presence of municipal police in addressing sustainable mobility issues. This means that local stakeholders collaborate independently of municipal police. All actions taken by local stakeholders may significantly impact the performance of the municipal police. As an illustration, if all local communities take collaborative actions (e.g., advocacy movements) to pursue social awareness regarding sustainable mobility, the workload of the municipal police will be alleviated.

5.2.2 Main Causal Loop of Performance Outcomes of Municipal Police and Local Stakeholders at the Inter-Institutional Level

The feedback loops regarding performance outcomes within Palermo’s mobility system can reveal how different outcomes interact with each other. It aids in analyzing how one outcome serves as both the cause and effect of another outcome. Furthermore, it maps the relationships between intermediate and final outcomes. For example, reducing vehicle circulation in restricted traffic zones not only alleviates traffic congestion but also enhances perceived pedestrian safety. Addressing both traffic congestion and perceived pedestrian safety simultaneously can significantly improve the following outcomes, leading to a good mobility

culture in the future. If municipal police and local stakeholders focus on only one aspect, the sustainable mobility culture may not be optimally achieved. Both must be considered holistically to contribute effectively to the overall sustainable city and community.

Furthermore, achieving sustainable mobility behavior and culture should not reduce the performance of the municipal police and local stakeholders in the future. This may occur because the municipal police and local stakeholders tend to work responsively. The municipal police and local stakeholders appear more responsive when there is a problem than when there is no problem. Consequently, an intended state in the short term does not necessarily guarantee long-term sustainability. In turn, an expected state in the long term does not necessarily have a positive impact on the short term, focusing on the performance of municipal police and local stakeholders. Achieving the desired state in both the short and long term requires diligent efforts. This can be controlled through the extended causal loop of performance outcomes.

The extended causal loop related to outcomes provides a projection of potential scenarios. If the loop driving municipal police and local stakeholders' performance functions as anticipated, the performance outcomes will align with expectations. Conversely, if the loop driving municipal police and local stakeholders' performance deviates from expectations, the performance outcomes will similarly deviate. By optimizing these loops, municipal police and local stakeholders can create a robust foundation for achieving desired outcomes. The extended causal loop also elucidates the critical role of municipal police and local stakeholders' performance in achieving sustainable mobility goals.

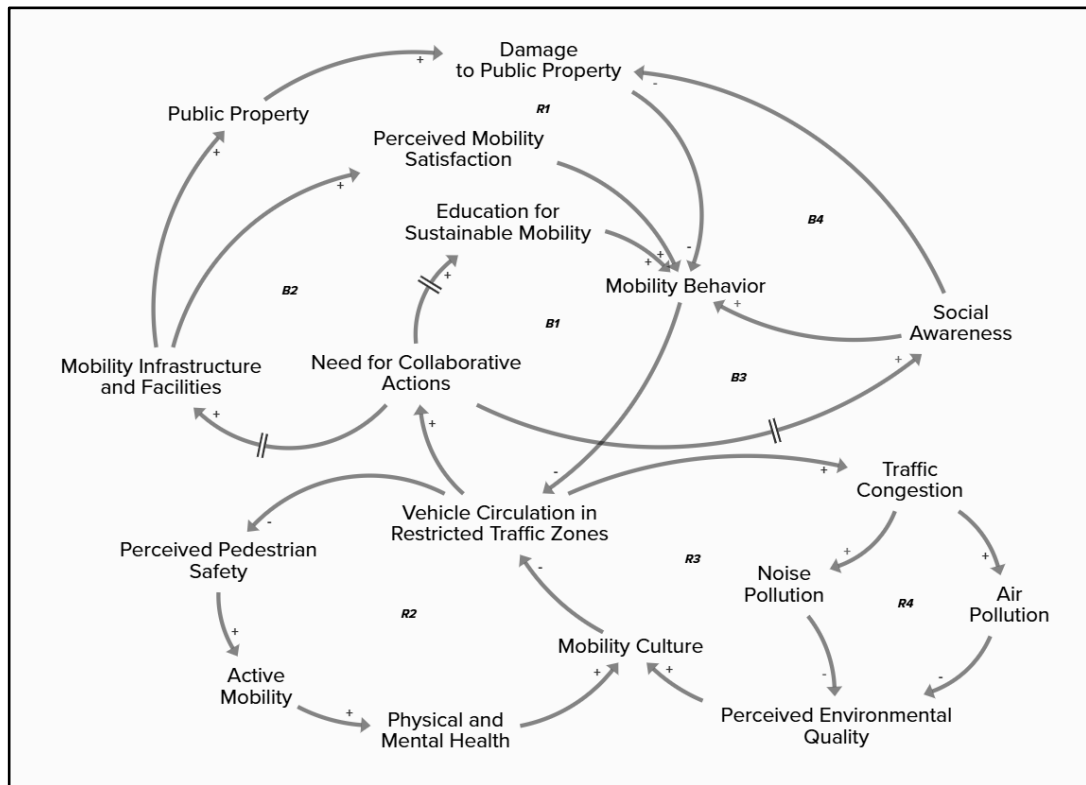
In addition, the main causal loop at the inter-institutional level covers the actions of all relevant stakeholders. This means that variables in the inter-institutional domain are not only about what the municipal police do but also about what relevant stakeholders do. Feedback links for variables at the inter-institutional level still use closed feedback loops as the basic logic of system dynamics. Variables in this feedback loop cover the social system in local areas. Variables refer to shared

actions rather than single actions of an organization. Variables in this subchapter include actions from various stakeholders who help or support the tasks of municipal police as enforcement officers.

The feedback links in this subchapter encompass a broader range of spheres. This differs from the previous subchapters, which specifically covered only the boundaries of the municipal police. This thesis assumes that the causal mechanisms of sustainable mobility issues are interrelated on multiple levels. Mapping causal loops at the inter-institutional level specifically aids in analyzing causal mechanisms at the community level (e.g., pedestrian areas and limited traffic zones), where local authorities (e.g., municipal government agencies) implement regulations for sustainable mobility. Analyzing causal mechanisms at the community level helps us to understand community perspectives and actions regarding sustainable mobility policies.

In Figure 5.9, all variables encompass activities carried out by municipal police and/or relevant stakeholders. Most variables are derived from stakeholders who support (e.g., education for sustainable mobility) and those who oppose (e.g., potential damage to property). The variable of mobility infrastructure and facilities is related to the joint actions of the municipal police with relevant public and private institutions in planning, creating, maintaining, and utilizing infrastructure to support sustainable mobility policies. All variables delineate boundaries that extend beyond those of the municipal police agency.

Figure 5.9 Main Causal Loop Regarding Municipal Police and/or Local Stakeholders' Performance at the Inter-Institutional Level



Source: Author's elaboration

In the B1 loop, if vehicle circulation in restricted traffic zones increases, then the need for collaborative actions will increase. Next, it continues increasing education for sustainable mobility. The polarity is positive. However, it can happen after a delay. In fact, increasing the number of vehicles parked in pedestrian areas, for example, around the *Quattro Canti*¹³² area or the intersection of the street *via Maqueda* and *via Vittorio Emanuele*, encourages a cyclist and pedestrian community to do educational activities by attaching flyers or brochures to private vehicles parked illegally in pedestrian areas and limited traffic zones. These flyers or brochures contain educational purposes (e.g., suggestions and criticisms) for violators, encouraging them to refrain from activities that violate the regulations. Unfortunately, these educational activities are not carried out every day. They distribute flyers or brochures containing information about not parking in

¹³² 38°06'56.5"N 13°21'41.3"E (the coordinate on Google Maps)

prohibited areas only at certain times. Educational activities for mobility violators are sometimes conducted in areas where violations are frequent.

Furthermore, if education for sustainable mobility increases, then mobility behavior will increase. Its link is a positive polarity. In fact, when the cyclist and pedestrian community attach educational brochures to certain parts of the car (e.g., windscreens), few violators run away or look for a suitable parking place. It can be concluded that the more often the cyclist and pedestrian community distribute educational brochures, the better the mobility behavior of residents and tourists will be. In turn, good mobility behavior may reduce vehicle circulation. Conversely, lousy mobility behavior may increase vehicle circulation. The link on this variable has a negative polarity. This means mobility behavior change can prevent violations in pedestrian areas and limited traffic zones. In the loop of B1, the variable of education for sustainable mobility becomes a key inter-institutional variable.

In the B2 loop, if vehicle circulation in restricted traffic zones increases, then the need for collaborative actions will increase. Next, it continues to increase mobility infrastructure and facilities. The polarity is positive. However, there is also a delay in this link. For instance, in the *Piazza Fonderia*¹³³, an increasing number of unauthorized vehicles circulating in pedestrian areas encourages the relevant municipal government agencies and private sectors to improve facilities and infrastructures (e.g., concrete spheres and sidewalk barriers). These facilities and infrastructures are to limit vehicle access to pedestrian areas. Unfortunately, the authorities do not periodically construct concrete spheres and sidewalk barriers in pedestrian areas. This indicates a delay in the construction of mobility infrastructures and facilities.

Next, increasing mobility infrastructure and facilities can increase convenient mobility. It has positive polarity. The more mobility infrastructure and facilities there are, the more convenient mobility becomes. In fact, constructing such concrete spheres and sidewalk barriers in various pedestrian areas provides

¹³³ 38°07'09.5"N 13°21'58.2"E (the coordinate on Google Maps)

convenience for pedestrians. Pedestrians seem more comfortable crossing pedestrian areas that have concrete spheres and sidewalk barriers. In addition to being comfortable, pedestrians feel safe from potential accidents due to vehicles passing through pedestrian areas. Increasing convenient mobility may increase mobility behavior. Its polarity relationship is positive. This means that the more convenient the mobility is, the better the mobility behavior of residents and tourists will be. Convenient mobility sends information to residents and tourists who often consider walking in pedestrian areas rather than driving. Convenient mobility also sends information to residents and tourists who prefer driving private vehicles rather than walking in pedestrian areas and limited traffic zones. The information may determine their choice of whether to walk or drive. In turn, increasing good mobility behavior reduces vehicle circulation. This link has a negative polarity. In the B2 loop, the variable of mobility infrastructure and facilities becomes a key variable at the inter-institutional level.

Additionally, in the B3 and B4 loops, if collaborative interventions by local communities increase, social awareness may subsequently rise after a delay. For example, residents and visitors who enjoy the pedestrian area work together to close access streets frequently used by offenders with baby strollers in *Piazza San Domenico*¹³⁴. Unfortunately, these actions are also not consistently carried out by local stakeholders daily. This means that the initiatives undertaken by residents and visitors are only temporary. That is why the link is marked with a delay symbol. On the one hand, increasing social awareness may increase mobility behavior (B3 loop). On the other hand, increasing social awareness may reduce the potential for property damage by vandals or offenders (B4 loop). A reduction in potential property damage may foster improved mobility behavior. Ultimately, mobility behavior contributes to decreased vehicle circulation, which in turn diminishes the need for collaborative interventions.

The R1 loop is the side effect of the B2 loop. An increase in mobility infrastructure and facilities leads to the addition of public property, which in turn heightens the

¹³⁴ 38°07'07.6"N 13°21'47.0"E (the coordinate on Google Maps)

potential for vandalism-related property damage. These causal links show positive polarities. Damage to public property refers to the destruction of such concrete spheres or sidewalk barriers. In fact, for example, concrete balls, benches, and flowerpots installed around *Piazza Fonderia*, which prevent vehicles from passing, are often moved or damaged by vandals. Vandals refer to people who deliberately damage or destroy public or private property. Furthermore, increasing potential damage to property can reduce the mobility behavior of residents or tourists. For example, vehicle circulation decreased when the concrete balls were installed around *Piazza Fonderia*. Unfortunately, vehicle circulation increased again when an unscrupulous person moved the concrete balls.

In addition to the R1 loop, three extended reinforcing loops (R2, R3, and R4) interact with one another according to their respective causal mechanisms. Causal loops related to performance outcomes are necessary to elucidate the broader system associated with sustainable mobility policies. By expanding these loops, performance outcomes can be effectively detected. This process is essential for distinguishing between intended and unintended outcomes. In the case of Palermo, implementing sustainable mobility policies requires a detailed analysis of the interconnected variables and feedback loops. The city of Palermo has been grappling with high traffic congestion and pollution. By incorporating extended causal loops regarding performance outcomes into the performance analysis of municipal police and local stakeholders, it becomes possible to identify and address the root causes of these sustainable mobility issues.

The R2 loop encompasses five variables, each of which can be described by the following statements: (1) if the vehicle circulation in restricted traffic zones increases, the perceived pedestrian safety will decrease (negative polarity); (2) if perceived pedestrian safety increases, active mobility will increase (positive polarity); (3) if the active mobility increases, the physical and mental health will increase (positive polarity); (4) if the physical and mental health increases, the mobility culture will increase (positive polarity); (5) in turn, if the mobility culture increases, the vehicle circulation in restricted traffic zones will decrease (negative polarity).

The R3 loop encompasses five variables, each of which can be described by the following statements: (1) if the vehicle circulation in restricted traffic zones increases, the traffic congestion will increase (positive polarity); (2) if the traffic congestion increases, the noise pollution will increase (positive polarity); (3) If the noise pollution increases, the perceived environmental quality will decrease (negative polarity); (4) if the perceived environmental quality increases, the mobility culture will increase (positive polarity); (5) in turn, if the mobility culture increases, the vehicle circulation in restricted traffic zones will decrease (negative polarity).

The R4 loop encompasses five variables, each of which can be described by the following statements: (1) if the vehicle circulation in restricted traffic zones increases, the traffic congestion will increase (positive polarity); (2) if the traffic congestion increases, the air pollution will increase (positive polarity); (3) If the air pollution increases, the perceived environmental quality will decrease (negative polarity); (4) if the perceived environmental quality increases, the mobility culture will increase (positive polarity); (5) in turn, if the mobility culture increases, the vehicle circulation in restricted traffic zones will decrease (negative polarity).

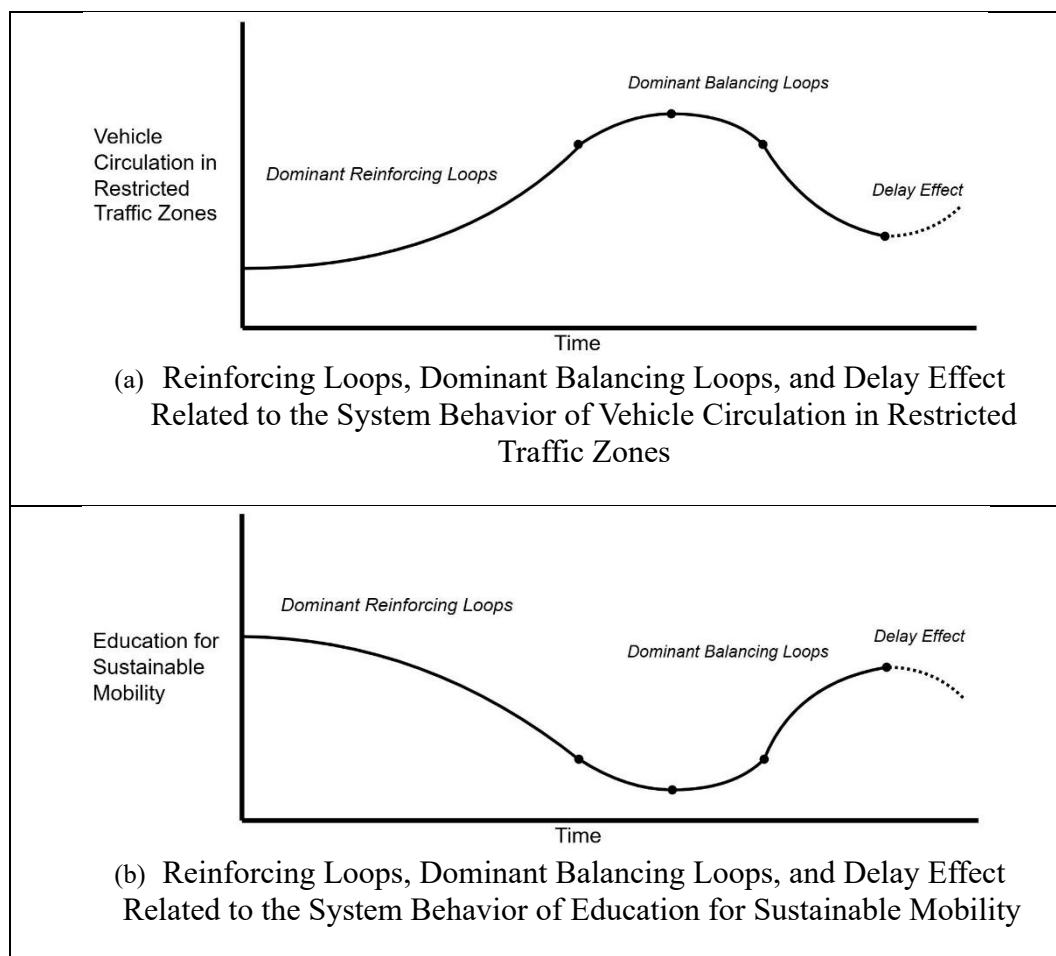
In Figure 5.9, the R1, R2, R3, and R4 loops must be prevented from dominating the system behavior in the causal loop diagram. If the R1, R2, R3, and R4 loops dominate the B1, B2, B3, and B4 loops, then vehicle circulation will continue to increase. This means that the goals of sustainable mobility are difficult to achieve. Setting key variables in the B1, B2, B3, and B4 loops is the best action. These key variables are education for sustainable mobility and mobility infrastructure and facilities. If the B1, B2, B3, and B4 loops dominate system behavior, vehicle circulation in restricted traffic zones will decrease further.

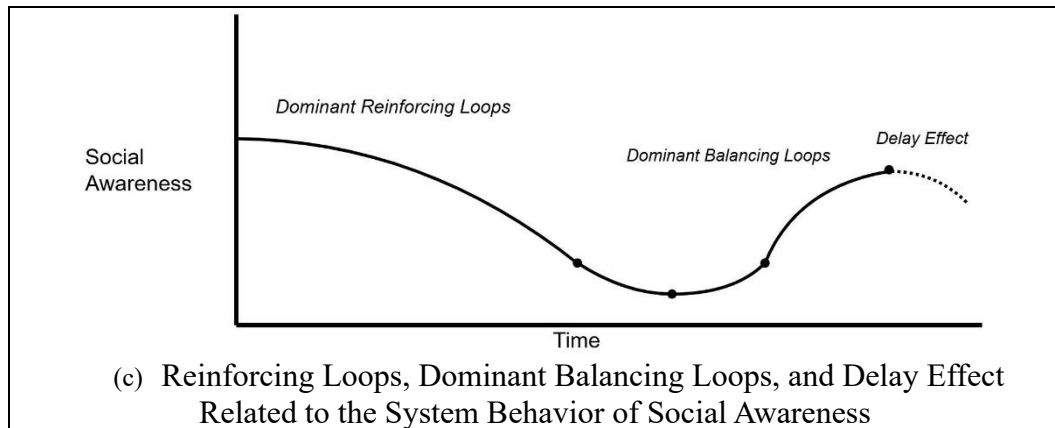
In conclusion, the R1, R2, R3, and R4 loops are not intended to dominate the system. If the loops dominate, achieving a sustainable mobility culture and behavior becomes challenging. The B1, B2, B3, and B4 loops serve as a counterbalance to the reinforcing loops. The equilibrium can be achieved if the balancing loops dominate the state through appropriate actions. However, if the balancing loops fail

to dominate, the reinforcing loops will have a negative impact, thereby hindering the achievement of sustainable mobility goals. Thus, the B1, B2, B3, and B4 loops play a central role in maximizing the effectiveness of the R1, R2, R3, and R4 loops.

In Figure 5.9, these eight loops indicate that the balancing loops equal the reinforcing loops. Under this condition, the system's behavior is strongly influenced by the extent to which the balancing loops can be managed as counterbalances to the reinforcing loops. The dominant balancing loop may shift from a stabilization scenario to a revitalization scenario. This change aims to maximize goal-seeking concerning sustainable mobility policies. The following figure depicts how a potential scenario could be designed with the support of multiple stakeholders.

Figure 5.10 System Behavior Regarding the Main Causal Loop at the Inter-Institutional Level





Source: Author's elaboration

Figure 5.10 (a) illustrates the system behavior of vehicle circulation in restricted traffic zones, dominated by reinforcing and balancing loops with varying strengths. Initially, the system's behavior illustrates dominant reinforcing loops, followed by dominant balancing loops with strong effects. The presence of B1, B2, B3, and B4 loops (see Figure 5.9) strengthens the balancing loop line in the system. Unfortunately, delays directly related to the balancing loops can affect changes in the line (see Figure 5.9). To change the system's behavior toward goal-seeking, appropriate input in education for sustainable mobility, as well as in mobility infrastructure and facilities, is needed.

Figure 5.10 (b) depicts the system behavior of education for sustainable mobility, and Figure 5.10 (c) depicts the system behavior of social awareness. Both are dominated by reinforcing and balancing loops with varying strengths. Initially, the system's behavior illustrates dominant reinforcing loops, followed by dominant balancing loops with strong effects. The presence of B1, B2, B3, and B4 loops strengthens the balancing loop lines in Figures 5.10 (b) and 5.10 (c). Unfortunately, delays directly related to the balancing loops can affect changes in these lines, as illustrated in the figure above. Appropriate adjustment time for interventions or inputs related to education for sustainable mobility and social awareness needs to be designed, implemented, and controlled to change the system's behavior toward goal-seeking. It aims to minimize the effects of the delay. Figures 5.10 (b) and 5.10 (c) represent shared strategic resources.

Figures 5.10 (b) and 5.10 (c) aim to strengthen crisis prevention (maintenance strategy) and restructuring (re-design strategy) scenarios implemented by multiple stakeholders to support the performance of the municipal police and local stakeholders. These strategic approaches maximize the reduction of vehicle circulation in restricted traffic zones over an extended period, achieving all intended outcomes. Conversely, if these scenarios are not implemented optimally, unintended outcomes may occur over the long term. The dominant reinforcing loops and delay effects need to be appropriately controlled. As supporting strategies at the inter-institutional level, these scenarios may address broader current issues and aim to prevent broader undesirable situations in the future.

As illustrated in Figure 5.10, a stabilization scenario may also be necessary to maximize the crisis prevention and restructuring scenarios and to control potential delay effects. The stabilization scenario may be considered to balance the delay time in education for sustainable mobility and social awareness. Delays in these two strategic resources can impact the achievement of goals. Achieving sustainable mobility goals certainly requires broader actions.

Furthermore, following the scenarios, the DPG charts identify all shared strategic resources, performance drivers, and end results pertaining to municipal police and local stakeholders' performance in pedestrian areas and limited traffic zones.

5.2.3 Applying Dynamic Performance Governance for Enhancing the Municipal Police and/or Local Stakeholders' Performance

The inter-institutional level refers to collaborative actions between municipal police and related stakeholders to address vehicle circulation issues in pedestrian areas and limited traffic zones. The term 'inter-institutional level' is used interchangeably with 'community level' in this subchapter to harmonize terminology commonly employed in street-level bureaucracy theory with the DPG approach.

The inter-institutional level encompasses shared strategic resources among all public, private, and community institutions concerning sustainable mobility policies, specifically in pedestrian areas and limited traffic zones. The inter-

institutional level is understood to extend beyond the boundaries of any single organization or institution, both government and non-government organizations. This differentiates from the two previous subchapters, which focused on individual and organizational resources of municipal police. This subchapter aims to pursue the intended outcomes of sustainable mobility policies from an inter-institutional perspective.

This subchapter frames shared strategic resources between municipal police and relevant stakeholders at the inter-institutional level. This means that these resources are not only owned by the municipal police but also by other organizations or communities involved in supporting the performance of the municipal police. It is called an inter-institutional level because it extends beyond a single organization or institution. In this explanation, resources that are not strategic assets for the municipal police are regarded as shared strategic resources. Such education for sustainable mobility is a shared strategic resource. Such mobility infrastructure and facilities are shared strategic resources. Also, such mobility behavior is a shared strategic resource for all at the inter-institutional level. Multiple individuals or organizations own all of the strategic resources.

Supporting relevant stakeholders may support the performance of municipal police. The involvement of citizens and relevant stakeholders is essential for performance management in local areas. As remarked by Bianchi (2021) and (Vignieri, 2023), enhancing an active community should be considered in local policy design and performance management based on local areas. This subchapter analyzes the shared strategic resources, the performance drivers, and the end results related to the pedestrian areas and limited traffic zones as local areas in Palermo. The combined view of DPM and DPG at the community level helps to identify the interconnectedness of shared strategic resources, performance drivers, and end results within broader closed-loop systems.

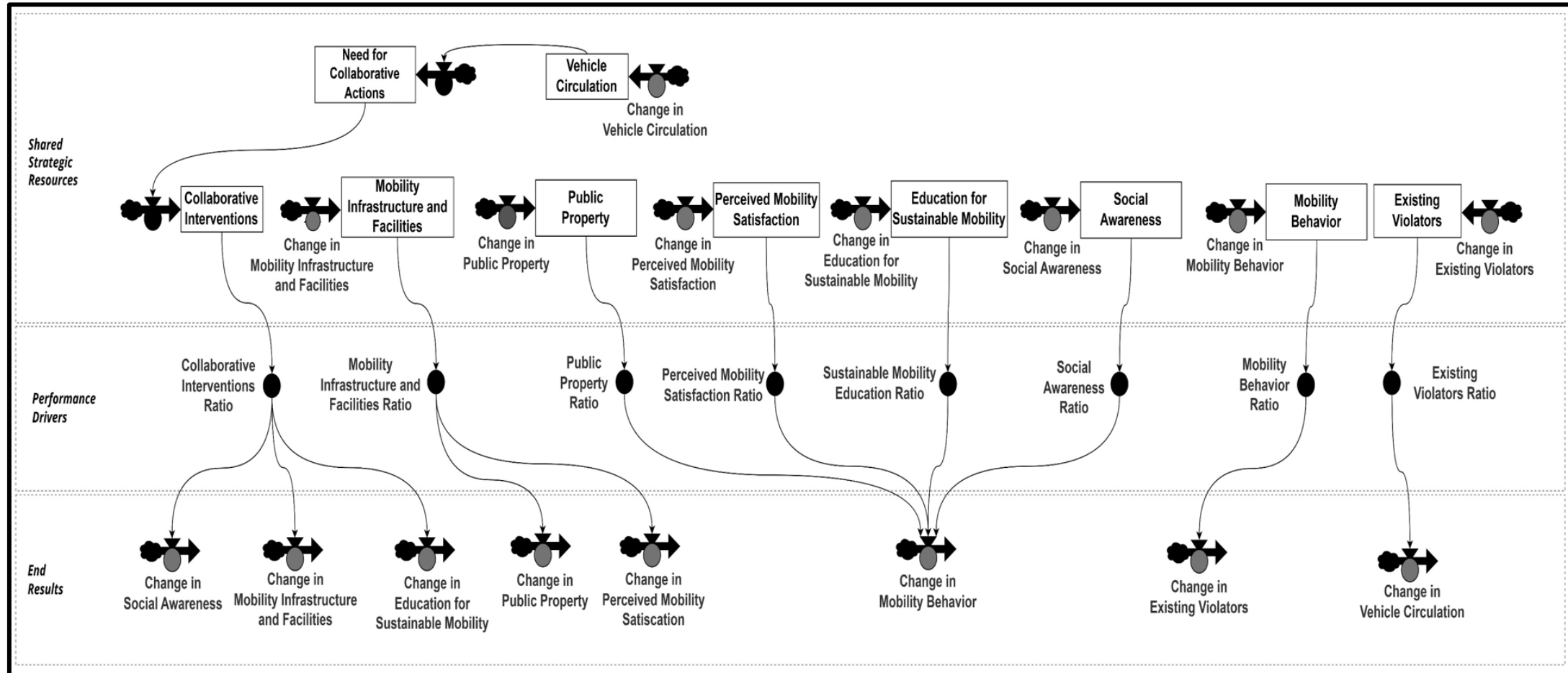
In pedestrian areas and limited traffic zones, municipal police and relevant stakeholders do—or can do—such collaborative actions. The combined view of DPM and DPG is appropriate for analyzing actions between municipal police and

relevant stakeholders in sustaining urban mobility. Through cross-organizational collaboration, strategic resources are shared among the municipal police and relevant stakeholders. These collaborative or coordination actions must be planned and controlled effectively to ensure the intended outcomes. The combined view of DPM and DPG at the inter-institutional level helps to understand how successful outcomes are achieved with collaborative actions.

Figure 5.11 (a) reframes the B1, B2, B3, B4, and R1 loops presented in Figure 5.10, while Figure 5.11 (b) reframes the R2, R3, and R4 loops. The DPG charts identify the interrelated variables in detail, illustrating how these loops collectively shape system behavior and highlight the dynamic interactions among shared strategic resources, performance drivers, and end results. This reframing not only clarifies the structural relationships but also emphasizes the critical role of reinforcing and balancing mechanisms in influencing municipal police and local stakeholders' performance. Also, the DPG charts aim to achieve intended sustainable mobility outcomes.

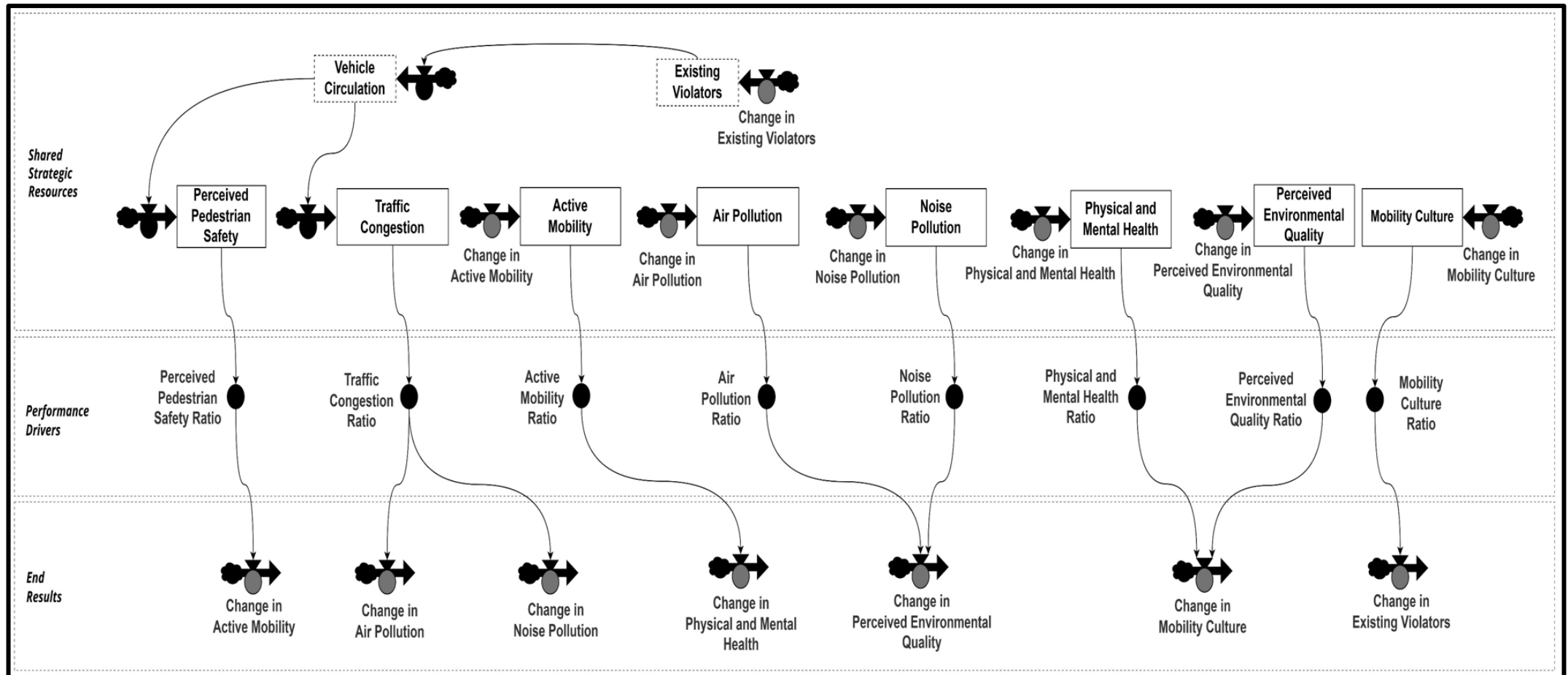
In the two figures related to DPG charts, shared strategic resources symbolized by the box (the stock symbol) influence performance drivers, depicted as the black circle. Next, performance drivers affect end results, symbolized by the large arrow (the flow symbol). The dark gray end-result symbols denote replications of the same symbols directly connected to shared strategic resources. Additionally, small arrows from shared strategic resources to performance drivers and from performance drivers to end results indicate influence or causal effects. Overall, the graphical symbols correspond closely to those depicted in the previously shown DPM charts. In addition, the dotted lines on the DPG charts denote alias or duplicate variables, indicating that these variables are neither new nor independent variables.

Figure 5.11 (a) DPG Chart for Enhancing Performance of Municipal Police and/or Local Stakeholders



Source: Author's elaboration

Figure 5.11 (b) DPG Chart for Enhancing Performance of Municipal Police and/or Local Stakeholders (continued)



Source: Author's elaboration

Figures 5.11 (a) and 5.11 (b) present DPG charts that highlight factors influencing the performance of pedestrian areas and limited traffic zones as the local areas in Palermo. The charts illustrate the causal relationships among shared strategic resources, performance drivers, and end results (outcomes), adopting causal loop feedback. The DPG approach applies an “outside-in” view, emphasizing the design and implementation of policies for local areas through the active involvement of multiple stakeholders (Bianchi, 2021, 2022). The DPG approach encompasses a broader set of variables than those included in the DPM approach. The DPG charts thereby address and complement dimensions not captured in the previously presented DPM charts.

The DPG charts indicate two final outcomes: ‘Change in Mobility Behavior’ that affects a shared strategic resource labeled ‘Mobility Behavior’ and ‘Change in Mobility Culture’ that affects a shared strategic resource labeled ‘Mobility Culture’. Mobility culture and behavior changes represent long-term outcomes that require time to achieve. Achieving these outcomes necessitates intermediate outcomes. Accordingly, the two variables are designated as final outcomes.

Intermediate outcomes related to ‘Change in Mobility Behavior’ are ‘Change in Perceived Mobility Satisfaction’, ‘Change in Public Property’, ‘Change in Education for Sustainable Mobility’, ‘Change in Social Awareness’, and ‘Change in Mobility Infrastructure and Facilities’. In addition, intermediate outcomes associated with ‘Change in Mobility Culture’ are ‘Change in Perceived Environmental Quality’, ‘Change in Physical and Mental Health’, ‘Change in Noise Pollution’, ‘Change in Air Pollution’, and ‘Change in Active Mobility’.

In terms of final outcomes, changes in mobility culture and behavior represent critical aims. The realization of both is fundamental to the success of sustainable mobility policies. According to Kuhnimhof and Wulfhorst (2013), within the framework of urban mobility, mobility culture and behavior are recognized as fundamental objectives that underpin sustainable policy outcomes. Moreover, political decisions, urban planning, historically produced space, socioeconomic factors, lifestyle milieus, and communication processes shape mobility culture and

behavior (Kuhnimhof & Wulfhorst, 2013). Within a broader context, both tangible and intangible factors shape urban mobility culture and behavior. As represented in the charts, mobility culture and behavior are defined as the collective values and social practices associated with non-vehicular mobility, particularly within pedestrian environments and traffic-restricted urban spaces.

In the preventive approach, changes in mobility culture and behavior are key to preventing the addition of incoming violators to existing violators. The greater the desired changes in these two outcomes, the less potential there will be for incoming violators. If mobility culture and behavior are well-established, mobility violators may disappear. Furthermore, reducing the number of existing violators will decrease vehicle circulation in pedestrian areas and limited traffic zones.

Following the two DPG charts, achieving the final outcomes requires consideration of 15 main performance drivers. Monitoring and evaluation of indicators are essential to ensuring progress toward both intermediate and final outcomes. The attainment of these outcomes is contingent upon dynamic performance management and governance, which provide accountability and sustained progress. Indeed, the DPG approach has the potential to foster sustainable outcomes in local contexts (Bianchi, 2021, 2022).

The first performance driver is the ‘Collaborative Interventions Ratio’. This ratio compares actual collaborative interventions with desired collaborative interventions. To support the sustainability of pedestrian areas and limited traffic zones in Palermo, local authorities and local stakeholders have undertaken collaborative efforts. These efforts include collaborative patrols between the municipal police of Palermo and the local police of Palermo metropolitan city; public-private partnerships in the installation of infrastructure and facilities (e.g., pedestrian safety and dedicated parking areas); the initiation of local community forums focused on advocating for the local community (e.g., *Famiglie in Piazza* and *Palermo Pedonale e Ciclabile*); and sustainable mobility campaigns involving various stakeholders (i.e., students, residents, and tourists). Collaborative relationships and joint solutions may sustain the SDGs, including sustainable cities

and communities (Ansell et al., 2022). Therefore, the collaborative interventions ratio may change end results labeled 'Change in Social Awareness', 'Change in Mobility Infrastructure and Facilities', and 'Change in Education for Sustainable Mobility'.

The second performance driver is the 'Mobility Infrastructure and Facilities Ratio', which compares actual infrastructure and facilities with the desired level. Mobility infrastructure and facilities encompass both primary and supporting interventions in pedestrian areas and limited traffic zones, including benches, paving materials, traffic signs, and surveillance cameras. This ratio may influence intermediate outcomes such as 'Change in Public Property' and 'Change in Perceived Mobility Satisfaction'.

The third performance driver is the 'Public Property Ratio', which compares the actual level of public property with the desired level of public property. In this context, public property refers to assets (e.g., land, buildings, and infrastructure) owned by the municipal government of Palermo in the city center. A higher proportion of public property dedicated to sustainable mobility, including automatic rising bollards on the streets of *via Maqueda* and *via Ruggero Settimo*, is associated with changes in residents' mobility behavior, particularly the avoidance of pedestrian areas and limited traffic zones by private vehicles. Similarly, improvements in pedestrian infrastructure, such as high-quality paving blocks in the city center, increase the likelihood of residents shifting from vehicle use to walking. In this context, the public property ratio may lead to changes in mobility behavior, hereafter referred to as 'Change in Mobility Behavior'.

The fourth performance driver is the 'Perceived Mobility Satisfaction Ratio', which compares the actual level of perceived mobility satisfaction with the desired level. Perceived satisfaction with mobility is inherently subjective, varying according to individual comfort and experience. Nevertheless, the availability of high-quality facilities and infrastructure can positively influence overall satisfaction levels. Accordingly, the perceived mobility satisfaction ratio may contribute to changes in residents' mobility choices, hereafter referred to as 'Change in Mobility Behavior'.

The fifth performance driver is the ‘Sustainable Mobility Education Ratio’, which compares the actual level of sustainable mobility education with the desired level. Sustainable mobility education encompasses both formal programs, such as the master’s and doctoral degrees offered by the University of Palermo through the *Centro di Sostenibilità e Transizione Ecologica di Ateneo* (Center for Sustainability and Ecological Transition), and non-formal initiatives, including the *Go2School* project that promotes cycling to school and the *School Goes Green* program that promotes sustainable lifestyles. Additional educational models, such as seminars, workshops, homeschooling, and forums, also contribute to shaping residents’ mobility choices. Accordingly, the sustainable mobility education ratio may lead to changes in mobility behavior, hereafter referred to as ‘Change in Mobility Behavior’.

The sixth performance driver is the ‘Social Awareness Ratio’, which compares the actual level of social awareness with the desired level. Social awareness is recognized as a critical variable in supporting the transition toward sustainable urban mobility. Limited public and institutional awareness has been identified as one of the key challenges in implementing the SDGs (Ansell et al., 2022). Social awareness is reflected in residents’ mobility behavior, and the social awareness ratio may therefore influence changes in mobility choices, hereafter referred to as ‘Change in Mobility Behavior’.

The seventh performance driver is the ‘Perceived Pedestrian Safety Ratio’, which compares the actual level of perceived pedestrian safety with the desired level. Perceived pedestrian safety is a critical factor influencing individuals’ decisions to walk rather than drive. As Panagopoulos et al. (2018, p. 17) observed, “safety is the primary need for pedestrians”. Higher levels of perceived pedestrian safety are associated with an increased willingness to walk. Accordingly, the perceived pedestrian safety ratio may affect the intermediate outcome, hereafter referred to as ‘Change in Active Mobility’.

The eighth performance driver is the ‘Traffic Congestion Ratio’, which compares the actual level of traffic congestion with the desired level. The desired level refers

to minimal congestion, reflecting efficient urban mobility. Congestion is defined as the condition in which vehicular demand exceeds road or street capacity, resulting in increased travel delays in the city center of Palermo. In practice, however, severe traffic congestion has become an everyday occurrence in Palermo (Vinci & Di Dio, 2014). Congestion is therefore recognized as one of the fundamental challenges in Palermo's urban mobility system (Migliore et al., 2020). Ultimately, the traffic congestion ratio may influence two intermediate outcomes, namely 'Change in Air Pollution' and 'Change in Noise Pollution'.

The ninth performance driver is the 'Air Pollution Ratio', which compares the actual air pollution level with the desired level. The desired level refers to the absence of air pollution, whereas the actual level reflects conditions at a given point in time. The air pollution ratio is measured through the accumulated concentration of pollutants, such as *nitrogen oxides* (NO_x), *volatile organic compounds* (VOCs), *carbon dioxide* (CO₂), *carbon monoxide* (CO), and other emissions, as well as particulate matter (*PM_{2.5}* and *PM₁₀*). Variations in the air pollution ratio may ultimately influence an intermediate outcome labeled 'Change in Perceived Environmental Quality'.

The tenth performance driver is the 'Noise Pollution Ratio', which compares the actual noise pollution level with the desired level. The desired level refers to the absence of noise generated by vehicle engines and horns, whereas the actual level reflects prevailing conditions at a given time. Noise pollution levels may vary considerably and fluctuate from minute to minute. However, accumulated hourly levels can negatively affect the surrounding environment. To determine the noise threshold, sound detection instruments, such as Sound Level Meter (SLM) and Noise Dosimeter, are required, as they accurately measure Sound Pressure Levels (SPL) in decibels (dB). In this context, the noise pollution ratio may influence an intermediate outcome, namely the 'Change in Perceived Environmental Quality'.

The eleventh performance driver is the 'Active Mobility Ratio', which compares the actual level of active mobility with the desired level. Improving active mobility, encompassing walking and cycling, is a central scenario in supporting the

Sustainable Urban Mobility Plan (Rupprecht Consult, 2019). Accordingly, the active mobility ratio is considered a key performance driver in this analysis. Beyond its role in sustainable urban transport, active mobility also contributes to improved public health outcomes. In this context, the active mobility ratio may influence an intermediate outcome, namely the ‘Change in Physical and Mental Health’.

The twelfth performance driver, the ‘Physical and Mental Health Ratio’, compares the actual and desired levels of physical and mental health. This indicator reflects the interconnection between health and urban sustainability, consistent with the SDGs. The analysis is predicated on the assumption that individuals with stronger physical and mental health are more likely to adopt and sustain changes in mobility culture. For instance, walking as a habitual practice within urban centers can contribute to improved health outcomes, thereby reinforcing walking as a cultural norm. Consequently, the physical and mental health ratio may influence the final outcome, namely the ‘Change in Mobility Culture’.

The thirteenth performance driver, the ‘Perceived Environmental Quality Ratio’, compares the actual and desired levels of perceived environmental quality. Environmental quality may be influenced by multiple factors, including air and noise pollution. Furthermore, designing the mobility of the future is based on the environmental point of view (Inguglia et al., 2020). This ratio can be operationalized through Perceived Environmental Quality Indicators (PEQIs), which employ survey or interview instruments to capture descriptions, ratings, and rankings of environmental quality (Hyman, 1981). Positive perceptions of environmental quality are hypothesized to encourage healthier mobility practices and reinforce cultural habits. Accordingly, the perceived environmental quality ratio may contribute to the final outcome, namely the ‘Change in Mobility Culture’.

Next, the fourteenth performance driver, the ‘Mobility Culture Ratio’, compares the actual and desired mobility culture. This ratio aims to achieve an actual mobility culture that meets or exceeds the desired level. Positive outcomes in this ratio are contingent upon the other performance drivers. Furthermore, the mobility culture ratio may influence the existing violators in the local areas. Preventive approaches

to reducing non-compliance are therefore closely linked to the strength of the mobility culture ratio.

Lastly, the fifteenth performance driver, the 'Mobility Behavior Ratio', compares the actual and desired levels of mobility behavior. Achieving actual mobility behavior exceeding desired mobility behavior is the desired goal, and vice versa. Similar to the fourteenth performance driver, the mobility culture ratio is highly dependent on the previous performance drivers. Ultimately, the mobility behavior ratio can, in turn, change existing violators. In addition to the mobility culture ratio, preventative approaches to reducing existing violators also depend heavily on the mobility behavior ratio. In essence, the mobility culture ratio and mobility behavior ratio can simultaneously change existing violators in pedestrian areas and limited traffic zones.

In this thesis, mobility behavior and mobility culture are positioned as the most important shared strategic resources. The sustainability of mobility policy depends on the realization of both outcomes. In the SUMP guidelines initiated by the European Union, mobility culture and behavior are identified as crucial aspects to be achieved (Rupprecht Consult, 2019). Nevertheless, other shared strategic resources also influence the achievement of SUMP objectives within a dynamic performance governance approach. This indicates that all shared strategic resources have a special function within causal feedback mechanisms. Accordingly, their levels must be monitored and evaluated periodically, systematically, and dynamically. Ultimately, all shared strategic resources outlined in the two DPG charts serve as determining factors for policy success or failure.

The following table provides a detailed point of view of the DPG charts in Figure 5.11 (a) and Figure 5.11 (b). Table 5.2 depicts and summarizes the key elements of the DPG charts related to the performance of municipal police and local stakeholders.

Table 5.2 Critical Success Factors for Enhancing Performance of Municipal Police and Local Stakeholders

Variables	Units	Performance Drivers	Benchmarks/ Inputs
Shared Strategic Resources			
Collaborative interventions	Dimensionless	Collaborative interventions ratio (actual level/desired level)	Desired collaborative interventions
Mobility infrastructure and facilities	Goods	Mobility infrastructure and facilities ratio (actual level/desired level)	Desired mobility infrastructure and facilities
Public property	Goods	Public property ratio (actual level/desired level)	Desired public property
Perceived mobility satisfaction	Dimensionless	Perceived mobility satisfaction ratio (actual level/desired level)	Desired level of perceived mobility satisfaction
Education for sustainable mobility	Services	Sustainable mobility education ratio (actual level /desired level)	Desired sustainable mobility education
Social awareness	Dimensionless	Social awareness ratio (actual level/desired level)	Desired social awareness
Perceived pedestrian safety	Dimensionless	Perceived pedestrian safety ratio (actual level/desired level)	Desired level of perceived pedestrian safety ratio
Traffic congestion	Dimensionless	Traffic congestion ratio (actual level/desired level)	Threshold of traffic congestion (desired level)
Air pollution	Pollutants	Air pollution ratio (actual level/desired level)	Threshold of air pollution (desired level)
Noise pollution	Noise levels	Noise pollution (actual level/desired level)	Threshold of noise pollution (desired level)
Active mobility	Dimensionless	Active mobility ratio (actual level/desired level)	Desired level of active mobility
Physical and mental health	Dimensionless	Physical and mental health ratio (actual level/desired level)	Desired level of physical and mental health
Perceived environmental quality	Dimensionless	Perceived environmental quality ratio (actual level/desired level)	Desired level of perceived

			environmental quality
Mobility culture	Dimensionless	Mobility culture ratio (actual level/desired level)	Desired level of mobility culture
Mobility behavior	Dimensionless	mobility behavior ratio (actual level/desired level)	Desired level of mobility behavior
Existing Violators	People	Existing violators ratio (actual level/desired level)	Threshold of existing violators (desired level)
Vehicle circulation	Vehicles	Not applicable	Not applicable
Need for collaborative actions	Dimensionless	Not applicable	Not applicable
End Results (Outcomes)			
Change in mobility behavior	Dimensionless	Not applicable	Not applicable
Change in mobility culture	Dimensionless	Not applicable	Not applicable
Change in perceived environmental quality	Dimensionless	Not applicable	Not applicable
Change in physical and mental health	Dimensionless	Not applicable	Not applicable
Change in public property	Goods	Not applicable	Not applicable
Change in perceived mobility satisfaction	Dimensionless	Not applicable	Not applicable
Change in air pollution	Pollutants	Not applicable	Not applicable
Change in noise pollution	Noise levels	Not applicable	Not applicable
Change in active mobility	Dimensionless	Not applicable	Not applicable
Change in mobility infrastructure and facilities	Goods	Not applicable	Not applicable

Change in education for sustainable mobility	Services	Not applicable	Not applicable
Change in social awareness	Dimensionless	Not applicable	Not applicable
Change in vehicle circulation	Dimensionless	Not applicable	Not applicable
Change in existing violators	Dimensionless	Not applicable	Not applicable

Source: Author's elaboration

In addition, as shown in Figure 5.10, 5.11 (a and b), and Table 5.2, the most crucial point in this subchapter is how to reduce the adjustment time (i.e., delay time) in collaborative interventions involving local communities, such as education for sustainable mobility. Also, the delay in the time of mobility infrastructure and facilities involving private companies is crucial. Although the municipal police agency cannot control the organizations and communities involved, it can encourage their active involvement. Ongoing interactive dialogue between municipal police and relevant stakeholders is essential at the community level.

Such changes in mobility behavior and culture may require additional interventions. Such collaborative interventions include various interventions conducted by other public entities. Activities such as patrols conducted by the state police, metropolitan police, and volunteers of ANPS (*Associazione Nazionale della Polizia di Stato*) that support the municipal police can be included. Volunteers of ANPS frequently reprimand scooterists who cross pedestrian areas. The more collaborative interventions (e.g., collaborative patrols) there are, the better they support municipal police performance.

Collaborative interventions are key actions at the community level because they can affect other shared strategic resources, leading to changes in sustainable mobility behavior and culture. In the future, mobility behavior and culture must be improved through various efforts involving Palermo's municipal government, Sicily's

regional government, Italy's central government, and the European Union. As mobility behavior and culture are complex issues in Palermo, various strategic actions are needed simultaneously and should not fall solely to the municipal police.

Chapter 6

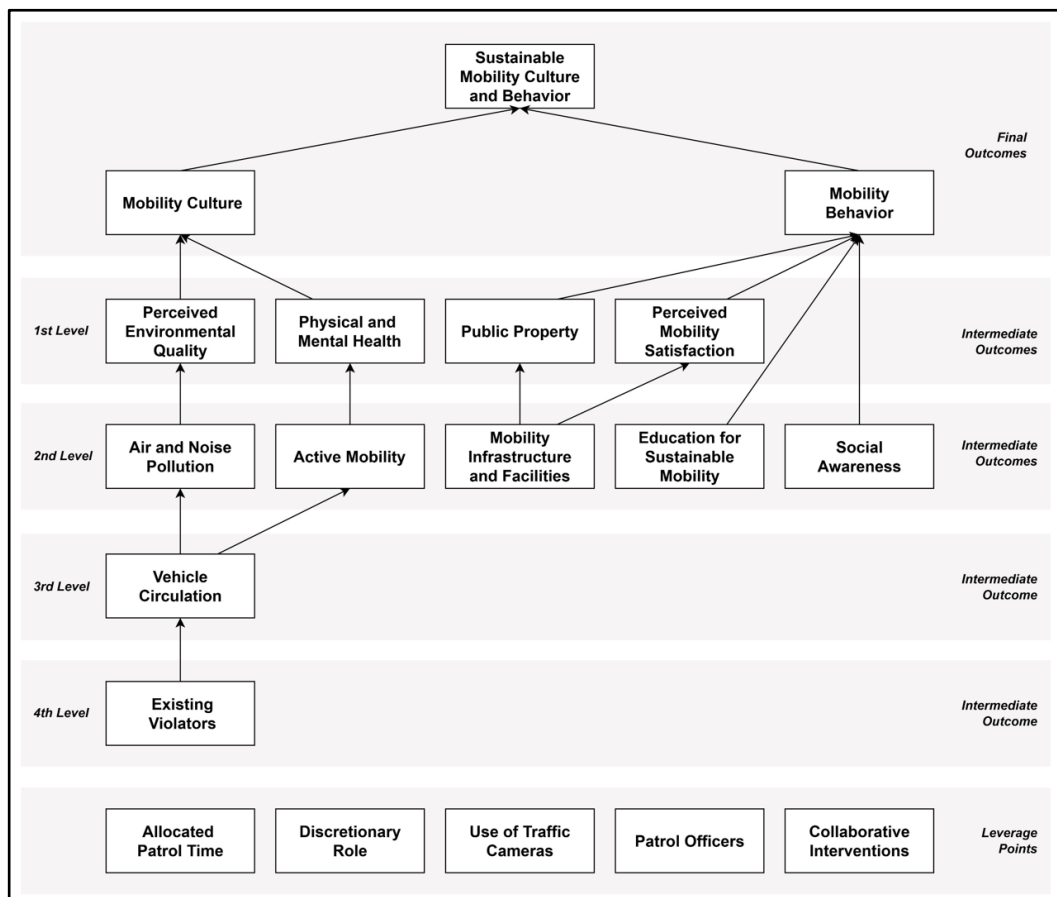
Discussions, Conclusions, and Recommendations

This chapter presents systematic discussions, followed by conclusions and recommendations. It integrates these three parts to ensure coherence and strengthen the connections between sections.

6.1 Introduction

The main findings and discussions presented in this chapter are based on the explanations provided in Chapter 5. Explanations in the previous chapter are integrated and elaborated upon, forming levels of outcomes and leverage points. The following figure depicts the comprehensive outcomes and leverage points.

Figure 6.1 Mapping Levels of Comprehensive Outcomes and Leverage Points



Source: Author's elaboration

In Figure 6.1, intermediate and final outcomes are the end results arising from actions with or without the municipal police. These outcomes encompass all short

and long-term results related to local stakeholders. This thesis identifies eleven intermediate outcomes and two final outcomes related to sustainable mobility policies in pedestrian areas and limited traffic zones. Intermediate outcomes comprise the existing violators, the vehicle circulation, the air and noise pollution, the active mobility, the mobility infrastructure and facilities, the education for sustainable mobility, the social awareness, the perceived environmental quality, the physical and mental health, the public property, and the perceived mobility satisfaction. Final outcomes include the mobility culture and the mobility behavior (i.e., the sustainable mobility culture and behavior). All of them exist on different levels but are interrelated.

The outcomes depicted in Figure 6.1 are integral components of the causal mechanism underpinning the implementation of sustainable mobility policies in Palermo. This implies that, on the one hand, the outcomes serve as the effect, while on the other hand, they function as the cause of the system's performance. If the intended outcomes are appropriately achieved, the goals of sustainable mobility policies will be optimal. Conversely, if unintended outcomes emerge, attaining the goals of sustainable mobility policies will become significantly challenging.

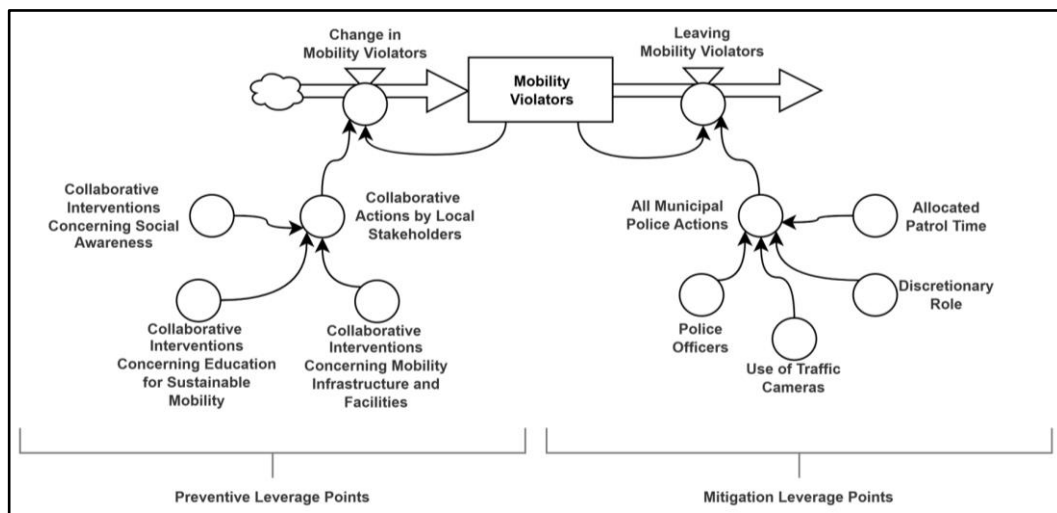
Also, this thesis identifies five leverage points, which are depicted in the lower part of Figure 6.1. The leverage points of allocated patrol time and discretionary role pertain to municipal police officers (i.e., individual level). The leverage points regarding traffic cameras and patrol officers are associated with the municipal police agency. The leverage point of collaborative intervention pertains to multiple stakeholders.

Leverage points associated with the municipal police are classified as mitigation actions, while those related to local stakeholders are classified as preventive actions. This thesis asserts that these leverage points are integrated into a single strategic action package that requires simultaneous implementation. In other words, if leverage points rely solely on mitigation or preventive actions, they may not achieve the intended outcomes. Conversely, if leverage points are based on both mitigation and preventive actions, they may be able to achieve the intended outcomes

optimally. The rationale behind this consideration is that the municipal police lack resources, whilst local stakeholders face time delays.

In the context of Palermo's city center, relying solely on mitigation actions is insufficient, and relying solely on preventive actions is equally inadequate. All leverage points must be executed concurrently to achieve a sustainable mobility culture and behavior. Figure 6.2 elucidates the instrumental view of leverage points in addressing mobility violators, thereby facilitating the attainment of sustainable mobility goals.

Figure 6.2 Mapping Leverage Points



Source: Author's elaboration

Figure 6.2 illustrates the mapping of each leverage point mentioned in Figure 6.1. Also, Figure 6.2 provides an instrumental view of the application of each leverage point within the system dynamics method for performance management and governance (i.e., the DPM and DPG approaches). The adjustment (i.e., increasing or decreasing) of the value of each leverage point is tailored to the specific needs regarding mobility violations. This adjustment is necessary because altering a few leverage points may have a negative impact on other related variables within the system's performance. Furthermore, the next subchapters provide detailed academic discussions and practical recommendations on leverage points and related aspects.

6.2 Discussions

The scope of street-level bureaucrats in policymaking exists at individual, organizational, and institutional levels (Rossi et al., 2024). In the context of sustainable mobility policies, municipal police, as street-level bureaucrats, also operate at the inter-institutional level. The inter-institutional level extends beyond a single organization or institution. According to Bianchi (2016), managing performance within the sustainability perspective extends beyond the institutional level to encompass the inter-institutional level. Personal, organizational, and environmental factors can affect the performance of street-level bureaucrats (Cohen, 2018; Gershgoren & Cohen, 2023), in turn, the performance of street-level bureaucrats may affect environmental factors.

As local law enforcement officers, municipal police are inherently connected to the organizational level at which they operate and the inter-institutional level at which they engage with various stakeholders. This connection arises from their role in representing the organization within the broader social environment. The effectiveness of municipal police in enforcing regulations related to sustainable mobility needs to be analyzed across three distinct levels: individual, organizational, and inter-institutional. These levels are interrelated through a systems thinking approach. Adopting this approach is crucial for enhancing the overall performance of the municipal police and their broader impact.

From a practical perspective, if the wicked problems (e.g., mobility access violations) of sustainable mobility are not effectively addressed at the personal level of the municipal police, they are pushed to the organizational level of the municipal police agency. If the wicked problems of sustainable mobility are not tackled well at the personal and organizational levels, they become significant issues at the inter-institutional level. If such wicked problems become problematic at the inter-institutional level, they become broader issues over time.

Sustainable mobility issues require special attention from municipal police officers, the municipal police agency, and relevant stakeholders supporting sustainable mobility agendas. Therefore, the discussion transcends the personal boundaries of

municipal police as street-level bureaucrats, extending into organizational and inter-institutional spheres. Wherever wicked problems exist, “frontline agency is an indispensable factor” (Peeters & Campos, 2023, p. 2) to tackle the sustainable mobility issues. Moreover, organizational and inter-institutional spheres play a role in supporting what municipal police do and what municipal police should do.

6.2.1 Performance of Municipal Police at the Individual Level

Street-level bureaucrat as an individual agency leads to action (Winter et al., 2022) in problem-solving and public service. Street-level bureaucrats work individually (Møller et al., 2022), even though they sometimes patrol in groups. For instance, patrol officers retain their individual identities even when they patrol in groups. They have equal duties and functions in enforcing the law, including sustainable mobility regulations. A patrol officer cannot delegate his/her responsibilities to another patrol officer. When patrolling in a police car, one of them may be the driver. This does not mean that one of them only serves as a driver. All of those who patrol are tasked with enforcing the local law.

The most critical aspect of a patrol officer's role is how each officer enhances their performance through enforcement. The large number of municipal police patrolling does not guarantee that many violators are sanctioned. One patrolman enforcing the regulations is much better than two patrolmen who only monitor the area without taking any action to punish mobility violators. The performance of municipal police officers should increase over time. Their performance may be contingent upon their resources.

One of the most essential resources for municipal police is time allocation to enforce the regulations. Street-level bureaucrats have personal resources (Mikkelsen et al., 2024), including skill, knowledge, and allocated time to patrol. More time dedicated by patrolmen to ideal duties yields a good score (King, 1999). Allocating more time to enforce regulations may reduce vehicle circulation. Conversely, less time dedicated to patrols may increase mobility violations (e.g., unauthorized vehicles passing and parking). Allocating time to work is a crucial variable influencing the performance of street-level bureaucrats (Bianchi & Rua,

2022). Thus, allocating patrol time is a critical resource for municipal police operations.

Another essential resource is the discretionary role. Discretionary actions can be equated with failure to penalize violators who deserve punishment. In the context of enforcing sustainable mobility regulations, the discretionary role of municipal police appears to be ill-suited. The more discretion there is, the more violators there are. The discretionary role of municipal police differs from that of other street-level bureaucrats. The street-level bureaucrats (e.g., teachers) who provide benefits rather than sanctions may need discretion when dealing with students. For example, if a student has low exam scores but is diligent in attending class, the teachers may be able to exercise discretion and still pass the student. Unlike teachers who teach students, patrol officers should not give discretion to anyone who breaks regulations. If discretionary action is still carried out, mobility violators will continue.

Although many authors develop discretionary roles of frontline implementers (Cohen et al., 2023) and “street-level discretion remains a key feature of welfare administration” (Ball et al., 2023, p. 1168), it is not always the right choice when solving problems. According to Ackrill et al. (2023), the exercise of discretion by street-level bureaucrats can result in “underenforcement” of regulations and policies. According to Wilson's theory, officers' discretion tends to be improper (Hassell et al., 2003). If patrol officers do not take discretionary roles, mobility violators may decrease further. If the number of mobility violators remains or even increases in certain areas, this indicates that patrol officers often take discretionary roles in those areas. When municipal police exercise discretionary powers, it may indicate unprofessional conduct. Professionalism refers to doing the right thing (Cohen, 2018). All levels of the police force should work professionally (Denys, 2010).

To sustain sustainable mobility, the professional practices of municipal police, as noted by Wilson (2003), must be upheld. Any actions undertaken by patrol officers result in policy outputs and outcomes. These outputs and outcomes, in turn, can

influence the overall performance of municipal police officers. This refers to a cause-and-effect relationship. Because municipal police officers are exposed to critical events, such as risk and resilience, as part of their duty (Prati & Pietrantonio, 2010), performance management with a system view is needed to overcome various possible problems. Potential side effects arising from the reduction of discretion granted to violators, such as threats of physical violence against patrol officers, must be anticipated and addressed through various strategies.

Performance measurement and management of street-level bureaucrats “offer feedback to adjust the system” (Lipsky, 1980, p. 40). This is important because individual factors shape how street-level bureaucrats perform their performance (Andreotti et al., 2024). “Despite the difficulties of performance measurement” (Lipsky, 1980, p. 51) of street-level bureaucrats, the DPM may help in addressing the difficulties. The DPM approach, which focuses on the output aspect, answers the arguments put forward by Donnelly who said that most police performance measurements only focus on input and output (2013). The DPM, which is frequently applied to organizational performance, can also be applied to individual performance. Previous research conducted by Bianchi and Rua (2022) described the potential application of DPM to the individual performance of schoolteachers. In addition to municipal police officers and schoolteachers, various other types of street-level bureaucrats (see Lipsky, 1980) are relevant to using the DPM in the performance management systems. As remarked by Bianchi (2016), the DPM also focuses on understanding the performance of public agencies. The DPM overcomes failures and enhances the achievement of patrol officers. Strengthening the performance of the municipal police is desirable (Sharma & Sachdeva, 1978) to ensure that such policy goals can be achieved optimally.

Research on the individual performance of street-level bureaucracy is an interesting issue (Eshuis et al., 2023). Various methodologies can be used to study the individual performance of street-level bureaucracy. One is the system dynamics for performance management. The DPM, which applies system dynamics to performance measurement, is an emerging method (Oladimeji et al., 2020). The DPM frames complexity in implementing performance measures (Cosenz, 2022),

where it might not be found using other approaches. Such performance measurement of police officers has been a concern since the theory of street-level bureaucracy was introduced (see Lipsky, 1980). Performance management systems can improve the performance targets (Pasha, 2018) of street-level bureaucrats individually. Bianchi and Rua (2022) remarked that DPM can support street-level bureaucrats' performance management and measurement systems. Therefore, the DPM can be adapted as a methodology for measuring the performance of street-level bureaucrats (e.g., police and schoolteachers).

6.2.2 Performance of Municipal Police at the Organizational Level

From an organizational perspective, an understanding of the performance of street-level bureaucracy is needed. The reason is that street-level bureaucrats represent governmental organizations at the local level (Lipsky, 1980). Although street-level bureaucrats remain independent from organizational control (Lipsky, 1980), individuals who achieve organizational goals are inextricably linked to the organizational control system (Flamholtz et al., 1985). This indicates that individual performance is intrinsically linked to organizational performance. Additionally, organizational performance is reciprocally connected to individual performance.

Such municipal police officers represent strategic resources of the municipal police agency. A pivotal consideration is the organizational perspective, as the control systems implemented at all levels of the police force are fundamentally command-based. The police system has an organizationally hierarchical approach, even though police officers play a functional role (Devroe & Ponsaers, 2017). In this way, their superiors can direct patrolmen on what actions to take. Patrolmen are not able to act entirely independently. When conducting patrols, municipal police officers must follow the direction and instructions of their superiors. This is unlike teachers, who have more freedom when dealing with students' problems. Teachers have more independence in determining what actions they will take in their work.

The organizational sphere can limit street-level bureaucrats' policymaking (Rossi et al., 2024). This means that the municipal police agency can influence what actions municipal police officers can or cannot take when conducting patrols. On the one

hand, municipal police officers are responsible for improving their performance; on the other hand, they must follow structural instructions from their superiors. In their actions, whether to perform discretion or not to perform discretion, street-level bureaucrats' roles are limited by their position, which is lower in the organizational hierarchy (Rossi et al., 2024). At a higher organizational level in a municipality, the mayor is the primary commander in addressing urban problems (Calaresu & Selmini, 2017), including what the municipal police should do to address sustainable mobility issues. If the performance of his superiors (e.g., Chief of Patrol Unit) is good, a patrolman's performance may also be good, and vice versa. Thus, the organization's role determines how municipal police perform.

Organizational factors influence policemen's behavior (Crank, 1992) and their capability. Additionally, organizations establish and promote higher performance standards of street-level bureaucrats to achieve their goals (Lipsky, 1980). According to the duties and functions, the municipal government agency is responsible for enforcing every regulation established by the municipality. It is the responsibility of the municipal police to achieve the policy objectives and goals, including sustainable mobility policies. The municipal police agency—an organizational entity—should take a strategic role if its officers who conduct patrols are less successful in reducing mobility violations. Organizational issues are always related to the development of municipal police studies (Wilson, 2003).

The municipal police agency is responsible for hiring new patrol officers. The municipal police agency can provide this effort by supporting actual municipal police officers. Hiring new patrol officers may help the performance of actual patrol officers. This effort may reduce patrol officers' workload when dealing with offenders. The patrol range of two municipal police officers is more extensive than that of a single officer. The more patrol officers there are, the more comprehensive the patrol range is. The more patrol officers who enforce the regulations, the fewer violations will occur. This means that the more patrol officers perform well, the more policy objectives will be achieved. Regrettably, there is a significant delay in the hiring of new patrolmen. This results in irregular recruitment schedules due to

various considerations such as regulations and budgets. A practical action to support patrolmen's performance is the utilization and maximization of traffic cameras.

Using traffic cameras may reduce the potential for imperfect discretion and promote the automation of regulatory enforcement against violators, resulting in decreased unauthorized vehicle circulation. In agreement with de Boer and Raaphorst (2023, p. 43), “due to automation, street-level bureaucrats’ discretion becomes bound by the forms and input required by the automated systems”. The digitalization mode emerges in street-level agencies' work (Ball et al., 2023). Recently, technology has played a role in police action (Kang, 2023). Unfortunately, traffic cameras require a significant budget, including procurement and maintenance costs. Additional facilities like control rooms and data centers are also needed to maximize its use. The municipal government and the municipal police agency are expected to allocate a routine budget for procuring traffic cameras to provide all facilities. Otherwise, it may become more challenging to achieve sustainable mobility policies. When the municipal police agency performs better, environmental circumstances and internal resources can be adequately controlled (Matusiak, 2019). When the municipal police agency performs inadequately, unintended situations, such as parked vehicles in restricted areas, may arise.

Organizational control system orients organizational goals (Flamholtz et al., 1985). It may help the efficient practice of street-level bureaucrats (Lipsky, 1980). To accomplish organizational goals as expected, strategic resources must be made available to support street-level bureaucrats. This means that the resources owned by the organization should be utilized to achieve the intended outcomes of sustainable mobility. The achievement of organizational goals is not exclusively the responsibility of street-level bureaucrats. To maximize resources within an organization, it is necessary to control them appropriately. The control system can be applied to an organization as a whole (Flamholtz et al., 1985). In an organizational context, it includes financial and managerial aspects (Flamholtz, 1983). The planning and control system should also include all resources owned by the municipal police agency. The control systems help allocate organizational resources (Anthony, 1965). “Performance management systems are effective at

improving organizational performance, but only for the performance dimensions that can be planned and strategized” (Pasha, 2018, p. 217).

Measuring and managing the organizational context of municipal police requires further research (King, 1999; Wilson, 2003). Accordingly, the DPM can be a current and future research methodology. As one of the tools or approaches used in organizational control systems, the DPM focuses on organizational performance. As remarked by Bianchi (2016), the DPM is used to improve an organization's capacity. According to him, organizations have various strategic resources, such as financial, human, and technical resources. According to Bianchi and Williams (2015), such issues related to police performance are suitable for using the DPM approach. The DPM approach supports the local government's strategic planning and control systems (Bianchi & Tomaselli, 2015), including the municipal police agency as a local government agency. The DPM is applied at the organizational level to design and implement the planning and control systems (Bianchi, 2016). In municipal police organizations, formal control mechanisms are in place (Wilson, 2003).

6.2.3 Performance of Municipal Police and/or Local Stakeholders at the Inter-Institutional Level

The performance of municipal police can be planned and controlled not only at the individual and organizational levels but also at the inter-institutional level. The inter-institutional level refers to actions undertaken by municipal police and other stakeholders within specific local areas. In addition to interactions between the municipal police and relevant stakeholders, this also includes interactions among those stakeholders. As remarked by Matusiak (2019), the institutional perspective of municipal police relates to stakeholders' relations within the surrounding organizational environment. In this part, the inter-institutional perspective covers all aspects of the organizational environment and extends beyond organizational boundaries structurally. This follows what Lipsky (1980) said about street-level bureaucrats operating in an environment where a problem is located.

Apart from organizational factors, environmental factors influence police behavior and performance (Crank, 1992; Davenport, 1999). Therefore, the performance of street-level bureaucracy should take into account the institutional context in which municipal police interact and collaborate with other stakeholders. In this thesis, the inter-institutional perspective refers to the collaboration, coordination, interactions, and relationships between different institutions or organizations to promote and achieve sustainable mobility goals.

The institutional (Andreotti et al., 2024) and inter-institutional factors may influence the performance of street-level bureaucrats. For instance, patrol officers address mobility violations and engage with local stakeholders (e.g., residents and cycling communities). This indicates that an inter-institutional entity exists in sustainable mobility areas. Collaborative actions by local communities are essential to support municipal police performance. Similarly, the involvement of various public and private sectors is crucial for achieving sustainable mobility goals. The complexity of sustainable mobility issues necessitates an inter-institutional perspective for thorough analysis.

The complexity of problems in a particular area significantly influences the actions taken by patrolmen. Mobility violations frequently occur at various locations, posing a challenge for municipal police to address the issue effectively. It is important to note that the municipal police have limited resources. The available resources are not commensurate with the problems faced. The municipal police cannot sanction all violators on their own. If mobility violations were not a regular occurrence, the municipal police might be able to handle all infractions. “Institutional factors simultaneously constrain and enable frontline work” (Peeters & Campos, 2023, p. 3). Hence, other public and private stakeholders must support municipal patrol performance in sustaining sustainable mobility. Therefore, other relevant stakeholders should support the performance of municipal patrols in sustaining sustainable mobility.

“If police agency efforts fail to provide adequate explanation for performance” (Davenport, 1999, p. 175), relevant stakeholders are considered to maximize the performance of municipal police at the inter-institutional level. Currently, issues extend beyond organizational and institutional boundaries (Kooiman, 1999). Therefore, inter-institutional entities are indispensable, particularly in addressing sustainable mobility issues.

Collaborative interventions concerning educational activities and social awareness aimed at promoting sustainable mobility. Local communities play a critical role in sustainable education and social awareness. At the same time, municipal government agencies and various private agencies are responsible for developing infrastructures and facilities for sustainable mobility. All these efforts may improve mobility behavior, reducing illegal vehicle circulation in pedestrian areas and limited traffic zones. This research states that mobility violations may decrease as mobility behaviors change.

Strengthening the collaborative approach to support patrolmen's performance in maintaining sustainable mobility is necessary. Collaborative approaches encompass all actions that support sustainable mobility policies. This includes collaborative patrols conducted by the state police, the local police, and the metropolitan police. As the highest authority responsible for urban mobility, the municipal government of Palermo must continue to encourage the participation of public and private entities. When the municipal government lacks sufficient finances, it relies on organizations (e.g., the European Union, the central government of Italy, and relevant companies). with financial resources to help it. Developing mobility infrastructures and facilities requires a collaborative approach. Even though patrolmen are not directly involved in its development, they are involved in its use. Collaboration is required for both development and utilization. Collaborative issues regarding the study of street-level bureaucrats have emerged as issues (Zhan et al., 2014). Street-level bureaucrats do collaborative work (Masood & Nisar, 2022). Collaborative strategies may increase the performance of street-level bureaucrats (Bianchi & Rua, 2022).

In addition, to support municipal police performance, it is necessary to strengthen active communities where mobility violations occur frequently. Community action has contributed to street-level bureaucracies (Lipsky, 1980). Strengthening such neighborhoods and communities as communal police could be a way to confront problems that are relevant to the duties of state and local police officers (Denys, 2010). The social function fulfilled by street-level bureaucrats within the larger society is essential (Lipsky, 1980). A continuous education program for sustainable mobility can significantly impact urban mobility. It may take considerable time to implement this. It is better to encourage communities to continue educating and advocating for sustainable mobility than to do nothing. Providing sustainable mobility through patrols conducted by municipal police officers does not seem sufficient to maintain urban mobility.

The DPG approach is applied to performance governance at the inter-institutional level (i.e., community level). The object of DPG use is the local areas (Bianchi, 2021). Such collaborative networks become the objects of the DPG (Bianchi, 2022). Street-level bureaucrats who interact and collaborate with various stakeholders in a particular area can become objects of the DPG approach. The DPG develops institutional and inter-institutional routines for specific issues (Vignieri, 2023), including sustainable mobility problems. In this thesis, the DPG is used to support municipal police performance at the inter-institutional level. In principle, the DPG aims to frame municipal police and local stakeholders' performance regarding sustainable mobility issues.

Integrating the DPM and DPG approaches is part of a comprehensive effort to improve municipal police performance and local stakeholders. Integrating the DPM and DPG approaches into the performance management system supports the sustainability of sustainable mobility policies over time. Appropriate methodological approaches, such as the DPM and DPG, can achieve the primary practical objective of this thesis, which is to attain sustainable mobility goals. Sustaining sustainable mobility policies can be achieved by improving the performance of municipal police at individual, organizational, and inter-

institutional levels. This includes the performance of local stakeholders in Palermo's city center.

6.2.4 Connecting the Performance of Municipal Police and Local Stakeholders to the Theory of Street-Level Bureaucracy, Collaborative Governance, and Related Concepts

In the early use of the theory of street-level bureaucracy, Lipsky (1980) focused on the individual level. Individual agency within organizational units is a key part of the existence of street-level bureaucracy theory (Winter et al., 2022). In this regard, individual output performance warrants close attention (Thomann, 2015). Accordingly, police officers, as street-level bureaucrats who have their own individual characteristics (Pasha, 2018; Cohen & Golan-Nadir, 2020), require the desired performance output. Considering that municipal police officers play roles similar to those of police officers, they also need to improve their performance output.

In this research, the performance output of municipal police officers in sustainable mobility issues is critically influenced by enforcement time allocation (i.e., the number of allocated patrol time) and discretionary roles (the number of violators granted discretion). This is supported by research conducted in Belgium (Antwerp city) by Dewinter et al. (2024) and in Germany (various cities) by Cors et al. (2025) who explain that managing patrol response time can enhance police performance. Additionally, Visser and Kruijnen (2021), who conducted research in the Netherlands, and Andreotti et al. (2024), who conducted research in Italy (Region of Lombardy and Emilia Romagna), stated that discretion necessitates a careful balance in the exercise of public service.

Over time, research on street-level bureaucracy theory has expanded to include organizational dimensions concerning the role of frontline officers. According to Lavee et al. (2018), the organizational environment may support street-level bureaucrats' actions. In addition, personal and organizational conditions are closely interrelated (Cohen, 2018). Accordingly, organizational performance plays a critical role in the development of street-level bureaucracy theory.

The performance of the municipal police agency in implementing sustainable mobility policies depends on critical success factors, namely the recruitment of additional personnel (i.e., the number of patrol officers) and the provision of supporting facilities (i.e., the use of traffic cameras). The recruitment of additional police officers may be a strategy to enhance the capacity of urban police forces in Europe (Denys, 2010). Also, traffic cameras have the potential to encourage coercive enforcement actions by police (Kang, 2023). These two factors can only be controlled at the organizational level rather than by individual personnel.

Furthermore, street-level bureaucracy theory encompasses the institutional sphere (Rossi et al., 2024) and system level (Gershgoren & Cohen, 2023). Accordingly, it is important to consider the feedback mechanisms of the institutional system that shape the practices of street-level bureaucrats (Bianchi & Rua, 2022). Thus, the performance of a local area as an institution may shape the effectiveness of street-level bureaucrats within its jurisdiction, and, conversely, bureaucratic performance (i.e., municipal police) may also influence institutional outcomes.

Considering municipal police work across organizational boundaries, a shift from short-term outputs to long-term outcomes is necessary (Bianchi et al., 2021). Furthermore, implementing collaborative governance is essential for improving the local ecosystem (Bianchi et al., 2021). In the future, incorporating collaborative performance management into street-level bureaucracy theory will be necessary.

Ensuring the continuity of sustainable mobility policies necessitates collaborative actions. According to Ansell et al., (2022), collaborative and collective actions are essential to achieving the SDGs agenda, both in European cities and in other cities around the world. Tackling complex challenges associated with the SDGs cannot be effectively accomplished through the actions of single organizations in isolation (Ansell et al., 2022). Within local contexts, collaborative actions may facilitate the attainment of intended outcomes.

6.3 Conclusions

6.3.1 How do municipal police officers enhance performance in enforcing sustainable mobility policies in Palermo?

Enhancing the performance of municipal police at the individual level is crucial to achieving sustainable mobility policies in Palermo's city center. Accordingly, municipal police officers should allocate more time to enforcing local regulations and limit their discretion regarding mobility violators. Besides, municipal police officers must improve their skills and knowledge in patrolling the city center. These mitigation strategies may reduce unauthorized vehicle circulation in restricted traffic zones and mitigate future consequences. Reducing unauthorized vehicle circulation by municipal police officers may lead to sustainable mobility.

6.3.2 How does the municipal police agency enhance the performance of municipal police officers in enforcing sustainable mobility policies in Palermo?

To maximize performance outputs, the municipal police agency must implement alternative mitigation measures to support patrol officers. From an organizational perspective, the municipal police agency remains inextricably linked to the individual performance of municipal police. Therefore, it is essential to mobilize all available resources to enhance their performance. Using effective traffic cameras and hiring additional patrol officers may assist patrol officers in their duties. Also, the optimal allocation of financial resources can support the operational costs associated with urban mobility. The municipal police agency is responsible for overseeing and managing these strategic resources. By maximizing the organizational resources, the performance of patrol officers can be effectively supported, leading to the achievement of desired outputs and outcomes.

6.3.3 How do municipal police and local stakeholders sustain sustainable mobility policies in Palermo?

The most essential point is that it is crucial to enhance the performance of municipal police and local stakeholders at the inter-institutional level, focusing on pursuing preventive actions. Mitigation measures implemented by the municipal police are

insufficient to address mobility violations adequately. In solving mobility issues with preventive actions, collaborative interventions involving local communities, public organizations, and private entities are required. Collaborative actions supporting education for sustainable mobility by the local stakeholders need to be maximized over time. The local authorities and relevant agencies should also effectively build mobility infrastructure and facilities in various areas. These preventive actions may alter sustainable mobility behavior and culture, thereby impacting sustainable mobility policies in the long term.

Furthermore, the street-level bureaucracy theory, in relation to performance aspects, should broaden its scope beyond performance management and measurement to include performance governance. This expansion is essential because municipal police performance is interconnected at the individual, organizational, institutional, and inter-institutional levels. Municipal police, as street-level bureaucrats, are inherently linked to the local areas where they enforce regulations and interact with the local stakeholders. On the one hand, municipal police actions can substantially impact the organization and the broader social environment. On the other hand, the actions of local stakeholders may influence their performance. Studies on the performance of street-level bureaucracy are recommended to prioritize outcome perspectives over output perspectives. Also, policy networks or collaborative platforms need to be integrated into future academic discussions of street-level bureaucratic theory.

Additionally, the DPM approach is appropriately applied to municipal police performance at the individual and organizational levels. The DPG approach is suitably applied to the performance of municipal police and/or local stakeholders at the community level. Integrating these approaches effectively frames the comprehensive performance of municipal police and local stakeholders in sustaining sustainable mobility policies. Ultimately, leverage points, (shared) strategic resources, performance drivers, and end results (both outputs and outcomes) can be identified and detected to facilitate the achievement of sustainable mobility policies in Palermo. Generally, the DPM and DPG approaches can facilitate the attainment of sustainable development goals.

However, this thesis acknowledges certain limitations, as the single-case design constrains the generalizability of findings beyond Palermo. Furthermore, while the DPM and DPG approaches provide valuable insights into performance management and governance, they do not permit quantitative testing or scenario-based simulations in this analysis. Future research may therefore benefit from applying the DPM and DPG charts in comparative analyses across multiple cities or extending the qualitative models into quantitative simulations to examine the long-term impacts of sustainable mobility policies.

6.4 Practical Recommendations

Practical recommendations include leverage points (see Figure 6.2) for municipal police and relevant stakeholders. Other potential strategic actions from local authorities and stakeholders to foster sustainable mobility in Palermo are also included. Practical recommendations follow the scenarios discussed in Chapter 5. The recommendations below provide concrete actions or policies to address the problematic issues and achieve the intended outcomes over time.

The following points are recommended for municipal police officers:

- Municipal police officers should allocate their patrol time proportionally throughout the day to all restricted traffic zones in the city center of Palermo. Areas with high levels of violations should be allocated more patrol time;
- Municipal police officers should not be permitted to exercise discretion toward violators in any situation, at any time, and anywhere. Even if discretion is exercised as part of a soft approach, it is only afforded to a few violators per day;
- Municipal police officers need to improve their knowledge and skills to maximize their capabilities periodically.

The following points are recommended for the municipal police agency:

- The municipal police agency needs to maximize the number of patrol officers in the city center of Palermo, either by hiring new patrol officers or temporarily reassigning non-patrol officers to patrol duties at certain times;

- The municipal police agency needs to utilize high-quality traffic cameras and install them in strategic locations. The use of traffic cameras must consider aspects of effectiveness and efficiency;
- The municipal police agency encourages joint patrols with other police forces (e.g., metropolitan police and state police);
- The municipal police agency needs to optimize the utilization of back-office officers to support the duties of patrol officers;
- The municipal police agency needs to increase fines paid by violators to deter offenders, so they do not commit further violations.

The following points are recommended for the relevant stakeholders:

- Community-based organizations or local associations are advised to continue their collaborative actions regarding educational movements for sustainable mobility at least twice a month. This is necessary to prevent delays;
- Residents and visitors are advised to continue their collaborative activities to promote broader social awareness at least twice a month. This measure is necessary to prevent delays;
- Other relevant private and public organizations are expected to optimize resources to support sustainable mobility agendas. In this regard, partnerships and cooperation are not solely based on profit but also serve as a scheme of social funding or corporate social responsibility.

The following recommendations are proposed for the municipal government of Palermo, as the principal municipal authority:

- The municipal government of Palermo must provide substantial financial support for the implementation of sustainable mobility policies;
- The municipal government of Palermo must install various types of pedestrian barriers that are difficult to move or damage;
- The municipal government of Palermo tightens regulations on pedestrian areas and limited traffic zones. The regulations that provide exceptions are minimized;

- The municipal government of Palermo should increase the provision of legal parking spaces to minimize vehicle circulation in restricted traffic zones;
- The municipal government of Palermo, in collaboration with AMAT, should optimize local public transportation services to reduce the reliance on private and passenger vehicles for commuting to and from the city center;
- The municipal government needs to enhance coordination across various levels of government to address the high rate of private vehicle ownership in Palermo.

References

- Ackrill, R., Igudia, E., Olusanya, O., & Oyalowo, B. (2023). Street level bureaucrats, policy entrepreneurship, and discretion in enforcing bans on motorcycle taxis in Lagos, Nigeria. *European Policy Analysis*, 9(4), 440–464. <https://doi.org/10.1002/epa2.1196>
- Agranoff, R., & McGuire, M. (2003). *Collaborative public management: New strategies for Local governments*. Georgetown University Press.
- Andersen, D. F., Rich, E., & Macdonald, R. (2020). System dynamics applications to public policy. In B. Dangerfield (Ed.), *System Dynamics. Encyclopedia of Complexity and Systems Science Series* (pp. 253–271). Springer. https://doi.org/10.1007/978-1-4939-8790-0_421
- Andreotti, A., Coletto, D., & Rio, A. (2024). Street-level bureaucrats' discretion between individual and institutional factors: The analysis of the minimum income policy implementation in two Italian regions. *Social Policy and Administration*, 58(3), 368–384. <https://doi.org/10.1111/spol.12964>
- Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory*, 18(4), 543–571. <https://doi.org/10.1093/jopart/mum032>
- Ansell, C., & Gash, A. (2018). Collaborative platforms as a governance strategy. *Journal of Public Administration Research and Theory*, 28(1), 16–32. <https://doi.org/10.1093/jopart/mux030>
- Ansell, C., Sørensen, E., & Torfing, J. (2022). Co-Creation for sustainability: The UN SDGs and the power of local partnership. In *Co-Creation for Sustainability: The UN SDGs and the Power of Local Partnership*. Emerald Group Publishing Ltd. <https://doi.org/10.1108/9781800437982>
- Anthony, R. N. (1965). *Planning and control systems: A framework for analysis*. Graduate School of Business Administration, Harvard University.
- Armah, F. A., Yawson, D. O., & Pappoe, A. A. N. M. (2010). A systems dynamics approach to explore traffic congestion and air pollution link in the city of Accra, Ghana. *Sustainability*, 2(1), 252–265. <https://doi.org/10.3390/su2010252>
- Arnold, G. (2013). Policy learning and science policy innovation adoption by street-level bureaucrats. *Journal of Public Policy*, 34(3), 389–414. <https://doi.org/10.1017/S0143814X14000154>
- Assadi, A., & Lundin, M. (2018). Street-level bureaucrats, rule-following and tenure: How assessment tools are used at the front line of the public sector. *Public Administration*, 96(1), 154–170. <https://doi.org/10.1111/padm.12386>
- Atkinson, M. M., & Coleman, W. D. (1992). Policy networks, policy communities and the problems of governance. *Governance: An International Journal of Policy and*

- Administration*, 5(2), 154–180. <https://doi.org/10.1111/j.1468-0491.1992.tb00034.x>
- Austen, A. (2018). In search of network sustainability: A multi-level perspective on the paradox of cooperation and competition in networks. *Sustainability*, 10(7), 2466. <https://doi.org/10.3390/su10072466>
- Avecedo, B., & Common, R. (2010). Governance, networks, and policy change: The case of cannabis in the United Kingdom. In S. P. Osborne (Ed.), *The new public governance? Emerging perspectives on the theory and practice of public governance* (pp. 394–412). Routledge.
- Axson, D. A. J. (2010). *Best practices in planning and performance management: Radically rethinking management for a volatile world* (Third Edition). Wiley.
- Bala, B. K., Arshad, F. M., & Noh, K. M. (2017). *System dynamics: Modelling and simulation*. Springer. <http://www.springer.com/series/10099>
- Ball, S., McGann, M., Nguyen, P., & Considine, M. (2023). Emerging modes of digitalisation in the delivery of welfare-to-work: Implications for street-level discretion. *Social Policy and Administration*, 57(7), 1166–1180. <https://doi.org/10.1111/spol.12939>
- Banister, D., Stead, D., Steen, P., Akerman, J., Dreborg, K., Nijkamp, P., & Schleicher-Tappeser, R. (2000). *European transport policy and sustainable mobility*. Routledge.
- Barral, S., & Ghosh, R. (2023). Between hierarchies and markets: How street-level bureaucratic autonomy leads to policy innovations. *European Policy Analysis*, 9(4), 418–439. <https://doi.org/10.1002/epa2.1178>
- Basiago, A. D. (1995). Methods of defining “sustainability.” *Sustainable Development*, 3, 109–119. <https://doi.org/10.1002/sd.3460030302>
- Bauhr, M., & Carlitz, R. (2021). When does transparency improve public services? Street-level discretion, information, and targeting. *Public Administration*, 99(3), 500–516. <https://doi.org/10.1111/padm.12693>
- Behn, R. D. (2003). Why measure performance? Different purposes require different measures. *Public Administration Review*, 63(5), 586–606. <https://doi.org/10.1111/1540-6210.00322>
- Belge, Z. S., & Ercan, M. A. (2022). Mobility and the role of pedestrian in the making of public space: The case study of Mersin. *Transportation Research Procedia*, 60, 386–393. <https://doi.org/10.1016/j.trpro.2021.12.050>
- Bell, E., & Scott, T. A. (2020). Common institutional design, divergent results: A comparative case study of collaborative governance platforms for regional water planning. *Environmental Science and Policy*, 111, 63–73. <https://doi.org/10.1016/j.envsci.2020.04.015>

- Bendor, J. (1994). The fields of bureaucracy and public administration: Basic and applied research. *Journal of Public Administration Research and Theory*, 4(1), 27–39. <https://www.jstor.org/stable/1181839>
- Bianchi, C. (2016). *Dynamic performance management* (Vol. 1). Springer. <https://doi.org/10.1007/978-3-319-31845-5>
- Bianchi, C. (2021). Fostering sustainable community outcomes through policy networks: A dynamic performance governance approach. In J. W. Meek (Ed.), *Handbook of Collaborative Public Management* (pp. 333–356). Edward Elgar Publishing. <https://doi.org/10.4337/9781789901917.00036>
- Bianchi, C. (2022). Enhancing policy design and sustainable community outcomes through collaborative platforms based on a dynamic performance management and governance approach. In B. G. Peters & G. Fontaine (Eds.), *Research Handbook of Policy Design* (pp. 411–433). Edward Elgar Publishing Ltd. <https://doi.org/10.4337/9781839106606.00036>
- Bianchi, C., Bereciartua, P., Vignieri, V., & Cohen, A. (2019). Enhancing urban brownfield regeneration to pursue sustainable community outcomes through dynamic performance governance. *International Journal of Public Administration*, 44(2), 100–114. <https://doi.org/10.1080/01900692.2019.1669180>
- Bianchi, C., & Caperchione, E. (2022). Performance management and governance in public universities: Challenges and opportunities. In C. Bianchi & E. Caperchione (Eds.), *Governance and Performance Management in Public Universities* (pp. 1–14). Springer. https://doi.org/10.1007/978-3-030-85698-4_1
- Bianchi, C., & Grippi, N. (2024). Developing collaborative ecosystem platforms to trigger sustainable “place-based” value creation: A dynamic performance governance approach. *International Journal of Productivity and Performance Management*, ahead-of-p(ahead-of-print). <https://doi.org/10.1108/IJPPM-10-2023-0580>
- Bianchi, C., & Hall, J. (2023). Harnessing the evolutionary advantage of emergent performance management regimes: Strengthening accountability for challenges of modern public administration and governance. *Public Administration Review*, 83(5), 1083–1087. <https://doi.org/10.1111/puar.13713>
- Bianchi, C., Nasi, G., & Rivenbark, W. C. (2021). Implementing collaborative governance: Models, experiences, and challenges. *Public Management Review*, 23(11), 1581–1589. <https://doi.org/10.1080/14719037.2021.1878777>
- Bianchi, C., & Rua, R. S. (2022). A feedback view of behavioural distortions from perceived public service gaps at ‘street-level’ policy implementation: The case of unintended outcomes in public schools. *Systems Research and Behavioral Science*, 39(1), 63–84. <https://doi.org/10.1002/sres.2771>

- Bianchi, C., & Tomaselli, S. (2015). A dynamic performance management approach to support local strategic planning. *International Review of Public Administration*, 20(4), 370–385. <https://doi.org/10.1080/12294659.2015.1088687>
- Bianchi, C., & Vignieri, V. (2021). Dealing with “abnormal” business growth by leveraging local area common goods: An outside-in stakeholder collaboration perspective. *International Journal of Productivity and Performance Management*, 70(3), 613–634. <https://doi.org/10.1108/IJPPM-07-2019-0318>
- Bianchi, C., & Williams, D. W. (2015). Applying system dynamics modeling to foster a cause-and-effect perspective in dealing with behavioral distortions associated with a city’s performance measurement programs. *Public Performance & Management Review*, 38(3), 395–425. <https://doi.org/10.1080/15309576.2015.1006471>
- Blackman, D. (2021). *Handbook on performance management in the public sector*. Elgar.
- Borgonovi, E., Anessi-Pessina, E., & Bianchi, C. (2018). Outcome-based performance management in the public sector. In E. Borgonovi, E. Anessi-Pessina, & C. Bianchi (Eds.), *Outcome-Based Performance Management in the Public Sector* (Vol. 2, pp. ix–xvi). Springer. <https://doi.org/10.1007/978-3-319-57018-1>
- Bouckaert, G., & Dooren, W. van. (2003). Performance measurement and management in public sector organizations. In T. Bovaird & E. Löffler (Eds.), *Public Management and Governance* (pp. 127–136). Routledge.
- Bouckaert, G., & Halligan, J. (2008). *Managing performance: International comparisons*. Routledge.
- Bouckaert, G., & van Dooren, W. (2003). Performance measurement and management in public sector organizations. In T. Bovaird & E. Löffler (Eds.), *Public Management and Governance* (pp. 127–136). Routledge.
- Bouma, G. (1998). Distinguishing institutions and organisations in social change. *Journal of Sociology*, 34(3), 232–245. <https://doi.org/10.1177/144078339803400302>
- Brown, M., & Hale, K. (2014). *Applied research methods in public and nonprofit organizations*. Jossey-Bass.
- Brumback, G. (2011). Performance management fundamentals. *Industrial and Organizational Psychology*, 4(2), 182–183. <https://doi.org/10.1111/j.1754-9434.2011.01321.x>
- Buschor, E. (2013). Performance management in the public sector: Past, current and future trends. *Tékhne*, 11(1), 4–9. <https://doi.org/10.1016/j.tekhne.2013.05.005>
- Busi, M., & Bititci, U. S. (2006). Collaborative performance management: Present gaps and future research. *International Journal of Productivity and Performance Management*, 55(1), 7–25. <https://doi.org/10.1108/17410400610635471>

- Calaresu, M., & Selmini, R. (2017). Policing and urban control in Rome and Milan: A view from the southern edge of Europe. In E. Devroe, A. Edwards, & P. Ponsaers (Eds.), *Policing European Metropolises: The Politics of Security in City-Regions* (pp. 182–200). Routledge.
- Campisi, T., Akgün, N., Ticali, D., & Tesoriere, G. (2020). Exploring public opinion on personal mobility vehicle use: A case study in Palermo, Italy. *Sustainability*, 12(13), 5460. <https://doi.org/10.3390/su12135460>
- Carlsson, L. (2000). Policy networks as collective action. *Policy Studies Journal*, 28(3), 502–520. <https://doi.org/10.1111/j.1541-0072.2000.tb02045.x>
- Castelo, S. L., & Gomes, C. F. (2023). The role of performance measurement and management systems in changing public organizations: An exploratory study. *Public Money and Management*, 1–8. <https://doi.org/10.1080/09540962.2023.2204400>
- Chan, P., & Lee, M. H. (2019). Prioritizing sustainable city indicators for Cambodia. *Urban Science*, 3(4), 104. <https://doi.org/10.3390/urbansci3040104>
- Chang, A. (2022). A formal model of street-level bureaucracy. *Rationality and Society*, 34(1), 6–27. <https://doi.org/10.1177/10434631211043205>
- Chang, A., & Brewer, G. A. (2023). Street-level bureaucracy in public administration: A systematic literature review. *Public Management Review*, 25(11), 2191–2211. <https://doi.org/10.1080/14719037.2022.2065517>
- Cheung, A. B. L. (2011). Budgeting and finance. In M. Bevir (Ed.), *The SAGE Handbook of Governance* (pp. 270–285). SAGE Publications.
- Choi, I., & Moynihan, D. (2019). How to foster collaborative performance management? Key factors in the US federal agencies. *Public Management Review*, 21(10), 1538–1559. <https://doi.org/10.1080/14719037.2019.1571275>
- Cohen, N. (2018). How culture affects street-level bureaucrats' bending the rules in the context of informal payments for health care: The Israeli case. *American Review of Public Administration*, 48(2), 175–187. <https://doi.org/10.1177/0275074016665919>
- Cohen, N., Arnold, G., & Petridou, E. (2023). Why we need to study street-level policy entrepreneurs. *European Policy Analysis*, 9(4), 342–355. <https://doi.org/10.1002/epa2.1195>
- Cohen, N., & Aviram, N. F. (2021). Street-level bureaucrats and policy entrepreneurship: When implementers challenge policy design. *Public Administration*, 99(3), 427–438. <https://doi.org/10.1111/padm.12755>
- Cohen, N., & Golan-Nadir, N. (2020). Why do street-level bureaucrats risk themselves for others? The case of Israeli police officers. *Australian Journal of Public Administration*, 79(4), 480–494. <https://doi.org/10.1111/1467-8500.12417>

- Cohen, N., & Hertz, U. (2020). Street-level bureaucrats' social value orientation on and off duty. *Public Administration Review*, 80(3), 442–453. <https://doi.org/10.1111/puar.13190>
- Cokins, G. (2006). Performance management. In T. Adkins (Ed.), *Case Studies in Performance Management: A Guide from the Experts*. Wiley.
- Cokins, G. (2009). *Performance management: Integration strategy execution, methodologies, risk, and analytics*. Wiley.
- Colombo, U. (2001). The Club of Rome and sustainable development. *Futures*, 33, 7–11. [https://doi.org/10.1016/S0016-3287\(00\)00048-3](https://doi.org/10.1016/S0016-3287(00)00048-3)
- Comer, J. C. (1978). “Street-level” bureaucracy and political support: Some findings on Mexican Americans. *Urban Affairs Quarterly*, 14(2), 207–228. <https://doi.org/10.1177/107808747801400204>
- Cors, T., Flidner, M., Haase, K., & Vlcek, T. (2025). Simulative assessment of patrol car allocation and response time. *European Journal of Operational Research*, 324(1), 290–307. <https://doi.org/10.1016/j.ejor.2024.12.035>
- Cosenz, F. (2022). *Managing sustainable performance and governance in higher education institutions* (Vol. 5). Springer. <https://doi.org/https://doi.org/10.1007/978-3-030-99317-7>
- Crank, J. P. (1992). Police style and legally serious crime: A contextual analysis of municipal police departments. *Journal of Criminal Justice*, 20, 401–412. [https://doi.org/10.1016/0047-2352\(92\)90076-L](https://doi.org/10.1016/0047-2352(92)90076-L)
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed method approaches* (4th ed.). Sage Publication.
- Dai, J., & Azhar, A. (2024). Collaborative governance in disaster management and sustainable development. *Public Administration and Development*, 44(4), 358–380. <https://doi.org/10.1002/pad.2071>
- Davenport, D. R. (1999). Environmental constraints and organizational outcomes: Modeling communities of Municipal police departments. *Police Quarterly*, 2(2), 174–200. <https://doi.org/10.1177/109861119900200203>
- de Boer, N. (2019). Street-level enforcement style: A multidimensional measurement instrument. *International Journal of Public Administration*, 42(5), 380–391. <https://doi.org/10.1080/01900692.2018.1465954>
- de Boer, N. (2020). How do citizens assess street-level bureaucrats' warmth and competence? A typology and test. *Public Administration Review*, 80(4), 532–542. <https://doi.org/10.1111/puar.13217>
- de Boer, N. (2021). The (un)intended effects of street-level bureaucrats' enforcement style: Do citizens shame or obey bureaucrats? *Public Policy and Administration*, 36(4), 452–475. <https://doi.org/10.1177/0952076720905005>

- de Boer, N., & Raaphorst, N. (2023). Automation and discretion: Explaining the effect of automation on how street-level bureaucrats enforce. *Public Management Review*, 25(1), 42–62. <https://doi.org/10.1080/14719037.2021.1937684>
- Deleon, P., & Varda, D. M. (2009). Toward a theory of collaborative policy networks: Identifying structural tendencies. *Policy Studies Journal*, 37(1), 59–74. <https://doi.org/10.1111/j.1541-0072.2008.00295.x>
- Denscombe, M. (2012). *Research proposals: A practical guide*. Open University Press.
- Denys, C. (2010). The development of police forces in urban Europe in the eighteenth century. *Journal of Urban History*, 36(3), 332–344. <https://doi.org/10.1177/0096144209359144>
- Devroe, E., & Ponsaers, P. (2017). European national police systems and metropolitan realities. In E. Devroe, A. Edwards, & P. Ponsaers (Eds.), *Policing European Metropolises: The Politics of Security in City-Regions* (pp. 23–74). Routledge.
- Dewinter, M., Jagtenberg, C., Vandeviver, C., Dau, P. M., Vander Beken, T., & Witlox, F. (2024). Reducing police response times: Optimization and simulation of everyday police patrol. *Networks*, 84(3), 363–381. <https://doi.org/10.1002/net.22241>
- Dey, I. (1993). *Qualitative data analysis: A user-friendly guide for social scientists*. Routledge.
- Donnelly, D. (2013). *Municipal policing in the European Union: Comparative perspective*. Palgrave Macmillan. <https://doi.org/10.1057/9781137290618>
- Dooren, W. Van, Bouckaert, G., & Halligan, J. (2015). *Performance management in the public sector* (Second Edition). Routledge. <https://doi.org/10.4324/9781315817590>
- Dooren, W. Van, Bouckkaert, G., & Halligan, J. (2015). *Performance management in the public sector* (Second Edition). Routledge.
- Durose, C. (2011). Revisiting Lipsky: Front-line work in UK local governance. *Political Studies*, 59(4), 978–995. <https://doi.org/10.1111/j.1467-9248.2011.00886.x>
- Eikenaar, T. (2019). Plural policing as professional strife. Municipal officers and police officers in the Netherlands. *International Journal of Police Science and Management*, 21(3), 146–155. <https://doi.org/10.1177/1461355719854107>
- Eker, S., & Zimmermann, N. (2016). Using textual data in system dynamics model conceptualization. *Systems*, 4(28), 1–14. <https://doi.org/10.3390/systems4030028>
- Emerson, K., & Nabatchi, T. (2015). *Collaborative governance regimes*. Georgetown University Press.
- Emerson, K., Nabatchi, T., & Balogh, S. (2012). An integrative framework for collaborative governance. *Journal of Public Administration Research and Theory*, 22(1), 1–29. <https://doi.org/10.1093/jopart/mur011>

- Engel, R. S., & Worden, R. E. (2003). Police officers' attitudes, behavior, and supervisory influences: An analysis of problem solving. *Criminology*, 41(1), 131–166. <https://doi.org/10.1111/j.1745-9125.2003.tb00984.x>
- Eshuis, J., de Boer, N., & Klijn, E. H. (2023). Street-level bureaucrats' emotional intelligence and its relation with their performance. *Public Administration*, 101(3), 804–821. <https://doi.org/10.1111/padm.12841>
- Farmaki, E., Aryblia, M., Tournaki, S., & Tsoutsos, T. (2022). Assessing sustainable urban mobility policies in the mediterranean tourism destinations through multi-criteria decision making models. In T. Tsoutsos (Ed.), *Sustainable mobility for island destinations* (pp. 19–37). Springer. <https://doi.org/10.1007/978-3-030-73715-3>
- Fischer, L. (2021). *Street-level bureaucrats' impact on the emergence of local governance networks*. Springer. <https://doi.org/10.1007/978-3-658-36153-2>
- Flamholtz, E. (1979). Organizational control systems as a managerial tool. *California Management Review*, 22(2), 50–59. <https://doi.org/10.2307/41165320>
- Flamholtz, E. (1996). Effective management control: Theory and practice. In *Effective Management Control*. Kluwer Academic Publishers. <https://doi.org/10.1007/978-1-4613-1359-5>
- Flamholtz, E. G. (1983). Accounting, budgeting and control systems in their organizational context: Theoretical and empirical perspectives. *Accounting, Organizations and Society*, 8(2/3), 153–169. [https://doi.org/10.1016/0361-3682\(83\)90023-5](https://doi.org/10.1016/0361-3682(83)90023-5)
- Flamholtz, E. G., Das, T. K., & Tsui, A. S. (1985). Toward an integrative framework of organizational control. *Accounting, Organizations and Society*, 10(1), 35–50. [https://doi.org/10.1016/0361-3682\(85\)90030-3](https://doi.org/10.1016/0361-3682(85)90030-3)
- Fontoura, W. B., & Ribeiro, G. M. (2021). System dynamics for sustainable transportation policies: A systematic literature review. *Urbe. Revista Brasileira de Gestão Urbana*, 13, e20200259. <https://doi.org/10.1590/2175-3369.013.E20200259>
- Ford, D. N. (2019). A system dynamics glossary. *System Dynamics Review*, 35(4), 369–379. <https://doi.org/10.1002/sdr.1641>
- Forrester, J. W. (1961). *Industrial dynamics*. The MIT Press.
- Forrester, J. W. (1968a). Industrial dynamics-after the first decade. *Management Science*, 14(7), 398–415. <https://www.jstor.org/stable/2628888>
- Forrester, J. W. (1968b). *Principles of systems* (2nd ed.). Wright-Allen Press.
- Forrester, J. W. (1969). *Urban dynamics*. Pegasus Communications.
- Forrester, J. W. (1973). *World dynamics* (2nd ed.). Wright-Allen Press.

- Forrester, J. W. (1980). Information sources for modeling the national economy. *Journal of the American Statistical Association*, 75(371), 555–566. <https://doi.org/10.1080/01621459.1980.10477508>
- Forrester, J. W. (1994). System dynamics, systems thinking, and soft OR. *System Dynamics Review*, 10(2–3), 245–256. <https://doi.org/10.1002/sdr.4260100211>
- Franceschini, F., Galetto, M., & Maisano, D. (2007). *Management by measurement: Designing key indicators and performance measurement systems*. Springer.
- Gall, T., Vallet, F., Mariana, L., Madrigal, R., Hörl, S., Abdin, A., Chouaki, T., & Puchinger, J. (2023). *Sustainable urban mobility futures*. Palgrave Macmillan. <https://doi.org/10.1007/978-3-031-45795-1>
- Gallo, M., & Marinelli, M. (2020). Sustainable mobility: A review of possible actions and policies. *Sustainability*, 12(18), 7499. <https://doi.org/10.3390/su12187499>
- Gerrish, E. (2016). The impact of performance management on performance in public organizations: A meta-analysis. *Public Administration Review*, 76(1), 48–66. <https://doi.org/10.1111/puar.12433>
- Gershgoren, S., & Cohen, N. (2023). Street-level bias: Examining factors related to street-level bureaucrats' state or citizen favoritism. *American Review of Public Administration*, 53(3–4), 115–133. <https://doi.org/10.1177/02750740231167897>
- Gerth, H. H., & Mills, C. W. (1946). *From Max Weber: Essays in sociology*. Oxford University Press.
- Giannico, O. V., Baldacci, S., Angelozzi, A., Caminada, S., Noberasco, G., Oradini-Alacreu, A., Pizzo, S., Schenone, S., & Scarpitta, F. (2022). Urban mobility and health: A multicentric survey conducted in some Italian cities. *Annali Dell'Istituto Superiore Di Sanita*, 58(4), 277–284. https://doi.org/10.4415/ANN_22_04_08
- Golub, A. (2016). Mobility and sustainability. In H. Heinrichs, P. Martens, G. Michelsen, & A. Wiek (Eds.), *Sustainability science: An introduction* (pp. 261–271). Springer. https://doi.org/10.1007/978-94-017-7242-6_21
- Grippi, N. (2023). *Tackling social exclusion in peripheric city neighborhoods through holistic societal transition: A dynamic performance governance approach, an application to the cities of Palermo and Baltimore* [Doctoral Dissertation]. <https://iris.unipa.it/handle/10447/619095>
- Gunn, J., Zwickert, K., & Hilyard, K. (2021). Reinventing performance management in the public sector. In D. Blackman (Ed.), *Handbook on Performance Management in the Public Sector* (pp. 1–18). Edward Elgar Publishing. <http://dx.doi.org/10.4337/9781789901207>
- Gustafson, J. (2013). Diversity in municipal police agencies: A national examination of minority hiring and promotion. *Policing*, 36(4), 719–736. <https://doi.org/10.1108/PIJPSM-01-2013-0005>

- Hall, R. H. (1963). The concept of bureaucracy: An empirical assessment. *American Journal of Sociology*, 69(1), 32–40. <https://www.jstor.org/stable/2775309>
- Halligan, J., Sarrico, C. S., & Rhodes, M. L. (2012). On the road to performance governance in the public domain?. *International Journal of Productivity and Performance Management*, 61(3), 224–234. <https://doi.org/10.1108/17410401211205623>
- Halpern, C. (2014). Urban mobility: What role for the European Union? Explaining dynamics of European Union policy design since 1995. *European Planning Studies*, 22(12), 2526–2541. <https://doi.org/10.1080/09654313.2013.844775>
- Hassell, K. D., Zhao, J., & Maguire, E. R. (2003). Structural arrangements in large municipal police organizations: Revisiting Wilson’s theory of local political culture. *Policing*, 26(2), 231–250. <https://doi.org/10.1108/13639510310475741>
- He, S. Y. (2013). Los Angeles: A transit metropolis in the making? In Institute for Mobility Research (Ed.), *Megacity Mobility Culture: How Cities Move on in a Diverse World* (pp. 161–183). Springer. <https://doi.org/10.1007/978-3-642-34735-1>
- Head, B. W. (2008). Wicked problems in public policy. *Public Policy*, 3(2), 101–118. <https://espace.library.uq.edu.au/view/UQ:167582>
- Head, B. W. (2010). Public management research: Towards relevance. *Public Management Review*, 12(5), 571–585. <https://doi.org/10.1080/14719031003633987>
- Head, B. W. (2022). *Wicked problems in public policy: Understanding and responding to complex challenges*. Palgrave Macmillan. <https://doi.org/10.1007/978-3-030-94580-0>
- Head, B. W., & Alford, J. (2015). Wicked problems: Implications for public policy and management. *Administration and Society*, 47(6), 711–739. <https://doi.org/10.1177/0095399713481601>
- Heinric, C. J. (2002). Outcomes-based performance management in the public sector: Implications for government accountability and effectiveness. *Public Administration Review*, 62(6), 712–725. <https://doi.org/10.1111/1540-6210.00253>
- Heinrich, C. J. (2011). Public management. In M. Bevir (Ed.), *The SAGE Handbook of Governance* (pp. 252–269). SAGE Publications.
- Heinrichs, H., Wiek, A., Martens, P., & Michelsen, G. (2016). Introduction. In H. Heinrichs, P. Martens, G. Michelsen, & A. Wiek (Eds.), *Sustainability science: An introduction* (pp. 1–4). Springer.
- Hernandez, A. S. (2023). Structuring complex or wicked problems: A multimethod approach in practice. In F. Matos & Á. Rosa (Eds.), *European Conference on*

- Research Methodology for Business and Management Studies*. Academic Conferences International Limited. <https://doi.org/10.34190/ecrm.22.1.1571>
- Holden, E. (2007). *Achieving sustainable mobility: Everyday and leisure-time travel in the EU*. Ashgate. <http://www.ashgate.com>
- Holden, E., Gilpin, G., & Banister, D. (2019). Sustainable mobility at thirty. *Sustainability*, 11(7), 1965. <https://doi.org/10.3390/su11071965>
- Homer, J. B. (1985). Worker burnout: a dynamic model with implications for prevention and control. *System Dynamics Review*, 1(1), 42–62. <https://doi.org/10.1002/sdr.4260010105>
- Hupe, P., & Buffat, A. (2014). A public service gap: Capturing contexts in a comparative approach of street-level bureaucracy. *Public Management Review*, 16(4), 548–569. <https://doi.org/10.1080/14719037.2013.854401>
- Hupe, P., & Hill, M. (2007a). Street-level bureaucracy and public accountability. *Public Administration*, 85(2), 279–299. <https://doi.org/10.1111/j.1467-9299.2007.00650.x>
- Hupe, P., & Hill, M. (2007b). Street-level bureaucracy and public accountability. *Public Administration*, 85(2), 279–299. <https://doi.org/10.1111/j.1467-9299.2007.00650.x>
- Inguglia, C., Marco, M. Di, & Ricci, M. (2020). Urban mobility, social inclusion and participation: A qualitative study in Palermo, Italy. In G. Smorto & I. Vinci (Eds.), *The role of sharing mobility in contemporary cities: Legal, social and environmental issues* (pp. 51–68). Springer. https://doi.org/10.1007/978-3-030-57725-4_4 51
- Kang, I. (2023). How does technology-based monitoring affect street-level bureaucrats' behavior? An analysis of body-worn cameras and police actions. *Journal of Policy Analysis and Management*, 42(4), 971–991. <https://doi.org/10.1002/pam.22493>
- Kaplan, H. B. (1960). The concept of institution: A review, evaluation, and suggested research procedure. *Social Forces*, 39(2), 176–180. <https://doi.org/10.2307/2574158>
- Khamis, A. (2021). Smart mobility: Exploring foundational technologies and wider impacts. In *Smart Mobility: Exploring Foundational Technologies and Wider Impacts*. Apress. <https://doi.org/10.1007/978-1-4842-7101-8>
- Kim, D. H. (1999). *What is systems thinking?* <https://thesystemsthinker.com/wp-content/uploads/2016/03/Introduction-to-Systems-Thinking-IMS013Epk.pdf>
- King, W. R. (1999). Time, constancy, and change in American municipal police organization. *Police Quarterly*, 2(3), 338–364. <https://doi.org/10.1177/109861119900200305>
- Klijn, E. H. (2008a). Complexity theory and public administration: What's new? *Public Management Review*, 10(3), 299–317. <https://doi.org/10.1080/14719030802002675>

- Klijn, E. H. (2008b). Governance and governance networks in Europe: An assessment of ten years of research on the theme. *Public Management Review*, 10(4), 505–525. <https://doi.org/10.1080/14719030802263954>
- Köhler, J., Whitmarsh, L., Nykvist, B., Schilperoord, M., Bergman, N., & Haxeltine, A. (2009). A transitions model for sustainable mobility. *Ecological Economics*, 68(12), 2985–2995. <https://doi.org/10.1016/j.ecolecon.2009.06.027>
- Kooiman, J. (1999). Social-political governance. *Public Management: An International Journal of Research and Theory*, 1(1), 67–92. <https://doi.org/10.1080/14719037800000005>
- Kooiman, J., & van Vliet, M. (2000). Self-governance as a mode of societal governance. *Public Management: An International Journal of Research and Theory*, 2(3), 359–378. <https://doi.org/10.1080/14719030000000022>
- Kosar, K. R. (2011). Street level-bureaucracy: The dilemmas endure. *Public Administration Review*, 71(2), 299–302. <https://doi.org/10.1111/j.1540-6210.2011.02342.x>
- Kumar, S., Kant, S., & Amburgey, T. L. (2007). Public agencies and collaborative management approaches: Examining resistance among administrative professionals. *Administration and Society*, 39(5), 569–610. <https://doi.org/10.1177/0095399707303635>
- Lavee, E., & Cohen, N. (2019). How street-level bureaucrats become policy entrepreneurs: The case of urban renewal. *Governance*, 32(3), 475–492. <https://doi.org/10.1111/gove.12387>
- Lavee, E., Cohen, N., & Nouman, H. (2018). Reinforcing public responsibility? Influences and practices in street-level bureaucrats' engagement in policy design. *Public Administration*, 96(2), 333–348. <https://doi.org/10.1111/padm.12402>
- Lee, H. (2023). Collaborative governance platforms and outcomes: An analysis of clean cities coalitions. *Governance*, 36(3), 805–825. <https://doi.org/10.1111/gove.12702>
- Lee, S. J., & Yoo, D. S. (2012). The adoption of collaborative governance institutions: The epa-states performance partnership agreements (ppas). *International Review of Public Administration*, 17(2), 143–161. <https://doi.org/10.1080/12294659.2012.10805231>
- Levy, J. J. (2021). Revanchism via pedestrianism: Street-level bureaucracy in the production of uneven policing landscapes. *Antipode*, 53(3), 906–927. <https://doi.org/10.1111/anti.12702>
- Liguori, M., & Kelly, M. (2023). Public-sector accountability: A journey from performance measurement to performance governance. In G. D. Carnegie & C. J. Napier (Eds.), *Handbook of Accounting, Accountability and Governance* (pp. 258–280). Edward Elgar Publishing. <https://doi.org/10.4337/9781800886544.00022>

- Lin, Y. C., Lin, Y. T., Chen, C. R., & Lai, C. Y. (2025). Meteorological and traffic effects on air pollutants using Bayesian networks and deep learning. *Journal of Environmental Sciences (China)*, 152, 54–70. <https://doi.org/10.1016/j.jes.2024.01.057>
- Lipsky, M. (1969). Toward a theory of street-level bureaucracy. In *The American Political Science Association* (pp. 1–45). The American Political Science Association.
- Lipsky, M. (1971). Street-level bureaucracy and the analysis of urban reform. *Urban Affairs Quarterly*, 6(4), 391–409. <https://doi.org/10.1177/107808747100600401>
- Lipsky, M. (2010). *Street-level bureaucracy: Dilemmas of the individual in public services. 30th Anniversary Expanded Edition*. Russell Sage Foundation.
- Lipsky, Michael. (1980). *Street-level bureaucracy: Dilemmas of the individual in public services*. Russell Sage Foundation.
- Loyens, K., & Maesschalck, J. (2010). Toward a theoretical framework for ethical decision making of street-level bureaucracy: Existing models reconsidered. *Administration and Society*, 42(1), 66–100. <https://doi.org/10.1177/0095399710362524>
- Lye, J. M. (2006). Performance measurement in the public sector: A clarification and agenda for research. *Australian Accounting Review*, 16(2), 25–33. <https://doi.org/10.1111/j.1835-2561.2006.tb00357.x>
- Mah, D. N., & Hills, P. (2012). Collaborative governance for sustainable development: wind resource assessment in Xinjiang and Guangdong Provinces, China. *Sustainable Development*, 20(2), 85–97. <https://doi.org/10.1002/sd.466>
- Mancebo, F. (2015). Introduction. In F. Mancebo & I. Sachs (Eds.), *Transitions to sustainability* (pp. 1–4). Springer. https://doi.org/10.1007/978-94-017-9532-6_1
- Masood, A., & Nisar, M. A. (2022). Repairing the state: Policy repair in the frontline bureaucracy. *Public Administration Review*, 82(2), 256–268. <https://doi.org/10.1111/puar.13414>
- Matusiak, M. C. (2019). Environmental predictors of Municipal police agency goals. *Police Quarterly*, 22(1), 112–136. <https://doi.org/10.1177/1098611118797068>
- Meadows, D. H. (2008). *Thinking in systems*. Earthscan.
- Meier, K. J., & Krause, G. A. (2003). The scientific study of bureaucracy: An overview. In K. J. Meier & G. A. Krause (Eds.), *Politics, Policy, and Organizations: Frontiers in the Scientific Study of Bureaucracy* (pp. 1–20). University of Michigan Press.
- Mensah, J. (2019). Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent Social Sciences*, 5(1), 1–21. <https://doi.org/10.1080/23311886.2019.1653531>

- Mertens, D. M. (2010). *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods*. Sage Publication.
- Metzenbaum, S. H. (2013). Performance management: The real research challenge. *Public Administration Review*, 73(6), 857–858. <https://doi.org/10.1111/puar.12150>
- Michelsen, G., Adomßent, M., Martens, P., & Hauff, M. von. (2016). Sustainable development –background and context. In H. Heinrichs, P. Martens, G. Michelsen, & A. Wiek (Eds.), *Sustainability science: An introduction* (pp. 5–29). Springer.
- Migliore, M., D’Orso, G., & Caminiti, D. (2020). The environmental benefits of carsharing: The case study of Palermo. *Transportation Research Procedia*, 48, 2127–2139. <https://doi.org/10.1016/j.trpro.2020.08.271>
- Mikkelsen, K. S., Madsen, J. K., & Baekgaard, M. (2024). Is stress among street-level bureaucrats associated with experiences of administrative burden among clients? A multilevel study of the Danish unemployment sector. *Public Administration Review*, 84(2), 248–260. <https://doi.org/10.1111/puar.13673>
- Modell, S., & Grönlund, A. (2007). Outcome-based performance management: Experiences from Swedish Central Government. *Public Performance & Management Review*, 31(2), 275–288. <https://doi.org/10.2753/PMR1530-95763>
- Møller, A. M., Pedersen, K. Z., & Pors, A. S. (2022). The bureaucratic ethos in street-level work: Revitalizing weber’s ethics of office. *Perspectives on Public Management and Governance*, 5(2), 151–163. <https://doi.org/10.1093/ppmgov/gvac001>
- Myrovali, G., & Morfoulaki, M. (2021). Sustainable urban mobility. In J. Papathanasiou, G. Tsaples, & A. Blouchoutzi (Eds.), *Urban sustainability: A game-based approach* (pp. 39–80). Springer. https://doi.org/10.1007/978-3-030-67016-0_2
- Nabavi, E., Daniell, K. A., & Najafi, H. (2017). Boundary matters: the potential of system dynamics to support sustainability. *Journal of Cleaner Production*, 140, 312–323. <https://doi.org/10.1016/j.jclepro.2016.03.032>
- Nankervis, A. R., & Compton, R.-L. (2006). Performance management: Theory in practice. *Asia Pacific Journal of Human Resources*, 44(1), 83–101. <https://doi.org/10.1177/1038411106061509>
- Norris, P. (2011). Measuring governance. In M. Bevir (Ed.), *The SAGE Handbook of Governance* (pp. 179–199). SAGE Publications.
- Nothdurfter, U., & Hermans, K. (2018). Meeting (or not) at the street level? A literature review on street-level research in public management, social policy and social work. *International Journal of Social Welfare*, 27(3), 294–304. <https://doi.org/10.1111/ijsw.12308>

- Noto, G. (2020). *Strategic planning for urban transportation: A dynamic performance management approach* (Vol. 3). Springer. <https://doi.org/https://doi.org/10.1007/978-3-030-36883-8>
- Oladimeji, O. O., Keathley-Herring, H., & Cross, J. A. (2020). System dynamics applications in performance measurement research: A systematic literature review. *International Journal of Productivity and Performance Management*, 69(7), 1539–1576. <https://doi.org/10.1108/IJPPM-12-2018-0453>
- O’Leary, R., & Vijn, N. (2012). Collaborative public management: Where have we been and where are we going?. *American Review of Public Administration*, 42(5), 507–522. <https://doi.org/10.1177/0275074012445780>
- Osborne, S. P. (2006). The new public governance? *Public Management Review*, 8(3), 377–387. <https://doi.org/10.1080/14719030600853022>
- Osborne, S. P. (2010). Public governance and public services delivery: A research agenda for the future. In S. P. Osborne (Ed.), *The new public governance?: Emerging perspectives on the theory and practice of public governance* (pp. 413–428). Routledge. <https://doi.org/10.4324/9780203861684>
- O’Sullivan, E., Rassel, G., Berner, M., & Taliaferro, J. D. (2017). *Research methods for public administrators* (6th ed.). Routledge.
- Panagopoulos, T., Tampakis, S., Karanikola, P., Karipidou-Kanari, A., & Kantartzis, A. (2018). The usage and perception of pedestrian and cycling streets on residents’ well-being in Kalamaria, Greece. *Land*, 7(3), 100. <https://doi.org/10.3390/land7030100>
- Pasha, O. (2018). Can performance management best practices help reduce crime? *Public Administration Review*, 78(2), 217–227. <https://doi.org/10.1111/puar.12856>
- Peake, G., & Forsyth, M. (2022). Street-level bureaucrats in a relational state: The case of Bougainville. *Public Administration and Development*, 42(1), 12–21. <https://doi.org/10.1002/pad.1911>
- Peeters, R., & Campos, S. A. (2023). Street-level bureaucracy in weak state institutions: A systematic review of the literature. *International Review of Administrative Sciences*, 89(4), 977–995. <https://doi.org/10.1177/00208523221103196>
- Peters, B. G. (2011). Institutional theory. In M. Bevir (Ed.), *The SAGE handbook of governance* (pp. 78–90). SAGE Publications.
- Peters, B. G. (2017). What is so wicked about wicked problems? A conceptual analysis and a research program. *Policy and Society*, 36(3), 385–396. <https://doi.org/10.1080/14494035.2017.1361633>
- Peters, B. G. (2018). *Policy problems and policy design*. Elgar.

- Piore, M. J. (2011). Beyond markets: Sociology, street-level bureaucracy, and the management of the public sector. *Regulation and Governance*, 5(1), 145–164. <https://doi.org/10.1111/j.1748-5991.2010.01098.x>
- Pollitt, C., & Bouckaert, G. (2011). *Public management reform: A comparative analysis—New public management, governance, and the neo-Weberian state* (Third Edition). Oxford University Press.
- Prati, G., & Pietrantonio, L. (2010). Risk and resilience factors among Italian municipal police officers exposed to critical incidents. *Journal of Police and Criminal Psychology*, 25(1), 27–33. <https://doi.org/10.1007/s11896-009-9052-0>
- Rajala, T., Laihonon, H., & Vakkuri, J. (2020). Exploring challenges of boundary-crossing performance dialogues in hybrids. *Journal of Management and Governance*, 24(3), 799–820. <https://doi.org/10.1007/s10997-019-09485-x>
- Reynolds, M., & Holwell, S. (2020). Introducing systems approaches. In M. Reynolds & S. Holwell (Eds.), *Systems Approaches to Making Change: A Practical Guide* (Second Edition, pp. 1–24). Springer. https://doi.org/10.1007/978-1-4471-7472-1_1
- Rice, D. (2013). Street-level bureaucrats and the welfare state: Toward a micro-institutionalist theory of policy implementation. *Administration & Society*, 45(9), 1038–1062. <https://doi.org/10.1177/0095399712451895>
- Richardson, A. J. (2004). Applied research in accounting: A commentary. *Canadian Accounting Perspectives*, 3(2), 149–168. <https://doi.org/10.1506/NCW7-EWN8-FRV6-3WMH>
- Richardson, G. P. (1986). *Problems with causal-loop diagrams*. 2(2), 158–170. <https://doi.org/10.1002/sdr.4260020207>
- Rossi, P., Tuurnas, S., & Stenvall, J. (2024). Street-level bureaucrats as policymakers in the implementation of information system in social services. *Public Management Review*, 1–20. <https://doi.org/10.1080/14719037.2024.2362247>
- Rowe, M. (2012). Going back to the street: Revisiting Lipsky’s street-level bureaucracy. *Teaching Public Administration*, 30(1), 10–18. <https://doi.org/10.1177/0144739411435439>
- Rua, S. R. (2023). Exploring the conceptual roots of outcome-oriented Performance Measurement Systems. In *Improving Consistency in Performance Measurement System Design: The Case of the Colombian Public Schools* (Vol. 7, pp. 49–61). Springer. https://doi.org/10.1007/978-3-031-24699-9_3
- Rupprecht Consult. (2019). *Guidelines for developing and implementing a Sustainable Urban Mobility Plan: Second edition*. www.rebekkadold.de

- Rupprecht Consult, Koucky, & Partners. (2021). *Sustainable neighbourhood mobility planning - Synergies between city-wide SUMP and neighbourhood-based planning*. <https://civitas-sunrise.eu/resources/>
- Salvo, G., & Sanfilippo, L. (2014). Traffic-light cycle coordinated by Microsimulation: A solution to the traffic congestion in Palermo. In A. Arisha & G. Bobashev (Eds.), *SIMUL 2014: The Sixth International Conference on Advances in System* (pp. 7–13). International Academy, Research, and Industry Association. https://personales.upv.es/thinkmind/SIMUL/SIMUL_2014/simul_2014_1_20_50095.html
- Sandström, A., & Carlsson, L. (2008). The performance of policy networks: The relation between network structure and network performance. *Policy Studies Journal*, 36(4), 497–524. <https://doi.org/10.1111/j.1541-0072.2008.00281.x>
- Sandström, A., & Lundmark, C. (2016). Network structure and perceived legitimacy in collaborative wildlife management. *Review of Policy Research*, 33(4), 442–462. <https://doi.org/10.1111/ropr.12180>
- Sanger, M. B. (2008). From measurement to management: Breaking through the barriers to state and local performance. *Public Administration Review*, 68(s1), 70–85. <https://doi.org/10.1111/j.1540-6210.2008.00980.x>
- Saunders, M., Lewis, P., & Thornhill, A. (2007). *Research methods for business students* (4th ed.). Prentice Hall.
- Scott, P. G. (1997). Assessing determinants of bureaucratic discretion: An experiment in street-level decision making. *Journal of Public Administration Research and Theory*, 7(1), 35–58. <https://doi.org/10.1093/oxfordjournals.jpart.a024341>
- Selmini, R. (2017). Urban policing in Italy: Some reflections from a comparative perspective. In E. Devroe, A. Edwards, & P. Ponsaers (Eds.), *Policing European Metropolises: The Politics of Security in City-Regions* (pp. 167–181). Routledge.
- Sevä, M., & Sandström, A. (2017). Decisions at street level: Assessing and explaining the implementation of the European water framework directive in Sweden. *Environmental Policy and Governance*, 27(1), 74–89. <https://doi.org/10.1002/eet.1734>
- Sharma, S. K., & Sachdeva, D. R. (1978). Municipal police: Role and responsibilities. *Indian Journal of Public Administration*, 24(1), 209–216. <https://doi.org/10.1177/0019556119780121>
- Shaygan, M., Meese, C., Li, W., Zhao, X. (George), & Nejad, M. (2022). Traffic prediction using artificial intelligence: Review of recent advances and emerging opportunities. *Transportation Research Part C: Emerging Technologies*, 145, 103921. <https://doi.org/10.1016/j.trc.2022.103921>
- Sidha, Z., Asingo, P., & Magutu, J. (2021). Street-Level bureaucrats as policy entrepreneurs: The nexus between timing of traffic enforcement activities and road

- safety policy outcomes. *Politics and Policy*, 49(1), 186–204. <https://doi.org/10.1111/polp.12386>
- Silvia, C. (2011). Collaborative governance concepts for successful network leadership. *State and Local Government Review*, 43(1), 66–71. <https://doi.org/10.1177/0160323x11400211>
- Stave, K., Zimmermann, N., & Kim, H. (2024). Qualitative aspects of system dynamics modeling. *System Dynamics Review*, 40(4), e1793. <https://doi.org/10.1002/sdr.1793>
- Sterman, J. D. (2000). *Business dynamics: System thinking and modelling for a complex world*. Irwin McGraw-Hill.
- Talbot, C. (2009). Performance management. In E. Ferlie, L. E. Lynn Jr, & C. Pollitt (Eds.), *The Oxford Handbook of Public Management* (pp. 491–518). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199226443.001.0001>
- Temmerman, L., Veeckman, C., & Ballon, P. (2021). Collaborative governance platform for social innovation in Brussels. *Social Enterprise Journal*, 17(2), 165–182. <https://doi.org/10.1108/SEJ-12-2019-0101>
- Termeer, C. J. A. M., Dewulf, A., & Biesbroek, R. (2019). A critical assessment of the wicked problem concept: relevance and usefulness for policy science and practice. *Policy and Society*, 38(2), 167–179. <https://doi.org/10.1080/14494035.2019.1617971>
- Thomann, E. (2015). Is output performance all about the resources? A fuzzy-set qualitative comparative analysis of street-level Bureaucrats In Switzerland. *Public Administration*, 93(1), 177–194. <https://doi.org/10.1111/padm.12130>
- Thomann, E., Maxia, J., & Ege, J. (2023). How street-level dilemmas and politics shape divergence: The accountability regimes framework. *Policy Studies Journal*, 51(4), 793–816. <https://doi.org/10.1111/psj.12504>
- Thomas, C. G. (2021). *Research methodology and scientific writing* (2nd ed.). Springer. <https://doi.org/10.1007/978-3-030-64865-7>
- Tschoerner, C. (2016). A governance approach to sustainable mobility. In G. Wulforst & S. Klug (Eds.), *Sustainable Mobility in Metropolitan Regions: Insights from Interdisciplinary Research for Practice Application* (pp. 19–31). Springer. https://doi.org/DOI 10.1007/978-3-658-14428-9_2
- Tschoerner-Budde, C. (2019). *Sustainable mobility in Munich: Exploring the role of discourse in policy change*. Springer. <https://doi.org/10.1007/978-3-658-24180-3>
- Tummers, L., & Bekkers, V. (2014). Policy implementation, street-level bureaucracy, and the Importance of discretion. *Public Management Review*, 16(4), 527–547. <https://doi.org/10.1080/14719037.2013.841978>
- UN-Habitat. (2013). *Streets as public spaces and drivers of urban prosperity*.

- Uusikylä, P., & Valovirta, V. (2007). Three spheres of performance governance: Spanning the boundaries from single-organization focus towards a partnership network. *Evaluation*, 13(4), 399–419. <https://doi.org/10.1177/1356389007082128>
- van Berkel, R., & Knies, E. (2016). Performance management, caseloads and the frontline provision of social services. *Social Policy and Administration*, 50(1), 59–78. <https://doi.org/10.1111/spol.12150>
- van Bueren, E. M., Klijn, E.-H., & Koppenjan, J. F. M. (2003). Dealing with wicked problems in networks: Analyzing an environmental debate from a network perspective. *Journal of Public Administration Research and Theory*, 13(2), 193–212. <https://doi.org/10.1093/jopart/mug017>
- van der Meer, J., Vermeeren, B., van Thiel, S., & Steijn, B. (2024). The bureaucrat, the entrepreneur, and the networker: Developing and validating measurement scales for civil servants' role perceptions. *Public Administration Review*, 84(3), 500–518. <https://doi.org/10.1111/puar.13702>
- van Nunen, J., Huijbregts, P., & Rietveld, P. (2011). Introduction to transitions towards sustainable mobility. In Nunen Jo van, P. Huijbregts, & P. Rietveld (Eds.), *Transitions Towards Sustainable Mobility: New Solutions and Approaches for Sustainable Transport Systems* (pp. 1–15). Springer. https://doi.org/10.1007/978-3-642-21192-8_1
- van Thiel, S. (2014). *Research methods in public administration and public management: An Introduction*. Routledge.
- van Thiel, S. (2022). *Research methods in public administration and public management: An introduction* (Second Edition). Routledge.
- Vandycke, N., & Viegas, J. M. (2022). *Sustainable mobility in a fast-changing world: From concept to action*. Palgrave Macmillan. <https://doi.org/10.1007/978-3-031-08961-9>
- Vennix, J. A. M. (1996). *Group model building: Facilitating team learning using system dynamics*. Wiley. <https://archive.org/details/groupmodelbuildi0O000venn>
- Vignieri, V. (2022). *Enhancing performance regimes to enable outcome-based policy analysis in cross-boundary settings: A dynamic performance management approach* (Vol. 6). Springer. <https://link.springer.com/book/10.1007/978-3-031-07074-7>
- Vignieri, V. (2023). Active community for climate change: A dynamic performance governance analysis of a biodiversity preservation program. *Sustainability Accounting, Management and Policy Journal*, 14(6), 1150–1182. <https://doi.org/10.1108/SAMPJ-04-2022-0167>
- Vinci, I., & Di Dio, S. (2014). Designing mobility in a city in transition: Challenges from the case of Palermo. *Journal of Land Use, Mobility and Environment, Special Issue*, 977–988. <https://doi.org/10.6092/1970-9870/2514>

- Visser, E. L., & Kruyen, P. M. (2021). Discretion of the future: Conceptualizing everyday acts of collective creativity at the street-level. *Public Administration Review*, 81(4), 676–690. <https://doi.org/10.1111/puar.13389>
- Vos, J. De. (2024). Towards truly sustainable mobility. *Transportation Research Interdisciplinary Perspectives*, 24, 101039. <https://doi.org/10.1016/j.trip.2024.101039>
- Werland, S. (2020). Diffusing sustainable urban mobility planning in the EU. *Sustainability*, 12(20), 8436. <https://doi.org/10.3390/su12208436>
- Wichowsky, A., & Moynihan, D. P. (2008). Measuring how administration shapes citizenship: A policy feedback perspective on performance management. *Public Administration Review*, 68(5), 908–920. <https://doi.org/10.1111/j.1540-6210.2008.00931.x>
- Wilson, J. M. (2003). Measurement and association in the structure of municipal police organizations. *Policing*, 26(2), 276–297. <https://doi.org/10.1108/13639510310475769>
- Winickoff, D. E., Kreiling, L., Borowiecki, M., Garden, H., & Philp, J. (2021). Collaborative platforms for emerging technology: Creating convergence spaces collaborative platforms for emerging technology. *OECD Science, Technology and Industry Policy Papers*, 109, 1–85. <https://doi.org/10.1787/ed1e030d-en>
- Winter, S. C., Mikkelsen, M. F., & Skov, P. R. (2022). Individual agency in street-level bureaucrats' implementation of policy reforms: The role of their policy evaluation and self-efficacy. *Journal of Public Administration Research and Theory*, 32(4), 781–794. <https://doi.org/10.1093/jopart/muac003>
- Wolstenholme, E. F., & Coyle, R. G. (1983). The Development of system dynamics as a methodology for system description and qualitative analysis. *The Journal of the Operational Research Society*, 34(7), 569–581. <https://doi.org/10.1057/jors.1983.137>
- Wulfhorst, G., & Kesselring, S. (2016). Perspectives on sustainable mobility in metropolitan regions: Shaping mobility cultures. In G. Wulfhorst & S. Klug (Eds.), *Sustainable Mobility in Metropolitan Regions: Insights from Interdisciplinary Research for Practice Application* (pp. 201–221). Springer. https://doi.org/DOI 10.1007/978-3-658-14428-9_12
- Wulfhorst, G., & Klug, S. (2016). Sustainable mobility in the metropolitan region of Munich: An introduction. In G. Wulfhorst & S. Klug (Eds.), *Sustainable Mobility in Metropolitan Regions: Insights from Interdisciplinary Research for Practice Application* (pp. 1–15). Springer. https://doi.org/DOI 10.1007/978-3-658-14428-9_11
- Yin, R. K. (2003). *Case study research design and methods* (Third Edition). Sage Publications.

- Zacka, B. (2017). *When the state meets the street public service and moral agency*. The Belknap Press of Harvard University Press.
- Zang, X. (2016). Research on street-level discretion in the west: Past, present, and the future. *Chinese Political Science Review*, 1(4), 610–622. <https://doi.org/10.1007/s41111-016-0041-z>
- Zhan, X., Wing-Hung Lo, C., & Tang, S. Y. (2014). Contextual changes and environmental policy implementation: A longitudinal study of street-level bureaucrats in Guangzhou, China. *Journal of Public Administration Research and Theory*, 24(4), 1005–1035. <https://doi.org/10.1093/jopart/mut004>
- Zhang, L., Zhao, J., & Dong, W. (2021). Street-level bureaucrats as policy entrepreneurs: Action strategies for flexible community governance in China. *Public Administration*, 99(3), 469–483. <https://doi.org/10.1111/padm.12730>
- Zito, P. (2009). Influence of coordinated traffic lights parameters on roadside pollutant concentrations. *Transportation Research Part D: Transport and Environment*, 14(8), 604–609. <https://doi.org/10.1016/j.trd.2009.08.006>

Appendix 1

Interview Guide for Government Actors

1. Plan Stages

- a. When was the sustainable mobility policy plan initiated in Palermo?
- b. When were sustainable mobility policies implemented in Palermo?
- c. Can you explain the general traffic plan in Palermo?
- d. Can you explain the progress of Sustainable Urban Mobility Plans (SUMP) in Palermo?
- e. Why did the municipal government designate pedestrian areas? What were the reasons for choosing these areas?
- f. Why did the municipal government designate limited traffic zones? What were the reasons for choosing these areas?
- g. How to reduce passing private vehicles in restricted areas? What strategies have been implemented? What strategy will be carried out?
- h. How to reduce parking private vehicles in restricted areas? What strategies have been implemented? What strategy will be carried out?
- i. What are preventive actions for traffic and mobility violators?
- j. How was the decision-making process of local regulations regarding sustainable mobility? Are community or relevant agencies involved? Who are the individuals and organizations involved?
- k. What are the government's plans regarding sustainable mobility policy in the future?
- l. What kind of facilities that support sustainable mobility have been built?
- m. What kind of facilities that support sustainable mobility will be built?
- n. What kind of infrastructures that support sustainable mobility have been built?
- o. What kind of infrastructures that support sustainable mobility will be built?

2. Implementation Stages

- a. What are the general challenges faced when implementing pedestrian areas?
- b. What are the general challenges faced when implementing limited traffic zones?

- c. What are the fundamental challenges faced when implementing pedestrian areas?
- d. What are the fundamental challenges faced when implementing limited traffic zones?
- e. Which is more challenging, pedestrian areas or limited traffic zones? Why does this happen?
- f. What are the fundamental challenges faced when patrolling pedestrian areas?
- g. What are fundamental challenges faced when patrolling limited traffic zones?

3. Enforcement Stages

- a. What are municipal police's roles, duties, and responsibilities regarding sustainable mobility policies?
- b. How do you perform your roles, duties, and responsibilities regarding sustainable mobility policies?
- c. How are patrols carried out? How many patrols are carried out each day? Is there a distribution schedule for patrol teams? How many people are in a team?
- d. What sanctions will patrolman get if patrolman do not patrol professionally?
- e. Is there any coordination when conducting patrols? How is this coordination carried out?
- f. How does the mechanism impose sanctions on traffic and mobility violators?
- g. Are traffic cameras functioning correctly? How does the traffic camera work?
- h. How can traffic violations in pedestrian areas be controlled?
- i. How can traffic violations in limited traffic zones be controlled?
- j. Why are some traffic violators sanctioned and some not? What are the provisions for a traffic and mobility violator to be subject to sanctions?
- k. Are there differences between patrolling pedestrian areas and limited traffic zones with other areas? What are the differences?

- l. Is there a difference between patrols on weekdays and weekends (holidays)?
What are the differences?
- m. What do you pay attention to when monitoring areas?
- n. What do you pay attention to when enforcing regulations?

Appendix 2

Interview Guide for Non-Government Actors

1. General Questions

- a. Are you familiar with the sustainable urban mobility plan (SUMP)?
- b. Do you like walking in downtown Palermo? Why do you like it? Why do you not like it?
- c. Do you like cycling in downtown Palermo? Why do you like it? Why do you not like it?
- d. Do you ride a private motorcycle or scooter? Why do you ride it? Why do you not ride it?
- e. Do you drive a private car? Why do you drive it? Why do you not drive it?
- f. Do you like public transportation (bus and tram)? Why do you like it? Why do you not like it?
- g. Do you like passenger transportation (taxi and ape taxi)? Why do you like it? Why do you not like it?
- h. Do you often rent a car-and-bike sharing? Why do you rent it? Why do you not rent it?
- i. Do you often rent micromobility vehicles (e-scooters and e-bikes)? Why do you rent it? Why do you not rent it?

2. Sustainable Mobility Issues

- a. What do you think about the sustainable urban mobility plan (SUMP)?
- b. What do you experience about the pedestrian area in downtown Palermo?
- c. What do you experience about the limited traffic zones in downtown Palermo?
- d. What do you experience about parking areas in downtown Palermo?
- e. What do you experience regarding traffic and mobility violations?
- f. What do you think about the pedestrian area in downtown Palermo?
- g. What do you think about the limited traffic zones in downtown Palermo?
- h. What do you think about traffic and mobility violations?
- i. What do you think about parking areas in downtown Palermo?

3. Local Stakeholders' Assessment

- a. Do you often see municipal police patrolling? When do they routinely patrol?
- b. How do municipal police behave when patrolling? How do they act?
- c. Have you ever been sanctioned by patrolmen for committing a traffic and mobility violation? How do patrolmen provide these sanctions?
- d. Have you ever seen patrolmen giving sanctions to traffic and mobility violators? What did the patrolmen do at that time?
- e. Have you ever seen patrolmen not giving sanctions to traffic and mobility violators? What did the patrolmen do at that time?

4. Local Stakeholders' Behavior

- a. Have you ever driven a private vehicle in a prohibited area? Why did you do it?
- b. Have you ever parked a private vehicle in a prohibited area? Why did you do it?
- c. Will you commit traffic and mobility violations again? Why will you do it?
- d. Why are there still many traffic and mobility violations? What is the leading cause?
- e. How to change mobility behavior? What is the best way to change it?

5. Local Stakeholders' Actions

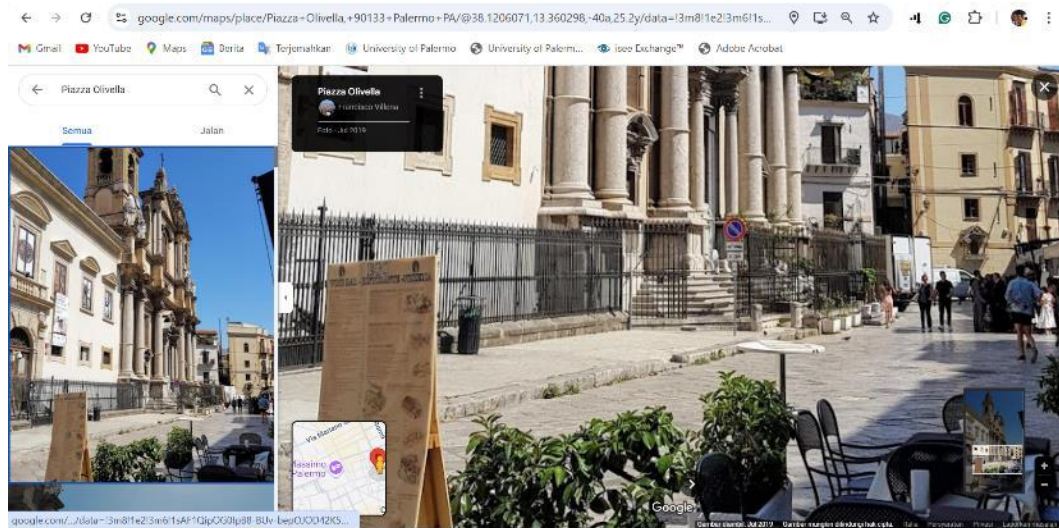
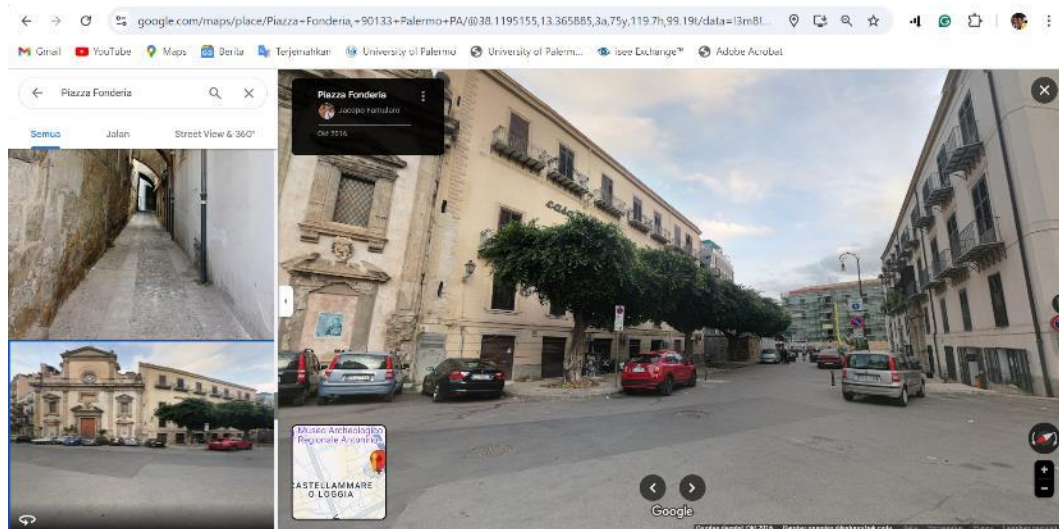
- a. Have you ever been involved in government decision-making regarding urban mobility? What is the process and mechanism? How do you convey your opinion to the government if there is a problem with urban mobility?
- b. What is the basis for your advocacy movement toward traffic and mobility violators?
- c. What challenges do you face when carrying out advocacy movements against traffic and mobility violators?

6. Local Stakeholders' Expectations

- a. What should the municipal government do regarding pedestrian areas?
- b. What should the municipal police do regarding pedestrian areas?
- c. What should the municipal government do regarding limited traffic zones?
- d. What should the municipal police do regarding limited traffic zones?

Appendix 3

Examples of Observed Areas



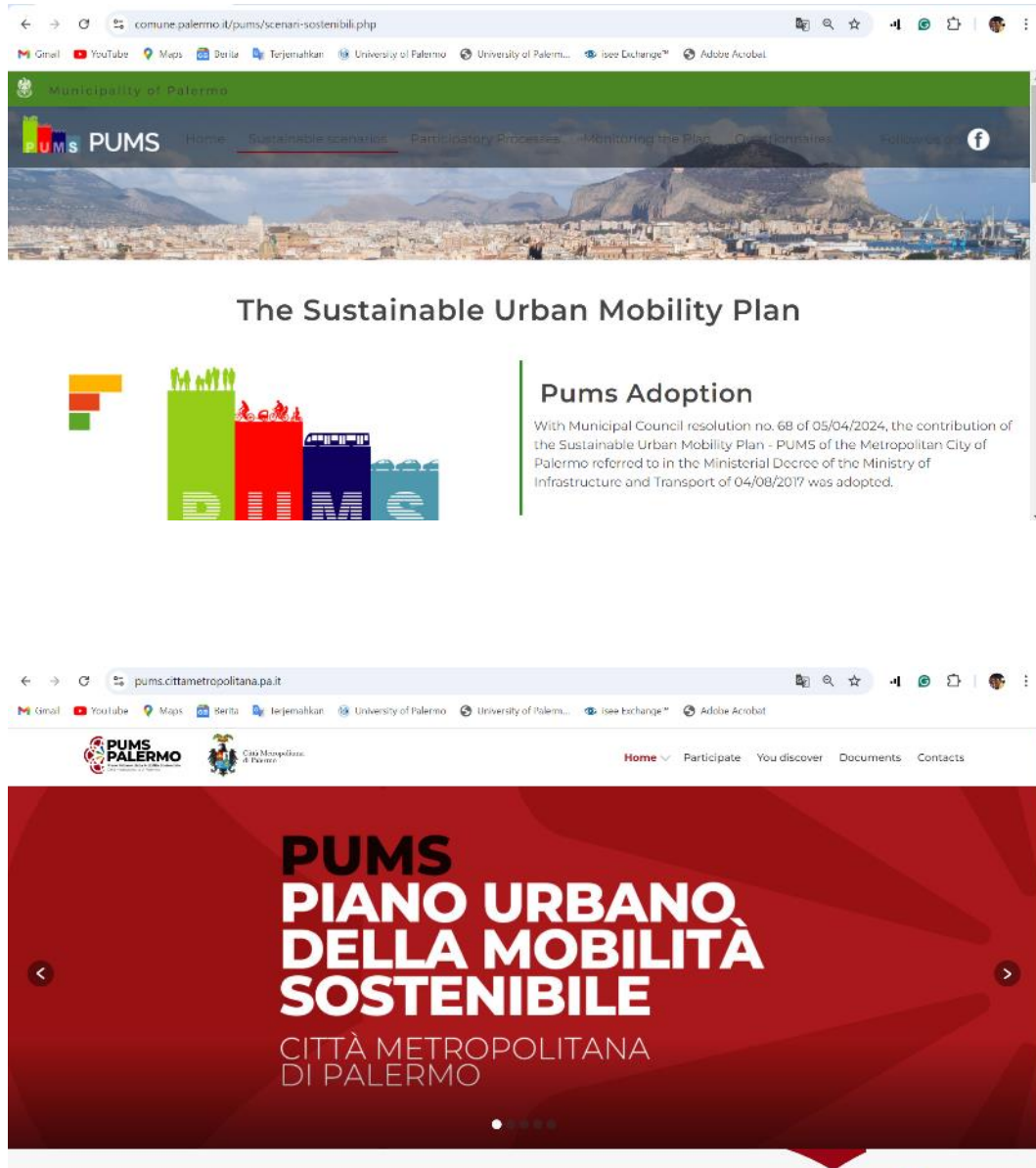
Appendix 4

Examples of Official SUMP Documents



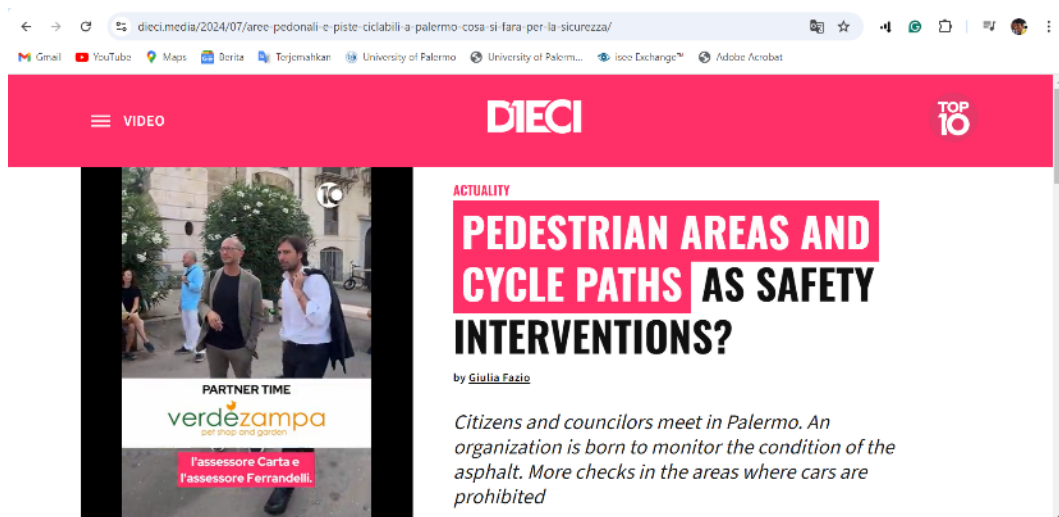
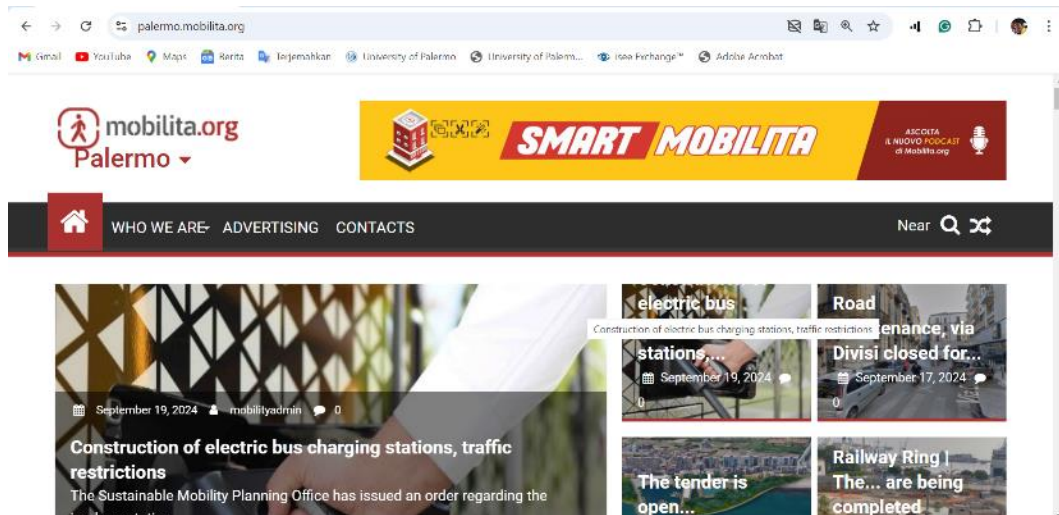
Appendix 5

Examples of Official Websites Regarding Sustainable Mobility



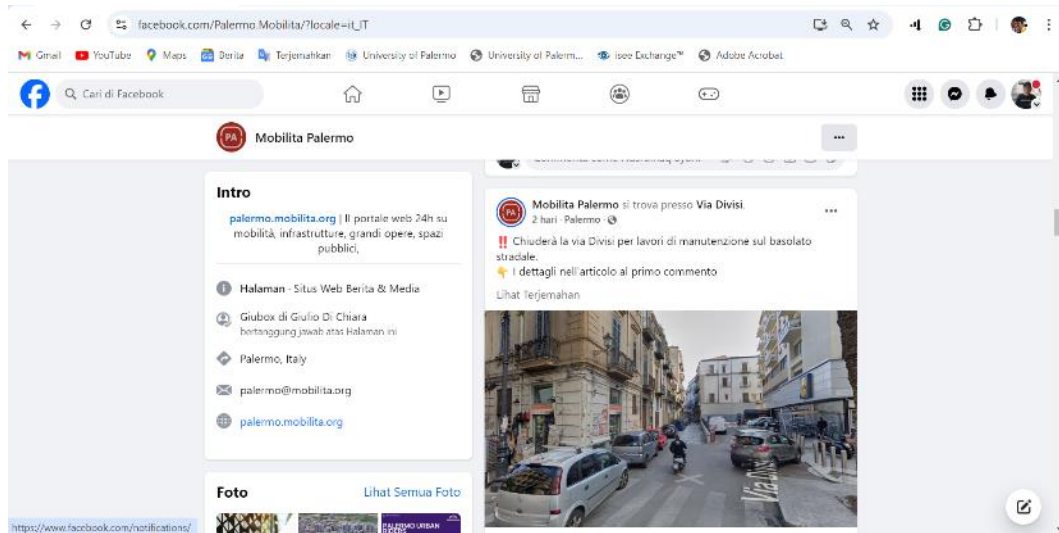
Appendix 6

Examples of Mass Media Regarding Sustainable Mobility Issues



Appendix 7

Examples of Social Media Regarding Sustainable Mobility Issues



Appendix 8

Governance of Sustainable Mobility Agenda in Palermo

Governance of Sustainable Mobility Agenda						
International Organizations	Multilevel Government Organizations	Municipal Government	Public Organizations	Private Organizations	Community-Based Organizations	Neighborhood Committees and Residents
• United Nations Sustainable Development Group - Promote the SDGs based on local wisdom and interests • European Commission - Fund and invest in public transport and active mobility infrastructure - Promote sustainable mobility plans based on local wisdom and interests	• Ministry of Infrastructure and Transport - Support local public transport and active mobility infrastructure • Military Police, State Police, Local Police, and Metropolitan Police - Patrol with municipal police collaboratively • President of Sicily Region - Control and facilitate the urban mobility system	• Mayor, <i>Giunta Comunale</i> and <i>Cosiglio Comunale</i> - Regulate effective policies - Allocate resources efficiently • Municipal Police - Enforce regulations actively • Municipal Government Agencies - Design and implement policies effectively • District Administration - Coordinate the local community and resident engagement	- Allocate supporting resources to sustainable mobility policies - Engage in policy design and implementation actively - Internalize the sustainable mobility agenda in the organizational sphere - Promote the sustainable mobility agenda	- Allocate supporting resources to sustainable mobility policies - Engage in policy design and implementation actively - Internalize the sustainable mobility agenda in the organizational sphere - Promote the sustainable mobility agenda	- Support sustainable mobility policies - Engage in policy design and implementation actively - Internalize the sustainable mobility agenda among organizational members - Promote the sustainable mobility agenda	- Support sustainable mobility policies - Engage in policy design and implementation actively - Promote the sustainable mobility agenda

Source: Authors' elaboration