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D7.1: Contextual models of broader institutional factors

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Executive Summary

This document sums up the key aspects of the institutional and governance analysis and design for the PETRA project. It sets up the empirical analysis of data platforms for mobility that will be the basis for the governance design for PETRA in the cities of Tel Aviv, Rome and Venice. In addition, that analysis will provide the basis for the main deliverables of WP7: the handbooks for governance and incentive design.

This deliverable goes hand-in-hand with deliverable D7.2, which further details the elements to analyse.

This deliverable looks at the stakeholders, based on the analysis done by the total PETRA team and refined in this deliverable. In addition, it looks at the institutional and governance context of data platforms and the key governance design aspects.

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1 Introduction

PETRA – Personal Transport Advisor: an integrated platform of mobility patterns for Smart Cities to enable demand-adaptive transportation systems - is a project funded by the Seventh Framework Programme of the European Commission under Grant Agreement No. 609042. It provides the technological foundation for developing a service platform that connects the providers and controllers of transport in cities with the travellers in a way that information flows are optimized while respecting and supporting the individual freedom safety and security of the traveller.

Due to world-wide urbanization, major problems of cities are often related to urban congestion, accessibility, liveability, air quality or traffic safety. The aim of the PETRA project is to minimize (a set of) these problems by advancements on sustainable city-wide transportation development and increasing the knowledge on emergent trends in mobility, while meeting the city users’ mobility information needs and simultaneously having the cities’ best interest.

Within this deliverable, the contextual models of broader institutional factors are described, including the definition of users and stakeholders, data and services and user requirements. This document will be an input for the empirical analysis of governance models.

1.1 PETRA Project Overview

The goal of the PETRA project is to develop a service platform that connects the providers and controllers of transport in cities with the travellers in a way that information flows are optimized while respecting and supporting the individual freedom safety and security of the traveller. In that respect cities will get an integrated platform to enable the provision of citizen-centric, demand-adaptive city-wide transportation services. Travellers will get mobile applications that facilitate them in making travel priorities and choices for route and modality. The work will result in a city-wide transportation system comprised of several sub-systems that involve transportation services and policies to be adaptive to the travel demand of the citizens. To achieve this, the platform will fuse different data from various city sources, travel operators and citizens, perform a broad class of predictive analytics, detect the real-time events based on the analytical information and real-time data, and provide information services to the transportation service providers and city stakeholders to optimize the transportation offerings, taking citizens’ interests into account directly. The envisioned platform will address key research challenges by:

- a) enabling a coherent model of mobility patterns via the capture of their multi-dimensional, collective, analytical and dynamic aspects;
- b) driving the application of this model via incorporation into various transportation services and city-level policy evaluations;
- c) paying specific attention to the governance aspects on how to handle the public – private and privacy issues of connecting travellers, cities and data and transport providers together through such a platform.

Three cities with different use cases will evaluate the platform and will host three demonstrations of a mobile Personal Mobility Advisor app.

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To achieve its goals, PETRA conducts original research and applies technologies from the fields of Big Data Management, the Internet of Services, Semantic Web, AI Planning, Stream Processing, Simulation, Data Mining, and Human-Computer Interaction. For more information, please refer to the project Website at <http://petraproject.eu/>.

1.2 Deliverable Purpose, Scope and Context

This document focuses on the third of the key research challenges mentioned above: governance aspects on how to handle governance issues of connecting travellers, cities data and transport providers through such a platform. The key aim of this document is to describe a contextual model of relevant institutional and governance factors for the role-out and long-term success of data platform like PETRA. The core product of PETRA is a data platform on mobility with attached services. As mobility patterns and policies change, the platform will have to develop accordingly to keep its value. This needs intelligent governance to effectively evaluate and direct the response of PETRA to those dynamics.

1.3 Document Preparation

This document is primarily prepared by TU Delft with input from AVM and RSM. The document builds on the outcome of earlier plenary meetings. These meetings provided a perspective on the key stakeholders, data sources and possible high-level designs, including a range of options conditioning the governance. This is all captured in deliverable D2.1.

In Rome and Venice interviews were carried out to understand the institutional context in which PETRA will have to function in these two cities. In addition, earlier research was revisited that analysed both inter-organizational governance models for data platforms as well as metropolitan governance of mobility, both throughout Europe as well as in Tel Aviv.

Finally, the models were reviewed by the partners from Rome and Venice.

The models will form the basis for a further analysis of governance in Europe of data platforms and metropolitan mobility systems. Eventually, this will be the basis for the two handbooks for governance design and the designs of the governance of the platforms in Tel Aviv, Rome and Venice, to be validated by the partner cities.

1.4 Document Status and Target Audience

This document is listed in the Description of Work (DoW) as “public”, as it provides general information about the contextual models for governance of PETRA and can therefore be used by external parties in order to get according insight into the project activities.

While the document is primarily aimed at the project partners, this public deliverable can also be useful for the wider scientific and industrial community. This includes other publicly funded projects, which may be interested in collaboration activities.

1.5 Document Structure

This deliverable is broken down into the following sections:

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- Chapter 1 provides an introduction for this deliverable, including a general overview of the project, and outlines the purpose, scope, context, status, and target audience of this deliverable;
- Chapter 2 provides a strategic overview of the context where PETRA will be used and identifies the positioning within PETRA;
- Chapter 3 introduces the contextual models for governance of PETRA, with description of the main components;
- Chapter 4 further develops the initial stakeholder analysis as provided in deliverable D2.1;
- Chapter 5 summarizes the institutional factors that will be included in the analysis and design of governance models of work package 7;
- Chapter 6 summarizes the governance factors that will be included in the analysis and design of governance models of work package 7;
- Chapter 7 provides the key conclusions.

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2 Strategic overview

2.1 State of the Art

It has become increasingly clear that large technical systems, like a data platform for mobility, need to be embedded in an organizational context that is nurturing its development and keeping it aligned with the dynamics of its environment. Technical solutions like PETRA do not survive in an organizational vacuum, but are dependent on a changing need of its users and providers.

Governance embeds different stakeholders through mechanisms of market, network and hierarchy to drive the decision-making (Powell, 1990). In market-driven governance, the stakeholders decide through transactions and competing alternatives. For PETRA this could be used for example in the choice for mobile phone data. In network-driven governance, different stakeholders work together to decide through the development of shared solutions. In hierarchy-driven governance, more traditional organizational structures, temporary or permanent, are set up to steer the development.

The expectation is that the governance of PETRA will include mechanisms from all three. However, as the platform is particularly inter-organizational, network governance will play a major role. In addition, market mechanisms will play a role with end users – usually much more fragmented –, like the travellers. Finally, the public and private stakeholders participating will have standing internal hierarchies on which PETRA governance can be developed further.

An important element in the governance of platforms is the role of the platform provider (i.e. the party (or parties) offering the platform itself) in relationship to the content providers (i.e. the parties offering the data, services, or other value-adds to the platform). There typically is much interdependence between those actors; the content providers need the platform in order to offer their services and the platform provider needs content providers to make the platform worthwhile and to thereby attract a critical mass of users. And the more users a platform has, the more attractive the platform will be for content providers as a means to offer their content. This might imply a power difference; once content providers are linked to the platform, it becomes an important resource for connecting to users, but this resource may not be under their control. Furthermore, parties invest in their own systems and interfaces with the platform, making switching to other platforms relatively costly (the ‘lock-in’ effect). For these reasons, becoming a platform leader is a business strategy that many companies desire for competitive advantage and hence much literature on platforms concerns parties and strategies that aim to become a platform leader (Gawer and Cusumano, 2008)¹.

The actual degree of dependency by content providers on the platform providers also depends on many other factors. For example, it depends on the importance of the platform for the operations of an actor. If a content provider needs the platform for survival (i.e. it is their only or main way to connect to the user communities for their main services or

¹ Gawer, A., and Cusumano, M. A. "How Companies Become Platform Leaders," MIT Sloan Management Review (49:2) 2008, pp 28-35.

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products), the dependency is much greater than when the platform offers an extra channel to connect with users, or when the services or products offered via the platform are not core to the actor. Furthermore, the availability of alternative platforms (and the costs associated with them) may limit this dependency.

Relationships between actors involved in platforms are often much more complicated. Some content or data providers may have access to resources (e.g. certain data) vital to the functioning of the platform, and a platform provider may need them more than they need the platform. To build a platform in such a setting, the platform may need a form of governance with representation of the key stakeholders (users and providers), for example by having them on the board, or by putting platform ownership in the hands of a collaboration (Klievink, Janssen and Tan, 2012)². In that case, the platform provider would primarily be the platform operator. Platform owners are often responsible for the technologies, standards and interfaces used in the platform whereas platform providers provide the actual technologies and interact with the users of the platform.

The platform owner or operator may even have to go as far as open book accounting, to show that the revenue they make from the services based on the platform are actually used to cover the costs of the operation, or establish mechanisms for gain sharing to fund the enabling parts of the platform (cf. Dekker, 2004). Furthermore, if the platform is meant to (partially) fulfil a public role, governments may step in by on the one hand subsidizing parts of the basic infrastructure and on the other hand pushing for open standards to ensure flexibility. Open standards reduce the dependency on a specific platform and thereby weaken the position of the platform provider. In any case, the use of technological standards is needed to facilitate adoption, as a lack of standards lead to high investments by actors without the ability to re-use them in other connections (Markus, 2006)³.

For these reasons, managing relationships with all users (both on the side of the content providers and on the side of end-users) is probably more important for platform providers than the platform as a technical artifact is (Gawer & Cusumano, 2002)⁴. To do so, governance mechanisms are needed to define the structure, power and process to make decisions on the collective components and activities in the platform (Von Tunzelmann, 2003)⁵. Platform governance refers to the solutions that organizations devise for problems

² Klievink, B., Janssen, M., & Tan, Y.-H. (2012). A Stakeholder Analysis of Business-to-Government Information Sharing: the Governance of a Public-Private Platform. *International Journal of Electronic Government Research*, 8(4).

³ Markus, M. L., Steinfield, C. W., Wigand, R. T., & Minton, G. (2006). Industry-Wide Information Systems Standardization as Collective Action: The Case of the U.S. Residential Mortgage Industry. *MIS Quarterly*, 30, 439–465. doi:10.2307/25148768

⁴ Gawer, A., and Cusumano, M. A. *Platform leadership : How Intel, Microsoft, and Cisco drive industry innovation* Harvard Business School Press, Boston, Mass., 2002, pp. xiv, 305 p.

⁵ Von Tunzelmann, N. (2003). Historical coevolution of governance and technology in the industrial revolutions. *Structural Change and Economic Dynamics*, 14(4), 365–384. doi:10.1016/S0954-349X(03)00029-8

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of coordination (Markus & Bui, 2012)⁶. These include rules, practices, decision-making processes and institutional arrangements used to align the various characteristics of demand (i.e., information users) and supply (i.e., information providers and IT-service providers) (Cusumano, 2005; Lynn et al., 2000)⁷⁸.

Tiwana, Konsynski and Bush⁹ identify three main elements of platform governance:

- The decision-making structure. Who decides, and how, on what components of the platform should do, how it should do it (design, implementation), and on who has control over the interfaces, which may outlive the platform itself. These kinds of decisions rights could rest with the platform owner, but also with developers of components of the platform, or in collaboration with governments. An important question is how and when decision rights should be shared, often a question of balancing autonomy of parties and coordination of the platform. This is especially challenging in a platform that joins-up public and private parties as that the private sector business models (also on the platform leadership) should be aligned with the action and values that have to be created by government organizations¹⁰.
- Formal and informal mechanisms of control over the platform (i.e. to encourage desirable behavior by actors involved). Tiwana et al. identify different forms of formal control: input control (where an owner decides what goes on the platform especially in a closed architecture), output control (criteria for output, e.g. evaluation, rewards or penalties), and process control (methods and procedures prescribed to parties). Informal control via values, norms, trust, etc. (ibid.). Control can have different directions (not necessarily just from the platform owner to the others), as described above.
- Ownership structure: proprietary to a single firm, or ownership shared between multiple actors. An important element here is the (perceived) neutrality of the platform, especially when it comes to data that are commercially sensitive. There is a perceived vulnerability when giving a platform owner control over part of your functionality, or vulnerability that is perceived because of giving up data which others can then use, repackage, combine and 'sell'. Power and contract-based

⁶ Markus, M. L., & Bui, Q. "Neo." (2012). Going Concerns: The Governance of Interorganizational Coordination Hubs. *Journal of Management Information Systems*, 28(4), 163–198. doi:10.2753/MIS0742-1222280407

⁷ Cusumano, M. A. (2005). Google: what it is and what it is not. *Communications of the ACM*, 48(2), 15-17.

⁸ Lynn, L., Heinrich, C., & Hill, C. (2000). Studying Governance and Public Management: Challenges and Prospects. *Journal of Public Administration Research and Theory*, 10(2), 233-261.

⁹ Tiwana, A., Konsynski, B., & Bush, A. a. (2010). Research Commentary —Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics. *Information Systems Research*, 21(4), 675–687. doi:10.1287/isre.1100.0323

¹⁰ Janssen, M., Kuk, G., & Wagenaar, R. W. (2008). A survey of Web-based business models for e-government in the Netherlands. *Government Information Quarterly*, 25(2), 202–220. doi:10.1016/j.giq.2007.06.005

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governance may limit the flexibility of users (both sides) of the platform^{11 12}(Hart and Saunders, 1997; De Reuver, 2009).

The remainder of this document will look at how these three elements will be researched in the cases of mobility related data platforms. That analysis is consequently the basis for the design in Tel Aviv, Rome and Venice and the handbooks.

The research approach will work outside in, from institutional and governance conditions to the data platform decision-making structures, mechanisms of decision-making and ownership, as encapsulated by first circle of contracts around the data platform and a second circle of contracts that the stakeholders in the first circle hold with third parties, and that are relevant for the data platform. You could think about the contract a regional government has with a public transport operator, which influences the tendency to share data with a platform like PETRA. From that the broader governance picture will be built up, as presented below.

2.2 The positioning of PETRA

PETRA holds a unique position in terms of offering personal mobility services backed with a city-wide data platform. It mainly aims to meet the mobility requirements of the citizens and other city stakeholders in a modern urban environment by realising a one-stop-shop for regular travellers, tourists, freight companies and service providers to get mobility advice that is perfectly adapted to the needs of the user, through profiles, preference setting and tracking of history, and all in a way that protects the privacy-sensitive data of the user. In that respect, the objective of PETRA is not to make a better mobile application for the user, or to gather the data, but is to make the real-time integrated platform that balances public policies, privacy, personal mobility and commercial interests of service providers.

Intuitively, the concept of mobility patterns and their use to optimize the mobility is the unique point and offers an advantage to PETRA over any competitors in the market today. In particular, understanding the dynamics of the city and its inhabitants' daily mobility patterns is essential for the provision of innovative transportation services and the planning and management of transportation system. By offering intelligent techniques to capture the information of mobility patterns from a vast amount of city data and enabling this information to the various transportation services, PETRA is mainly filling a gap between the city environment and the users of those services. This is clearly a major step forward beyond the current state-of-the-art mobility applications, which mostly have a limited scope and which are highly tailored to specific application scenarios.

¹¹ Hart, P., & Saunders, C. (1997). Power and trust: Critical factors in the adoption and use of electronic data interchange. *Organization Science*, 8(1), 23–42.

¹² De Reuver, M (2009). Governing mobile service innovation in co-evolving value networks. Delft University of Technology, the Netherlands.

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3 Contextual models

3.1 Overview

The outcome of the PETRA research project will be a “coherent, installable set of software”, i.e. a working prototype system that implements an expandable set of services to enable a demand-adaptive personal mobility advisor working on top of multimodal urban data. As the different use cases describe, PETRA will target both classical journey planning requests such as “going from A to B, at time T, walking a maximum of 10 minutes”, and tourist activity planning ones such as “spending 6 hours around Venice, seeing at least museum X and attraction Y”.

In brief, the PETRA environment system will consist of

- Stakeholders
- Governance factors

3.2 Stakeholders

Stakeholders are important element of the PETRA environment. Due to the broad nature of the project, various types (categories) of stakeholders are involved in a PETRA system. For example, PETRA considers city stakeholders such as data providers, city managers or the researchers to be mainly interacting with PETRA system in order to better manage the city-wide transportation or provide valuable city data in addition to end-user stakeholders who will be actual users of the PETRA mobile and Web apps. A categorization of the major PETRA stakeholders and a comprehensive list will be given in Chapter 5.

3.3 Governance

For this project, we will define *institutional factors*¹³¹⁴ as those relevant contextual institutions conditioning the design of PETRA governance, but not being a part of the governance of PETRA itself. To illustrate; the model will consider the way in which public authorities direct public transport operators, the way in which privacy and data use are regulated, the way in which transport policy is developed, the way in which different authorities and jurisdictions are set up in the metropolitan area in which PETRA platform should function and others.

In addition, *governance factors* are those institutions that are set up to make decisions over PETRA core product. To illustrate; the model will consider the way that the relations between the platform provider, data providers, policy makers and end-users are set up for decision-making, including the use of organizational structures defining hierarchy,

¹³ Williamson, O (2000) “The new institutional economics: taking stock, looking ahead,” in: *Journal of economic literature*, pp. 595–613.

¹⁴ We use the word “institutions” here in line with Williamson (2000) both as the broader term for rules and regulations guiding behaviour as well as the specific level of rules and regulations with a relatively fixed character (changing every 10 to 100 years), like legal and administrative contexts.

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contracts setting the rules and processes, structuring the interactions between the different stakeholders. These are the key governance factors PETRA wants to provide design guidance on governance for future developers of data platforms, like the one being the core product of PETRA.

		Time-scale focus	
		Institutions (long-term)	Governance (medium-term)
System focus	Context	Institutional factors, conditioning governance model Example: existing legal responsibilities of municipalities on public transport / road network management	Governance factors context, conditioning governance model Example: existing contracts between municipalities and public transport operator / road network manager
	Dedicated	Not relevant	Governance factors PETRA, defining governance model Example: contract characteristics between public transport operators / road network managers and PETRA platform managers

Table 1 The relation of institutional and governance analysis and governance design in WP7

Institutions are those rules and regulations, formal and informal, structuring and driving decision-making processes. They include hierarchy, network and market mechanisms and their respective procedures, remuneration structures and incentives. The governance of PETRA will cross the public-private divide. That means specific problems of combining market institutions and public governance are likely to occur.

4 Stakeholders

This chapter gives an overview of the different stakeholders identified for the PETRA platform and app(s). These will be included in the institutional and governance analyses of WP7. This list is only slightly adapted from the work done by the project team for D2.1. Interviews were carried out in WP7 to develop this list. The additions are provided in italics. After the list of stakeholders a first structuring of the stakeholders is provided in a first stakeholder analysis. Finally, a first evaluation is given of the stakeholder-related governance challenges.

4.1 Categorisation

Stakeholders can be grouped in the following categories:

- End Users of the PETRA products (i.e., city residents and tourists);
- Transportation providers (i.e. public transport operators, car sharing operators, etc.)
- Service and/or data providers (i.e. mobile communication providers, ITS providers, city event organizers, tourist organizations, etc.)
- Authorities (i.e. mobility agency, implementing strategies for incentives, etc.)
- R&D actors (i.e. universities, research centres, etc.)

The following paragraphs list the main stakeholders for each category.

4.1.1 End users

These include:

1. City residents (i.e residents of Rome, Venice and Tel Aviv)
2. Tourists (from all over the world, visiting Rome, Tel Aviv and particularly Venice)
3. Commuters (city users) (Especially in Rome and Tel Aviv metropolitan area)

Within this category there are also specific interest groups, for example:

- Disabled people (requiring specific mobility support and information)
- Students, elderly, or other vulnerable groups particularly targeted by policy

4.1.2 Transport service providers

These include:

1. Public transport operators (As contracted by the city project partners RSM, AVM and NTA.)
2. Parking operators (For example: Venice: Interparking, Garage San Marco, and Marco Polo Park for airport parking)
3. Car sharing operators (Rome: RSM, Car2Go)
4. Bike sharing operators (Tel Aviv: Tel-o-fun)
5. Taxi companies
6. Commercial fleets (able to provide FCD)

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4.1.3 Service/data providers

These include:

1. Mobility agencies (or mobility directorate), as data providers. In our demonstrations: RSM in Rome, AVM in Venice, and NTA in Tel-Aviv.
2. Local police, providers of information about how the city is used, traffic rules, data
3. Events/attraction providers (museums, theatres, etc.). In the demonstration in the city of Venice, this is actually done through AVM's interaction with the city itself.
4. Tourism municipal directorate, provider of information about how the city is used, where attraction points, which events are programmed and where
5. Retailers (whose business can be influenced by mobility strategies)
6. Mobile telecom providers. For our demonstration, the Italian mobile phone operator WIND was initially contacted for collaboration.

4.1.4 Authorities

These include:

1. City public administration. It is intended that the main stakeholder is the City, as long as Petra is expected to apply the city governance policies (governance to be done directly, or indirectly through e.g. the Mobility Agency)
2. Other local authorities (e.g. Province, Region, ...)
3. Neighbouring cities
4. *Higher (national, international) authorities as providers of legal frameworks and political climate*
 - a. *Regulators of privacy*
 - b. *Regulators of data use*
 - c. *Regulators of markets*
 - d. *Regulators of mobility*

4.1.5 R & D actors

These include:

1. Universities, and in particular research groups on mobility related issues
2. Research Centers
3. R & D departments of companies providing technological solutions for sustainable mobility
4. Experts, to provide expertise on how the city is used
5. *Competitors working on similar solutions*

4.2 First stakeholder analysis

Our first high-level stakeholder analysis follows the approach of Murray-Webster and Simon (2006)¹⁵. It is based on the first interviews in Rome and Venice. We distinguish between eight types of stakeholders based on their support (do they have a positive

¹⁵ Murray-Webster, R & Simon, P (2006) "Making sense of stakeholder mapping," in: *PM World Today*, pp. 1–5.

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attitude towards the project?), their engagement with the project (do they have an interest in the project?), and their power to influence the project (do they have instruments that allow them to control the project?).

The stakeholder analysis is not looking at particular stakeholders at this moment. At a later stage, based on further analysis of data platforms and their governance, WP7 will further develop the stakeholder analysis. At this point a high-level analysis shows the direction of the empirical analysis.

	Attitude	Interest	Power
Acquaintance: They need to be kept informed and communicated with on a 'transmit only' basis.	+	-	-
Friend: They should be used as a confidant or sounding board.	+	+	-
Saviour: They need to be paid attention to: keep them on your side – pander to their needs.	+	+	+
Sleeping giant: They need to be engaged in order to awaken them.	+	-	+
Tripwire: They need to be understood so you can 'watch your step' and avoid 'tripping up'.	-	-	-
Irritant: They need to be engaged so that they stop 'eating away' and then be 'put back in their box'.	-	+	-
Saboteur: They need to be engaged in order to disengage. Be prepared to 'clean-up after them'.	-	+	+
Time bomb: They need to be understood so they can be 'defused before the bomb goes off'.	-	-	+

Table 2 Stance of stakeholders (Murray-Webster and Simon, 2006)

In an initial stakeholder analysis, stakeholders are characterised by a positive or negative stance on the three variables: attitude, interest and power. This gives us an initial perspective on the position the platform would hold towards the stakeholders.

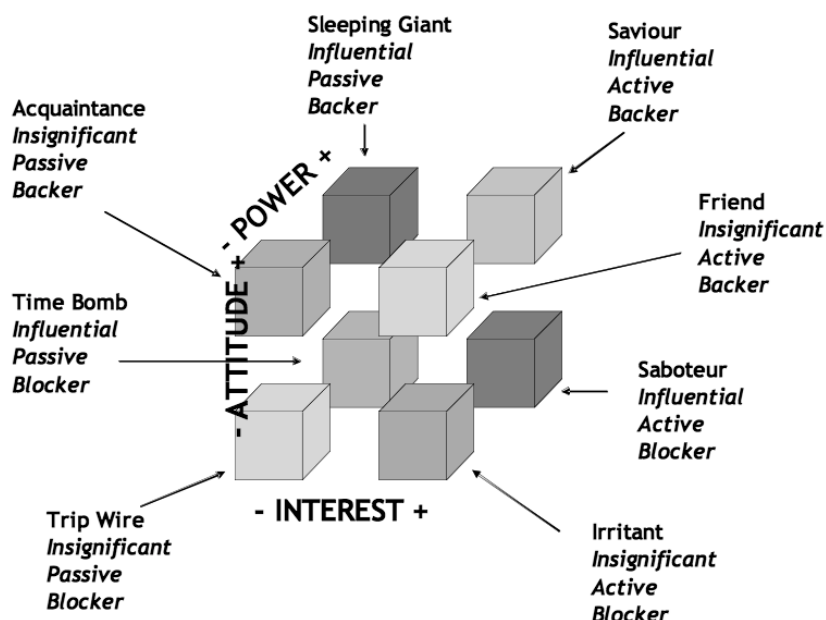


Figure 1 Cube of stakeholder stances (Murray-Webster and Simon 2006)

On a high level PETRA has five types of stakeholders: end users, transport service providers, service and/or data providers, authorities and R&D. On that high level we could see the **end-users** as *friends*, with a positive and interested attitude, but limited power over the success of the data platform. Only representing bodies (traveller pressure groups) that are able to mobilize the end-users could add to their power, making them *saviours*. When due to specific concerns their approval drops, they could turn from friends to *irritants*.

The second group of stakeholders consists of **transport service providers**. They can be seen as *saviours*, with expected high support, power and engagement. However, PETRA has to provide them with real benefits. When they are only seen as data providers, data provision to the platform proves cumbersome, and the PETRA trip planning could be perceived to have a negative effect on their patronage, their support could be low, making them possible *saboteurs*.

The third group of stakeholders is that of **service and/or data providers**. Most of them should gain value from the platform, either through possible payments directly from the platform owners, through augmentation of their own data or services by being hooked to the platform.

For some providers the value might be very indirect. For example, the value of PETRA for a road management department of a city might be clear, but this can be less clear for their data centre management having to provide high-quality data to the platform. In that case, additional effort will have to be made to secure higher-level positive stakeholder positions to PETRA also work for other parts of the organization.

When the value for them can be created, these are *sleeping giants*: PETRA for them is not essential, but they are expected to be positive and powerful. When the value cannot be created, they are possible *time bombs*: PETRA is relying on them, but they can loose interest.

The fourth group consists of the **authorities**. This is a very diverse group. City authorities with a focus on mobility, safety and the environment are expected to be positive on all three factors and as such they are the *saviours*. However, other like public privacy watchdogs can be *saboteurs*. Others can be *sleeping giants*, having a positive attitude and power, but not necessarily interested. This could for example be the case for political representatives.

The fifth group is that of **research and development** related stakeholders. They can be *saboteurs*, when working on competing options. However, when aligned with the PETRA project it could create value to them making them *friends*.

At this stage a more detailed analysis of the stakeholders that further adds value is not possible. Based on the case studies in WP7 more detailed pictures of the expected positions of stakeholders will emerge.

4.3 First evaluation of governance challenges

The main concept of Petra is that stakeholders are part of a community where data belonging to each stakeholder is shared, so that it can be used to provide quality information for the advantage of all members of the community. The main governance challenge implied by the actor analysis is variety.

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1. A multitude of actors mean a challenge for alignment of interests
2. There is variety per category as well. For instance, public authorities themselves are multifaceted. They can provide technical, legal and management input on an operational level. On a political level they can provide ideas and motives. This further complicates the alignment of interests.
3. The variety of actors implies scope differences among projects. In some projects categories will be involved - even put on a central position - while in other projects they are not. Scope issues can apply to for example transport modes, geographical scale, administrative level, and data sources.
4. Variety is further enhanced by the fact that actors may play different roles per project. For example, actors may be data generators, data users, travellers, event organizers and end users at the same time. This influences for example the incentives of actors.
5. This refers to the question of ownership. While the City is the main stakeholder for the platform within the PETRA project, the actual ownership structure of a functional platform is more complex. First of all there is the question on who owns particular data. The city itself will own some sources, as will the mobility agency. However, much operational data on public transport will be owned by other actors - for instance the operators, as will be the case for taxis and car sharing operators. Business models and contracts will determine ownership structures on a case-by-case basis.

Within the Petra project there will be the opportunity to address data ownership and privacy, and the relationships among stakeholders. In particular, the experience of the demo cities will constitute an important reference for future implementations.

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5 Institutional factors

5.1 Overview

The PETRA platform will have to operate within an institutional context that is setting the stage for the governance of mobility in general and for PETRA in particular. This chapter looks at the aspects of the institutional context that are most relevant for PETRA, the functioning of the platform and the governance options that this institutional context provides.

The PETRA platform in its first inception in Rome, Tel Aviv and Venice has a limited variety of institutional contexts but a broad spread. The deployments in Rome and Venice obviously are both within an Italian context, including European Union legislation concerning for example privacy, competition, and transport. The Tel Aviv case is operating outside the jurisdiction of the European Union, providing a clearly different context. In addition, Italian governmental institutions are spread out over four layers (municipal, province, region, country). Israel features less government layers.

The goal of WP7 is to provide both a specific governance design for the three cities in PETRA (D7.3 and D7.4), as well as generic advice on the governance of data platforms for mobility (D7.5 and D7.6). For the latter, we need a broader understanding of how institutional factors shape the possibilities and challenges for a data platform for mobility along the lines of PETRA. This means that in our institutional analysis.

5.2 Institutional factors: key topics

There is a number of relevant aspects of institutions that we can a priori mention. First, how are **jurisdictions** and layers of government set up? Rules and regulations are bound to specific governmental entities. Introducing PETRA in a metropolitan area with a strong governmental entity covering that area is very different from doing that in a metropolitan area where that governmental layer is lacking or with limited powers. However, some of the conditioning of PETRA will come from different levels. Multi-level governance problems are set up by the way in which jurisdictions are institutionalised.

Second, how are relevant markets **regulated**? Public transport services, bus, rail, taxi, in Europe are generally heavily regulated. The regulatory framework sets the scene for the relation between the operator of the service and the authorities in the region. Those authorities will play an important role in the PETRA platform governance, and as such their relation with the operator is key. For example, when services are tendered out in longer concessions, changes to the demands of the operator might be more difficult.

Third, legal systems also can allocate tasks to stakeholders or **roles**. In our research of governance, we will look at possible generic roles (mobility service provider, subsidy provider, data provider, service user, data user etc) and look at the combination of a task and stakeholder to define a role. For the institutional factors it is important that some roles are predefined in law. As far as they are not, roles may also be defined in transactions - i.e. contracts - among solely private actors.

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To research the way in which institutions - jurisdictions, regulations, roles - drive the long-term success for data-platforms on mobility, the project team has to make a selection on which institutional variables should be part of the analysis. Here we'll give a general overview. D7.2 is more specific.

5.3 Institutional factors: data platforms like PETRA

The PETRA platform has two key characteristics: it is data driven and aimed at integral travel advice for travellers - optimized on both the criteria of the traveller and on specific mobility and sustainability policies. Institutional factors that are most important for PETRA are those that focus on managing the operational flows and managing the transactions. For example, how are the responsibilities for operational road capacity management put into law and how does the market regulation condition the transactions between traveller, government and public transport operator? Less important are those institutions that focus on the long run, like the way that infrastructure development is institutionalised.

Being data driven means that a lot of different stakeholders provide a variety of **data** to the system. Data ownership, availability and privacy are key aspects that are generally institutionalised in national or EU legal systems; these have put rules in place to which the users of the data have to abide. Legislation on these issues, European, national, and regional, allow for the way in which the data will flow through the PETRA platform and sets what data enrichment can't, can and has to be done. The institutional factors will have to include the way in which data use is regulated. For example, national governments can demand open data for those data streams that are developed with public money. Or privacy might be secured in a specific manner.

PETRA has a clear focus on mobility, providing the users with an integral perspective on mobility choices. Integral means that PETRA can not a priori focus on one mode or leaving out specific mobility. As a consequence, institutional factors of all possible mobility systems and services on all modes are relevant.

These mobility systems and services are provided very much on the public-private divide. For private transport, **infrastructure** is usually provided by the public sector. The institutions relevant for PETRA and related to infrastructure are threefold, in reducing importance. First, infrastructure can have the role as data provider, through induction loops, camera's, and other sensors. How is data extraction and external use of that data institutionalised - i.e. subjects to whose regulations? Second, the operational management of infrastructure is institutionalised. How is capacity and use managed through for example dynamic traffic control by the road authority and how is this regulated? Third, and least important for PETRA, the tactical and strategic management of infrastructure is institutionalised. How is decided about new infrastructure development?

Institutions in the field of mobility **services** are also relevant, as these represent the resources PETRA want to optimize for its users. We can distinguish between public transport, shared and private transport services. Public transport is generally defined as those transport services open to the public. Rail services and road services are included, but also taxi services and car and bike sharing schemes. A key institutional factor is how these services are regulated, more specifically, how the role of government is set up in defining the services. For example, is government initiating the service levels or is that left to the market. This is a key institutional difference when considering a government entity

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that wants to set up a PETRA platform and services and the way in which public transport can be included. Next to market regulation, service conditioning can be regulated. For example, a country, regional or metropolitan government might have regulated price, service levels, or even the quality of traveller information. All these aspects condition the quality of service that PETRA should be able to rely on when including those services in the platform.

A second set of services is sharing services, mostly car and bike. Generally, we see little legislation around these services. However, for a specific city it might be the case that services provision is regulated. This is the kind of institutional context that is relevant for PETRA.

A third set of services is private transport services. Here we define private transport services as those services that are not generally accessible to every traveller, like privately owner car. The success of PETRA is dependent on regulation of use and taxation of the private car and bike. The PETRA business case is influenced by that. Private transport services are operationally mostly controlled through infrastructure. For example, speed limitations on specific road stretches can be used to limit emissions. Or the infrastructure in parts of the city might be closed to specific vehicles or services.

New developments in mobility - such as the private mobility service Uber - show that the division of roles among public and private actors as well as the way they are institutionalized may move. In case of Uber public institutions are relatively weak and subject to change.

5.4 Conclusion

Concluding, in the analysis of institutional factors WP 7 will focus on the table below. The questions in the cells are examples.

	Data	Mobility services	Infrastructures
Jurisdictions	What government level is securing privacy?	What government levels are initiating which transport services?	What government level is responsible for the management of what road types?
Regulations	Is there a legal demand for open access to public data?	How is the relation between the public transport operator and the government regulated?	Are legal demands in place for the capacity management of infrastructures?
Roles	Under what legal conditions is the use of PETRA end-user location and stream data allowed?	Is the public transport operator part of the government responsible for the PETRA platform?	Is the infrastructure manager also responsible for the PETRA platform?

Table 3 Key categories of institutional questions to be answered conditioning PETRA governance design with example questions

In the table we have added examples of questions to be answered to build up a sound view of the institutional context in which PETRA will have to function.

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6 Governance factors

6.1 Overview

Governance factors are those organizational factors that can be changed on a relatively short time span. A typical example is given by the contract in place between different stakeholders. Contracts include the scope expected to be delivered, the remuneration for the scope delivery, generally quality and time aspects of the agreement, and often includes rules for decision-making in moments of conflicts between the parties. However, governance also includes more implicit rules about cooperation.

This chapter has a triple role. First, it describes the governance factors that will be included in the analysis of governance of data platforms that will be carried out in WP7. Second, also Tel Aviv, Rome and Venice will serve as case studies, not of governance of existing data platforms, but existing governance environments in which governance designs for PETRA will have to be fitted. The governance factors presented here will provide focus for the *analysis* of the governance context in these cities. Third, these factors are the basis for the *design* of the governance of the PETRA platform in these cities.

With regard to the methodology to be used to structure the governance factors, this chapter takes a simple to complex approach, as we will do in the analysis. Governance has both obvious and relatively simple factors, and more complex and hidden factors. Our analysis will start with the simple aspects. These are presented here in this chapter. However, in our analysis of the cases, we will snowball from these aspects to more complex elements of the governance as they show to be relevant in the cases.

The research approach of the governance factors will work outside in, from institutional and governance conditions to the data platform decision-making structures, mechanisms of decision-making and ownership, as encapsulated by first circle of contracts around the data platform and a second circle. From that the broader governance picture will be built up, as presented below.

In this chapter the focus is on bilateral contracts, directly around the data platform. This forms the first ring of contracts around the data platform. From here the cases will broaden the search for relevant governance factors:

- First, the second ring of contracts: which contracts do the direct partners have in place relevant for the functioning of the data platform?
- Second, is there multilateral cooperation around data platforms?
- Third, what implicit rules exist in the cooperation around data platforms?
- Fourth, what other factors are key for the functioning of the governance around mobility oriented data platforms?

6.2 Governance factors listed: bilateral contracts

Below are listed the key questions on a number of bilateral interfaces and the related contracts. The key elements of those contracts are scope definitions, financial agreements

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and additional arrangements. The section discusses the respective interfaces between the data platform and data providers and users, mobility service providers, infrastructure managers, city managers, and the end-user. For each of those interfaces the key questions to be answered are discussed.

6.2.1 Governance of data input and data use (platform – data provider and platform – data user)

- Who decides on the acceptable use (functionality) of data, and how?
 - o Are data providers and/or data users represented or involved in decision-making?
 - What rights do they have?
 - How are conflicts resolved?
- What are (quality) criteria for selection of data that may be used on the platform?
- Is there a contract or service level agreement between the data provider and the platform provider set up?
 - o Are they bilateral with each data provider, or generic terms (e.g. consent to use) applicable to all that provide data?
 - o Are privacy and/or confidentiality concerns dealt with?
 - o What are the incentives and safeguards for provisioning of data?
- Is there a contract or service level agreement between the data user and the platform provider set up?
 - o Are they bilateral with each data provider, or generic terms (e.g. terms of use) applicable to all that connect use data?
 - o Does it have criteria for data use?
 - o Are there incentives or costs associated with data use?
- How are problems from the social context dealt with if they are not covered in contracts or agreements?

6.2.2 Governance of mobility service incorporation (platform – mobility service provision)

- How is the governmental authority responsible for mobility services related to the (PETRA) platform manager?
 - o Are they within the same governmental entity?
 - o Are they regularly working together?
 - o How is coordination between the entities currently organised?
- Is there a contract or service level agreement between the mobility service provider and governmental authority set up?

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- Does it have provisions on data exchange?
- Does it have provisions for operational service optimization?
- Does it formulate performance boundaries?
- Does it incentivise cooperation in the field of PETRA (or the data platform)?
- How are the authority and the mobility service provider working within the confines of the contract?
 - Do they have regular contact?
 - Is informal mutual coordination generally used?
 - Is there a culture of closeness to the contract or more towards flexibility?
- What mobility services are included or excluded?
- If applicable, how is information of multiple service providers integrated?
 - Do bilateral or multilateral transactions exist?
 - Are these formal or informal transactions?
- Who has a final say about inclusion and integration?

6.2.3 Governance of infrastructure capacity use (platform – infrastructure manager)

- How is the governmental authority responsible for infrastructure management related to the (PETRA) platform manager?
 - Are they within the same governmental entity?
 - Are they regularly working together?
 - How is coordination between the entities currently organised?
- Is there a contract or service level agreement between the infrastructure manager and governmental authority set up?
 - Does it have provisions on data exchange?
 - Does it have provisions for operational service optimization?
 - Does it formulate performance boundaries?
 - Does it incentivise cooperation in the field of the (PETRA) data platform?
- How are the authority and the infrastructure manager working within the confines of the contract?
 - Do they have regular contact?
 - Is informal mutual coordination generally used?
- How are trade-offs between infrastructure management and breadth of supply made?
- What infrastructures are included or excluded?

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- If applicable, how is information from multiple infrastructure managers integrated?
 - o Do bilateral or multilateral transactions exist?
 - o Are these formal or informal transactions?
- Who has a final say about trade-offs, inclusion and integration?

6.2.4 Governance of government interventions on dashboard (platform – city manager)

- How is the governmental authority responsible for city management related to the PETRA platform manager?
 - o Are they within the same governmental entity?
 - o Are they regularly working together?
 - o How is coordination between the entities currently organised?
- Is there a contract or service level agreement between the city manager and governmental authority set up?
 - o Does it have provisions on data exchange?
 - o Does it have provisions for operational service optimization?
 - o Does it formulate performance boundaries?
 - o Does it incentivise cooperation in the field of the (PETRA) data platform?
- How are the authority and the city manager working within the confines of the contract?
 - o Do they have regular contact?
 - o Is informal mutual coordination generally used?
- How are trade-offs between city management and user demand made?
 - o On what level are these trade-offs made?
 - o How is transparency and accountability about these decisions organized?
- If applicable, how is information from multiple geographical managers integrated?
 - o Do bilateral or multilateral transactions exist?
 - o Are these formal or informal transactions?
- Who has a final say about trade-offs and integration?

6.2.5 Governance of apps (platform – end user)

- What are the economic drivers (incentives and business models) for the provisioning of apps?
 - o Do forces of demand and supply govern the provision of apps?
 - o Is there a revenue model for the platform?

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- Is it considered a public sector asset, or partially subsidized?
- Is the platform (partially) commercially viable? How?
- Are there criteria for output evaluation (rewards, penalties)?
- What is the capacity for upward flexibility (open to creation of any application or service, attracting bigger or new user groups)?
- What is the level of (input) control over what goes on the platform?
 - Who is in control?
 - What is the direction of control (e.g. from platform to service provider, from data provider to platform)?
 - Are key stakeholders represented in the decision-making arrangements?

6.3 Governance factors listed: beyond bilateral contracts

As stated before, in the cases the analysis will start at the above questions and then move beyond that, based on the relevance that is presented in the case itself, based on empirical merit of the factor. However, here we present a number of challenges in the governance that already have become clear.

These challenges, related to data platform, are:

- Data quality assurance: How is the supply of data selected to optimise functionality?
- Integration of supply and demand: What functionalities are in place? How are possible confrontations between supply (policies) and demand (user functionality) managed?
- Scoping: How are geographical, institutional and functional boundaries managed?
- Centrality: How are trade-offs between centralised ('deaf and blind') governance and decentralised ('fragmented') made both formally and informally?
- Core values: What is deemed the core value of the project and what as subject to conflict resolution?

6.4 Conclusion

WP7 will analyse the governance of a number of cases of European data platforms, their strengths and challenges. It will look at the first circle of stakeholders around the platform and the second circle of those stakeholders. The first step is on the bilateral contracts and the incentives in the contracts that condition behaviour in the overall stakeholder environment of the (PETRA) data platform. The second step in the analysis will focus on additional elements of the governance, driven by the first step

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7 Conclusion

This document shows the aspects that WP7 will take into account in the analysis of governance structures and business models of data platforms in mobility related services. The analysis will look at the stakeholders, the institutional factors that set the scene in which they operate and the governance factors that have to be tweaked to make the PETRA platform work and develop over the longer time period.

The stakeholder list created by the project team for deliverable 2.1 was represented. A high level analysis was done to analysis the expected positions of key stakeholders towards the (PETRA) data platform. These positions will be the topic of further analysis in the cases.

The institutional factors were presented with a focus on data, mobility service and infrastructural institutions. For the former, ownership and sharing possibilities are key; for the latter two, the way in which operational management is set up is key. Institutional analysis will include the analysis of jurisdictions, regulations and roles.

The governance factors showed how the analysis of the cases and the set up of the design will start from the bilateral contacts surrounding the data platform as a first circle and then move to the second circle of contracts. Furthermore, relevant governance aspects will be included in the analysis, based on the empirical evidence of various examples of data platforms in logistics and mobility.

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