DG Joint Research Centre

B6 - Digital Economy

Digital Platform for public services

Final Report

ISA^2 action 2016.10: ELISE

European Location Interoperability Solutions for e-Government

Specific contract 494 under Framework Contract n° DI/07172 – ABCIII

This study was carried out by Gartner for the ISA^2 programme by:

Gartner®

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Specific Contract No: 494

Framework Contract: DI/07172

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Document Control Information

Settings	Value
Document Title:	Digital Platforms in public services
Project Title:	SC494
Document Authors:	Ken Van Gansen Clementine Valayer David Allessie
Project Sponsor:	Francesco Pignatelli - DG JRC B6
Commission Project Manager (CPM):	Francesco Pignatelli - DG JRC B6
External Contractor Project Manager (ECPM):	Guido Vanderharst
Doc. Version:	1.0
Sensitivity:	Internal
Date:	01/10/2018

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Executive Summary

Digital platform environments have flourished in the private sector (e.g. AAAF: Alphabet, Apple, Amazon, Facebook) in the last decade. Underpinned by the use of technologies, these digital environments thrive thanks to the rewiring of traditional market dynamics. Digital Platforms are expected to greatly impact data and knowledge intensive industries (financial services, transportation, etc.), including governments. Location information plays an essential role in the far majority of Digital Platforms and the importance of location intelligence is reaching new heights thanks to the more than 25 billion devices that will be connected to the "Internet of Things" by 2021 of which 5.5 billion will be based in Europe. This work aims at understanding Digital Platforms and the role of location information in these 'digital ecosystems' from a government perspective. The analysis is based on academic and market research studies, stakeholders consultations with public and private sector stakeholders and case study data collection. The main results of the study are summarised below, grouped around the three main objectives of the study.

The first objective of the study was to define what Digital Platforms are and how they apply in the context of government environments. A number of unique organisational, economic, governance and technology characteristics of Digital Platforms were identified. The main conclusions from the study are that:

- Digital Platforms enable multi-directional network effects and value creation and allow platform owners to address the total market (see section 5.1.1)
- The near-zero marginal cost curve of Digital Platforms create the possibility of market domination by one platform and the high barriers to entry or exit lead to monopolistic and oligopolistic market structures (see section 5.1.2)
- Digital Platforms leverage network effects and information asymmetries that may lead to dominant market positions (see section 5.1.3)
- Developing Digital Platform businesses requires a shift in design thinking from resource ownership to resource orchestration (see section 5.1.4)
- Digital Government Platforms are often in a less advanced lifecycle stage compared to private Digital Platforms (see section 5.2.1)
- Government owned or funded Digital Platforms feature less often IoT (Internet of Things) and analytics systems than when government provides or consumes data from a platform (see section 5.2.2)

A number of recommendations linked to those conclusions were developed for how Digital Platforms could more easily apply and expand in the context of government environments:

- Governments should focus on orchestrating and reusing existing government services as a starting point for developing their Digital Platforms (see section 5.1.4.1)
- Governments should start building IoT capabilities (see section 5.2.2.1)

Secondly the roles that governments may play in Digital Platform environments were analysed. The study concludes that governments may play a number of roles in Digital Platforms:

- *Government as provider to a Digital Platform* – Providing reusable data to Digital Platforms beyond merely providing open data creates a window of opportunity for governments to stimulate new economic activity or develop self-sustaining business model (see section 5.3.1)

- *Government as an owner of a Digital Platform* – Creating Digital Platforms in governments shifts design thinking from a focus on citizen value to a focus on ecosystem value (see section 5.3.2)
- *Government as an owner or funder of a Digital Platform* – Digital Platforms are leveraged in digital transformation initiatives in governments and blur the boundaries between traditional industry segments and government sectors (see section 5.3.3)

A number of recommendations linked to those conclusions were developed for the roles governments could play in Digital Platform environments:

- Governments should optimise the use of their open data services by defining a service delivery approach that matches the needs of their target consumers (see section 5.3.1.1)
- Governments should invest in creating and designing ecosystems (see section 5.3.2.1)
- Governments should consider Digital Platforms to be a cornerstone of their Digital Government transformation initiative (see section 5.3.3.1)

Thirdly the role of location information and location intelligence in Digital Platform environments was evaluated, the study concludes that:

- Location information is inherent for the value creation of Digital Platforms (see section 5.4.1)
- Government data, including open data, is often leveraged in private Digital Platforms and thereby creates value for citizens and society (see section 5.4.2)

A number of recommendations linked to those conclusions were developed for governments to embed location information and location intelligence in Digital Platforms:

- Governments should enhance digital public services with location information and location intelligence (see section 5.4.1.1)
- Governments could benefit from supporting location data offerings to match providers and consumers (see section 5.4.2.1)

1.0 Introduction

1.1 Background

Today's market trends toward Digital Transformation and the role of Digital Platforms (public and private) in this process is expected to greatly impact data and knowledge intensive markets (financial services, governments, transportation, etc.). Location-enabled services (both public and private) as well as location information plays an essential role in the far majority of Digital Platforms and the importance of location intelligence is reaching new heights thanks to the more than 25 billion devices that will be connected to the "Internet of Things" by 2021 of which 5.5 billion will be based in Europe. This implies a compound annual growth rate of more than 30% over the coming three years, building on the current global installed base of 10 billion globally and 2.5 billion in Europe[1]. All of these devices will provide location-based data that may be consumed by Digital Platforms.

1.2 Context

1.2.1 Digital transformation and Digital Platforms

Digital is transforming every aspect of life, the way we:

- communicate (using e.g., smartphones and mobile internet)
- consume products and services (using e.g., e-commerce websites and)
- exchange information and knowledge (using cloud-based services)
- live at home (using e.g., smart home, personal assistants)
- organise ourselves at work (using e.g., the digital workplace)
- commute to work and back (using e.g., autonomous vehicles)
- interact with government authorities (using e.g., online portals and digital registries)

This digital transformation (also sometimes referred to as the "Fourth Industrial Revolution" or Industry 4.0) is not only impacting individuals but also businesses across all industries and governments across policy areas. In his book, "The Fourth Industrial Revolution"[2], Professor Klaus Schwab, founder and executive chairman of the World Economic Forum, describes how this fourth revolution is fundamentally different from the previous three, which were characterised mainly by advancements in technology. In this fourth revolution, organisations will be facing a range of new technologies that are blurring the lines between digital and physical worlds due to the convergence of people, businesses and things. These new technologies have great potential to continue to connect billions more people to the web, drastically improve the efficiency of businesses and governments and help regenerate the natural environment through better asset management in a sharing economy. According to Credit Suisse, businesses have an average life span that is three times lower (average of 18 years) compared to 50 years ago (average of 60 years)[3] and digitally enabled public services have become the base expectation of governments in nearly every jurisdiction and region around the world.

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[1] Rueb, Denise. Forecast: Internet of Things — Endpoints and Associated Services, Worldwide, 2017. Gartner Research, 21 December 2017, ID G00347577

[2] Schwab, Klaus. The Fourth Industrial Revolution. World Economic Forum, January 11, 2016, ISBN 1944835008

[3] Technology killing off corporate America: Average life span of companies under 20 years, CNBC, https://www.cnbc.com/2017/08/24/technology-killing-off-corporations-average-lifespan-of-company-under-20-years.html

Results from the 2017 Gartner CIO Survey[4] revealed that:

- 79% of top-performing organisations participate in digital ecosystems
- 25% of industries with new market leaders come from platform strategies
- 50% of all Enterprise Architecture initiatives will focus on defining and enabling digital business platform strategies by 2018

Definitions

Digital business[5] *is the creation of new business designs by blurring the boundaries between the digital and physical worlds due to the convergence of people, business and things.*

Digital Transformation[6] *is the change process associated with the application of digital technology in all aspects of human society. The process*[7] *covers renovating or optimising core IT and business services to enhance the existing business model and support digital business transformational opportunities.*

Throughout this report the terms “digital business” and “digital transformation” are used in the context of the impact it has on consumers, citizens, business and governments. As such, the concept of digital business covers the impact digital transformation has on all stakeholders in human society, whether these are public sector authority, private-sector companies or citizens/consumers. The term “business” in the scope of this report reflects the focus on the mechanisms for value creation. These mechanisms can go beyond striving for purely financial gains and profitability but could also encompass sustainability, performance, efficiency or other non-financial benefits.

Digital business requires the creation of digital products and services or the addition of digital capabilities to existing products or services. To create value in the connected world, organisations will need to look beyond the boundaries of their individual organisations, markets and even industries. Looking beyond organisational boundaries in a digitalised and connected world implies fundamental changes to the way businesses and governments operate. For example, cars won't simply be autonomous; they will connect with other cars, the road itself, the buildings that the cars travel to and other transportation modes. The changes will impact various dimensions of organisational strategy and design, in particular how, in a connected ecosystem of people, organisations and things, an organisation:

- positions its value proposition
- defines its platform business models
- sets up its platform governance models
- invests in digital technology systems
- measures the costs and benefits with new key performance indicators (KPIs)

At the core of a digital strategy often sits the challenge to find models that induce others to help build or connect with their organisation, i.e., creating a (digital) ecosystem. Those models often follow the principles of platform businesses combined with the advantages that new

[4]Rowsell-Jones, Andy; Lowendahl, Jan-Martin. The 2017 CIO Agenda: Seize the Digital Ecosystem Opportunity. Gartner Research, 14 October 2016, ID G00317427

[5]Definition based on Gartner Research: Scheibenreif, Don. A CIO's Guide to Gartner's Digital Business Research. Gartner Research, 27 February 2018, ID G00350802

[6]Stolterman, Erik; Croon Fors, Anna. Information systems research: relevant theory and informed practice. p. 689. Springer, 2004, ISBN 1-4020-8094-8.

[7]Definition based on Gartner Research: Scheibenreif, Don. A CIO's Guide to Gartner's Digital Business Research. Gartner Research, 27 February 2018, ID G00350802

digital technologies bring to organisations every day, this is often referred to as “Digital Platforms”.

Definition

*A **Digital Platform**[8] is a business-driven framework that allows a community of partners, providers and consumers to share, extend or enhance digital processes and capabilities for the benefit of all stakeholders involved through a common digital technology system.*

Consequently, the “Digital Platform” concept in the scope of the report is not limited to an interoperable stack of technologies, neither is it constrained to specific technology trends and hypes (e.g., Cloud, Artificial Intelligence, Blockchain, etc.).

1.2.2 Digital transformation in the context of Government

In the context of government the digital trend is sometimes referred to as Digital Government or Digital Government transformation and builds on the same assumption of the “blurring boundaries between the digital and physical worlds due to convergence”. Governments worldwide face multiple, concurrent global and local forces, including political, social and technological, which are rapidly changing their societies. New technologies are constantly emerging, raising citizen and business expectations, and changing citizen behaviour as technology innovations are being consumerised. Significant changes in how government services are offered and consumed are inevitable. Many government organisations aim to articulate a compelling business vision on which to base a digital strategy for supporting digital transformation of their public services. In defining these strategies there is often confusion about how previous e-government objectives differ from those of digital transformation.

Definition

***Digital Government** leverages advances in technologies and relies on the use and reuse of data and analytics to simplify (digital as well as offline) transactions for end users (citizens, businesses and government agencies). It creates information from data to support and enhance decision making of government, businesses and citizens, and it fosters the creation of new, collaborative and more efficient service delivery models. In the process, underlying service models are redesigned and re-engineered to improve mission effectiveness and efficiency, to achieve optimised outcomes, such as transparency and openness, long-range cost savings, better governance and better quality of life for citizens.*

This definition puts the emphasis on how critical it is to use quality data to support the work of government and the transformation to better processes and services. In contrast, e-government is more focused on making traditional government services available through online channels. To date, with few exceptions, most digital strategies are updated versions of a prior e-government strategy.[9] As such, they remain primarily focused on improving operational efficiency by speeding up business processes while preserving existing service models. This e-government approach favours the limited, one-time benefits of service optimisation by lowering the transactional costs of government, as measured in inputs and outputs. However, a true Digital Government strategy capitalises on the use and reuse of data to achieve large-scale optimisation that improves public service effectiveness.

[8]Definition based on Gartner Research: Moyer, Kristin R. Three Styles of Digital Business Platforms. Gartner Research, 12 October 2016, ID G00317581

[9]Di Maio, Andrea. Introducing the Gartner Digital Government Maturity Model 2.0. Gartner Research, 20 July 2017, ID G00334525

The shift from e-government to digital occurs along a continuum. Making steady progress in transforming public services requires digital transformation initiative leaders to assess where their organisation stands in relation to its goals and take strategic steps to increase digital maturity. The Digital Government Maturity Model provides them with a framework for that purpose.[10] The drivers of value creation vary depending on the stage of Digital Government Maturity and range from compliance, efficiency, transparency and openness in initial stages of maturity, toward constituent value, insight and sustainability in later stage of maturity.

Unsurprisingly, in Gartner's latest 2018 annual senior executives survey[11], digital transformation has become the top ranked goal for government over the next two years and the second ranked priority among private-sector companies (after growth/market share). With the exception of defence and intelligence agencies, digital transformation is ranked among the top two business objectives for senior executives in each tier of government — local (city, county or municipality), regional (state or province), and national or federal. Figure 1 shows responses to the survey question: Thinking about your organisation as a whole, what would you say is the top business or mission objective for the next two years (2017 and 2018)?

Figure 1. Top business or mission objective for the next two years (2017 and 2018)[12]

Top 10 Business Priorities	All Government (n = 379)	Local Government (n = 103)	State or Province (n = 90)	National or Federal (n = 143)	Defense and Intelligence (n = 35)	All Others (n = 2,236)
Digital business/digital transformation	18%	15%	20%	24%	6%	17%
Security, safety and risk	13%	18%	16%	6%	23%	
Governance, compliance, regulations	12%	13%	8%	14%	11%	
Technology initiatives/improvements	11%	12%	12%	10%	11%	6%
Service improvements/optimization	9%	13%	11%		14%	
Innovation, R&D, new products/services	9%	12%	8%	8%	6%	10%
Analytics/data/information	8%			11%		
Process improvement/optimization/automation	7%		13%	8%	9%	
Productivity/optimization/efficiency	7%	9%	7%		6%	
Sustainability/social responsibility	7%	13%		6%		
Infrastructure development/transformation		10%				
Growth/market share		9%				30%
Financial health			7%			
Customer focus			6%	8%		9%
Operations improvement/efficiency/excellence				8%	14%	6%
Workforce focus					11%	
Profit improvement/profitability/asset monetization						12%
Corporate/M&A/new business/consolidation						8%
New customers/retention/sales						7%
Cost optimization/management/reduction						7%

Percentage of Respondents

Base: All answering; 10 top ranked items per segment, excluding "don't know" responses; n varies by segment.
Q: Thinking about your organization as a whole, what would you say are its top business objectives for the next two years (2017/2018)?

[10]JRC Digital Government Report
[11]This survey is answered by Gartner clients and takes into account the opinion from people that have an interest in digital business and digital transformation activities. Therefore the result might reflect a stronger tendency towards digital preferences and priorities.
[12]Howard, Rick. Digital Marketplaces for a Platform World. Gartner Research, 28 July 2017, ID G00326470

1.3 Aim of the report and target audience

This report presents the findings of the study on governments in the context of Digital Platforms. The objectives of this study are to:

1. Define what Digital Platforms are and how they apply in the context of government environments
2. Analyse the different roles that governments may play in Digital Platform environments
3. Evaluate the role of location information and location intelligence in Digital Platform environments
4. Derive conclusions on the current state and provide recommendations for the future of Digital Platforms in the context of government environments

In order to cover all the above objectives, the scope of the study has mainly focused on Digital Platforms that have close relations with government and are centred on providing location information and services.

The target audience for this report is mainly:

- Public and Private sector stakeholders in Digital Platforms
- Geospatial specialists with and interest in Digital Platform developments
- EU Member State representatives of the ISA² steering and working groups
- eGovernment and Digital Government leaders and practitioners

1.4 Structure of the Report

The report is subdivided into five chapters which each address one or more of the study objectives as indicated below:

- **Chapter 2** provides an overview of the methodology used to conduct this study as well as an introduction to the analysis framework that has been designed to support the data collection and analysis
- **Chapter 3** aims at describing the main characteristics of a Digital Platform in order to delineate the scope of what constitutes a Digital Platform and what does not. As such, this chapter mainly addresses the first objective of the study i.e. to define what Digital Platforms are and how they apply in the context of government environments
- **Chapter 4** presents the case study analysis of Digital Platforms analysed in context of this study. It provides an overview of the platform characteristics is provided, the various business and governance models are investigated and the cost and benefits that are part of these Digital Platforms are analysed. The chapter covers three important sections that address three objectives of this study:
  - How digital platforms apply in the context of government environments (section 4.1)
  - The different roles that governments may play in Digital Platform environments (section 4.2)
  - The role of location information and location intelligence in Digital Platform environments (section 4.3)
- **Chapter 5** builds on the fourth objective of this study to derive conclusions on the current state and provide recommendations for the future of Digital Platforms in the context of government environments

The report is complemented by a bibliography, glossary and a number of appendices providing supporting elements for the chapters outlined above:

- **Appendix I – Stakeholder Engagement – Expert Interviews**
- **Appendix II – Digital Platform Canvas Explained**
- **Appendix III – Digital Platform Case Study Overview**
- **Appendix IV – Detailed Cost and Benefits Data Overview**
- **Appendix V – Action Plan**

2.0 Methodology and Analysis Framework

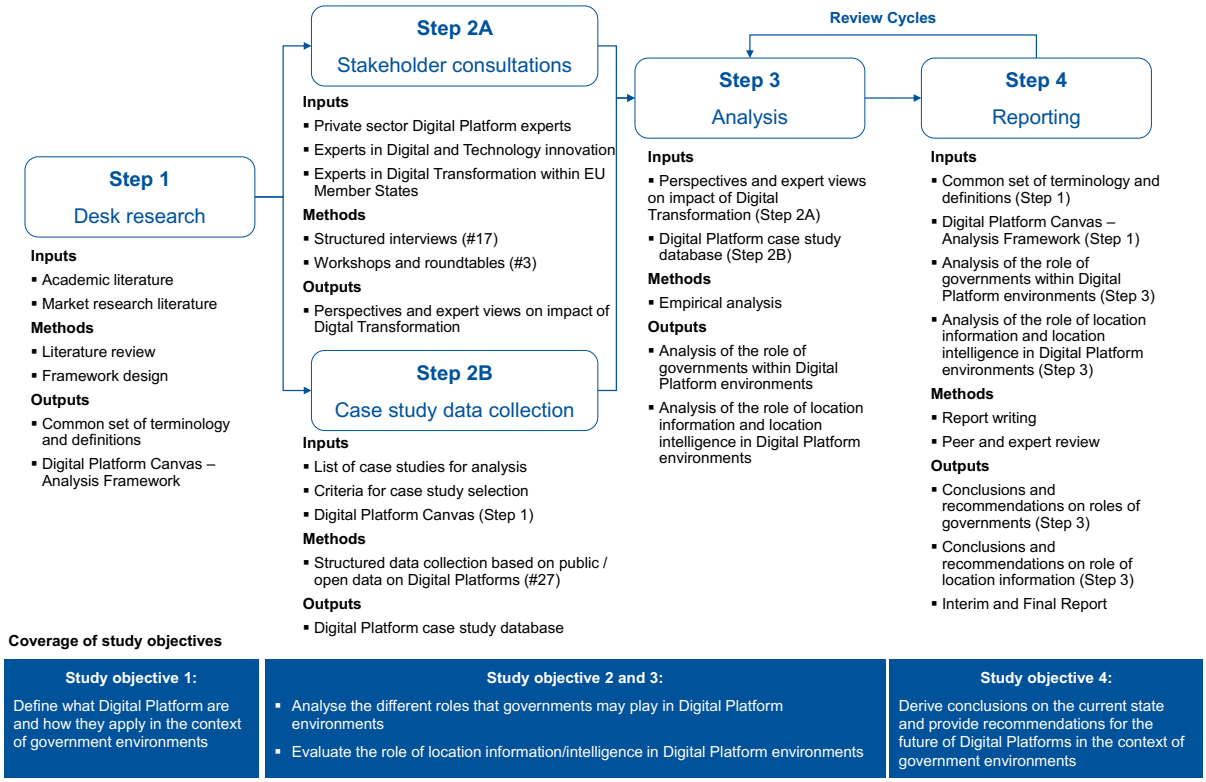
This chapter provides an overview of the methodology used to conduct this study as well as an introduction to the analysis framework that has been designed to support the data collection and analysis. The chapter is subdivided into two sections:

- **Section 2.1:** Description of the applied research methodology and approach
- **Section 2.2:** The Digital Platform Canvas: A structured method for gathering data on Digital Platforms to analyse Digital Platforms with governments taking on various roles in the context of the platform

2.1 Description of the applied research methodology and approach

The study applied a four-step methodology in Figure 2 to deliver the results of this study.

Figure 2. Overview of applied methodology



Step 1:

The common set of terminology, definitions and Digital Platform Canvas are based on outcomes of desk research covering a combination of proprietary and public information on the topic of Digital Platforms. The output of this analysis can be found in Chapter 4 of this report. The desk research was conducted in Q4 2017 and a full overview of the sources can be found in the Bibliography.

Step 2A:

A number of stakeholder consultations were held to collect perspectives and views on the impact of Digital Transformation and the role of Digital Platforms therein. Input was collected through interviews (with individuals) and workshops/roundtable discussions (with groups).

For the interviews the following stakeholders were identified:

- Private sector Digital Platform experts identified through analyst communities across industry and public sector initiatives
- Experts in Digital and Technology Innovation identified through Gartner research
- Experts in Digital Government Transformation within EU Member states by leveraging ISA² and other EC project related expert networks in Member States

A number of workshops and roundtables were held during the course of this study to liaise with the MS public administration experts in the areas of Digital Government, innovation and location information.

An overview of the interviews, workshops and roundtables conducted in scope of this study can be found in Appendix I — Stakeholder consultations.

Step 2B:

The study leveraged the Digital Platform Canvas to collect data on 27 different Digital Platforms. The Digital Platform Canvas is introduced in section 2.2 and further detailed in Appendix II - The Digital Platform Canvas Explained.

Platforms were selected to ensure the following criteria were met:

- Broad geographical coverage, including EU, US and China
- Mix of government and private sector owned Digital Platforms
- Mix of Digital Platforms covering different industries and government sectors
- Mix of Digital Platform in various life cycle stages: introduction, development, growth, maturity.

Data was collected based on public and open data in Q4 2017 and Q1 2018 and covered various dimensions:

In support of study objective 2: Role of governments in Digital Platform environments

- Business models (see section 4.1.1)
- Governance models (see section 4.1.2)
- Technology systems (see section 4.1.3)
- Costs and benefits (see section 4.1.4)

In support of study objective 3: Role of location information and intelligence in Digital Platform environments

- Location value creation mechanisms (see section 4.3.2)
- Usage of location APIs (see section 4.3.3)

The full list of Digital Platforms analysed can be found in Appendix III– Digital Platform Case Study Overview.

Step 3:

Perspectives collected from the interviews were used as input for a qualitative analysis of the ‘public task’ of governments in relation Digital Platform (see section 4.2.1) as well as an analysis of the drivers for Digital Government Platforms (see section 4.2.2)

Data collected through the case studies was complemented by an in-depth empirical analysis covering the same dimensions introduced in step 2B along two of the key objectives of the study:

In support of study objective 2: Role of governments in Digital Platform environments

- assessing the different roles of governments in Digital Platforms (see section 4.2.3):

- government as platform owner
- government as provider to a Digital Platform
- government as consumer of a Digital Platform
- government as ecosystem partner of a Digital Platform

In support of study objective 3: Role of location information and intelligence in Digital Platform environments

- assessing the role of location information in Digital Platforms i.e., "location-enablement"
  - assessment of the various value creation mechanisms
  - assessment of the usage of location APIs

Step 4:

In the final step of the study a synthesis of the analysis was conducted to provide conclusions and recommendations of Digital Platforms in the journey toward Digital Government.

2.2 The Digital Platform Canvas: A reusable method to analyse Digital Platforms

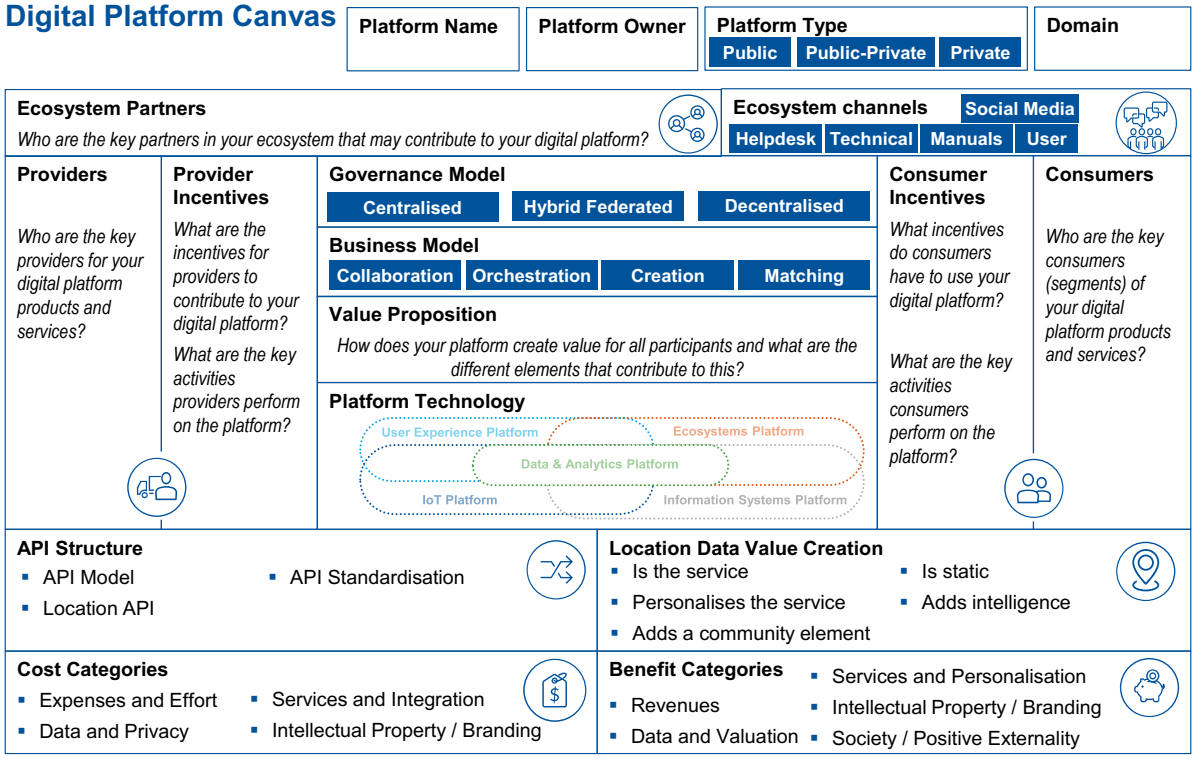
In the context of this study, inspired by the business model canvas[13], a reusable analysis framework, consisting of 14 building blocks that jointly form the essential building blocks of Digital Platforms, was designed. The framework was used to describe and analyse the 27 Digital Platforms along a structured model for comparative purposes.

Note that: The Digital Platform Canvas may also be used describe future-state models of Digital Platform.

[13]The Digital Platform Canvas is based on the Business Model Canvas methodology which was initially proposed by Alexander Osterwalder in 2008 and based on his earlier work on Business Model Ontology.

- The Business Model Canvas, http://www.nonlinearthinking.typepad.com
- Osterwalder, Alexander. The Business Model Ontology - A Proposition In A Design Science Approach. PhD thesis University of Lausanne, 2004

Figure 3. Digital Platform Canvas



Appendix II — Digital Platform Canvas Explained, contains a summary of the Digital Platform Canvas building blocks as well as definitions, key questions and an exemplary platform analysis based on the “Google Maps” case study.

The Canvas has interactively been tailored to reflect better the specifics of location information and location intelligence by including explicitly aspects such as:

- Location information Value Creation
- Location API Structure

3.0 Digital Platform Definition

This chapter aims at describing the main characteristics of a Digital Platform in order to delineate the scope of what constitutes a Digital Platform and what does not. As such, this chapter mainly addresses the first objective of the study i.e. to define what Digital Platforms are.

The main characteristics have been clustered along four differentiating perspectives; organisational, economic, governance and technological. These four perspectives are presented in the following sections:

- **Section 3.1 Organisational Perspective: Platform Businesses and Ecosystems**

  Digital Platforms naturally arise in the context of platform businesses, it is therefore essential to first identify what are the organisational characteristics of a platform business.

- **Section 3.2 Economic Perspective: Platform Business Model**

  Digital Platforms build on platform business models leveraging network effects to compete in (presumably) “winner takes it all” markets. This section focuses on the economic logic behind the network effects on which Digital Platforms thrive.

- **Section 3.3 Governance Perspective: Platform Governance Model**

  A wide range of governance models, ranging from highly centralised toward fully decentralised models, can be observed in Digital Platforms. This section describes the main variants of governance models and the importance of the role of ecosystems are explained.

- **Section 3.4 Technological Perspective: Digital Technology Systems**

  Digital Platforms should be supported by a set of digital business technology systems that match an organisation's chosen digital ambition. The new digital business technology systems extend beyond traditional IT systems to include user experience, Internet of Thing, data analytics and business ecosystems, all of which enable participation in a digital ecosystem.

The fifth section of this chapter summarises the above key characteristics of Digital Platforms and distinguishes between critical and optional criteria used for qualifying a Digital Platform.

- **Section 3.5: Conclusions on key characteristics of Digital Platforms**

3.1 Organisational Perspective: Platform Businesses and Ecosystems

Digital Platforms exclusively exist in the context of platform businesses[14], it is therefore essential to first identify what the organisational characteristics of a platform business are. These characteristics for a platform business are (among other outlined below) a condition sine qua non for any platform to be considered a Digital Platform.

Definition

[14] Van Alstyne, M., Parker, G. and Choudary, S. Pipelines, Platforms and the New Rules of Strategy. Harvard Business Review, April 2016

*A **platform business** is defined as a public or private organisation that enables value-creating interactions between participants using a common (technology) platform[15].*

Essentially platform businesses[16] have two main organisational characteristics:

- A first common denominator of platform businesses is that they **facilitate interactions between at least two distinct groups of participants** (hereafter sometimes referred as "multi-sided") to create or exchange *"something of value"* as part of the interaction. This "something of value" can be products, services, information, currencies or other assets that hold value in the eyes of the participants.
- Secondly, participants should use a **common (technology) platform** that establishes the standards, conditions and rules for the value-creating interaction to take place.

In the context of this report, four types of participants have been identified based on the role they play role in the platform business:

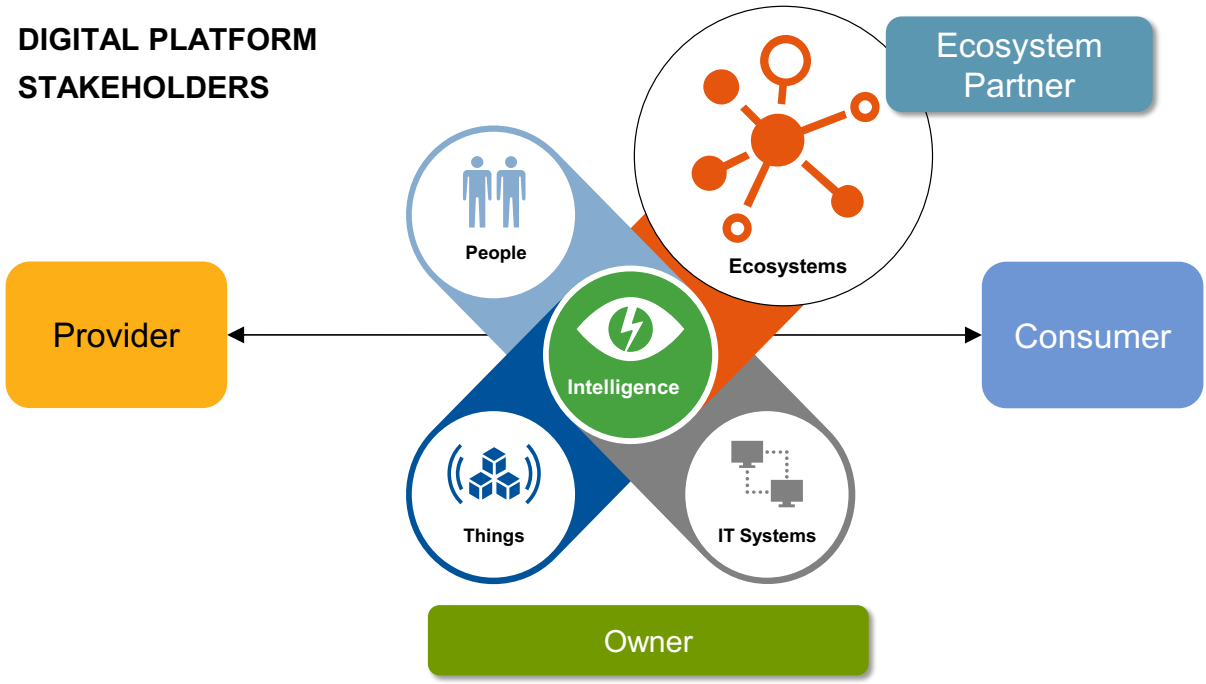
- **Provider:** A person, organisation or other entity that that provides products or services through the platform.
- **Consumer:** A person, organisation or other entity that consumes products or services through the platform.
- **Owner:** The entity that owns and sets the platform rules (including their integrity and enforcement) and business model.
- **Ecosystem Partner**: A person, organisation or other entity that works closely with the platform owner, often committing to only use that platform and in return gaining some level of influence over its direction.

In each of those categories, the participants can be (a combination of) governments, consumers/citizens and/or businesses.

[15]Common requirement of all leading economists that research platform businesses: Caillaud-Jullien, Sangeet Paul Choudary, Rochet & Tirole and others.

[16] Remark that platforms businesses have existed for years. Malls link consumers and merchants; newspapers connect subscribers and advertisers. What's changed in the last decades is that information technology has profoundly reduced the need to own physical infrastructure and assets. Digital technologies makes building and scaling up platforms vastly simpler and cheaper, allows nearly frictionless participation that strengthens network effects, and enhances the ability to capture, analyse, and exchange huge amounts of data that increase the platform's value to all.

Figure 4. Digital Platform Stakeholders



Vice versa, the same individual participant can play multiple roles on the same platform. This means the supply and demand model begins to blur; the supply side or demand side of these platforms can be a single enterprise or a group of enterprises, and they can be supplying and demanding at the same time:

- E.g., in the case of Amazon, they are both the owner of their eCommerce platform as well as the provider of products on that platform such their flagship eBook reader "Kindle"
- E.g., in the case of X-road, the Estonian government is the platform owner as well as (among others) data provider

Furthermore the platform owner might work with various ecosystem partners to enrich its platform and services.

- E.g., Google Maps is the base platform for many other platforms businesses (platform envelopment) such as Uber, Waze etc. who in turn make use or are embedded in other platforms
- E.g., in the case of Copernicus DIAS, the EU governments aspires to engage an ecosystem of developers to develop new services on the platform

As such the different participants in the platform(s) start to become intertwined and start to form a "networked marketplace". Value will be no longer created sequentially but primarily be created via the "networked marketplace" sharing products and services but also new forms of knowledge, information and data made possible by digital technology. They will allow addressing new market needs and potentially replace the way existing products and services are delivered. Value exchange will be facilitated by rules that are established by the participants engaged in those "networked marketplace" aka. an ecosystem.

Definition

*An **ecosystem** is an interdependent group of stakeholders (people, business and things) sharing a networked marketplace where multiple forms of value are exchanged to achieve a*

mutually beneficial purpose.[17] It enables various parties to expose their capabilities to others in order to achieve higher-level business value and outcomes.

Some organisations will create and run powerful ecosystems; others will participate. Two characteristics that make business ecosystems particularly unique in the age of digital business (also sometimes referred to as "digital ecosystems") are that: (1) They have the potential to become significantly broader and more complex; and (2) their characteristics are highly fluid and dynamic.

3.2 Economic Perspective: Multi-Sided Markets and Platform Business Models

To understand the basic economic logic and mechanism behind "platforms business models", it is essential to decompose the term into its constituent components, starting with what is a business model?

Definition

*A **business model** is a business design structure that guides an enterprise in organisation and retaining value.*

As indicated in section 3.1, value has to be understood broader then purely financial gains. This "something of value" can be products, services, information, currencies or other assets that hold value in the eyes of the participants. In the context of Digital Government Platform those value drivers can include amongst others increasing transparency in government operations, democratisation of government data usage and better citizen interactions (see section 4.2.2). As such the concept of business models also apply to governments in the context of Digital Platforms but value drivers will be and should be interpreted differently.

Sangeet Paul Choudary distinguishes between two broad families of business models[18]:

- A *traditional* or *pipeline* business model based on a linear value chain, with providers on one end and consumers on the other, thus creating enterprise value from the inside-out. In this model, providers create goods and services, push them out and sell them to consumers. Value is produced upstream and consumed downstream, i.e., there is a linear flow, much like water flowing through a pipe.
- A *platform business model* is a nonlinear, multi-dimensional design leveraging networks. In matching consumers and providers, or helping create/exchange goods, services and social currency, it lets participants capture value created from the outside-in, through ecosystems.

Definition

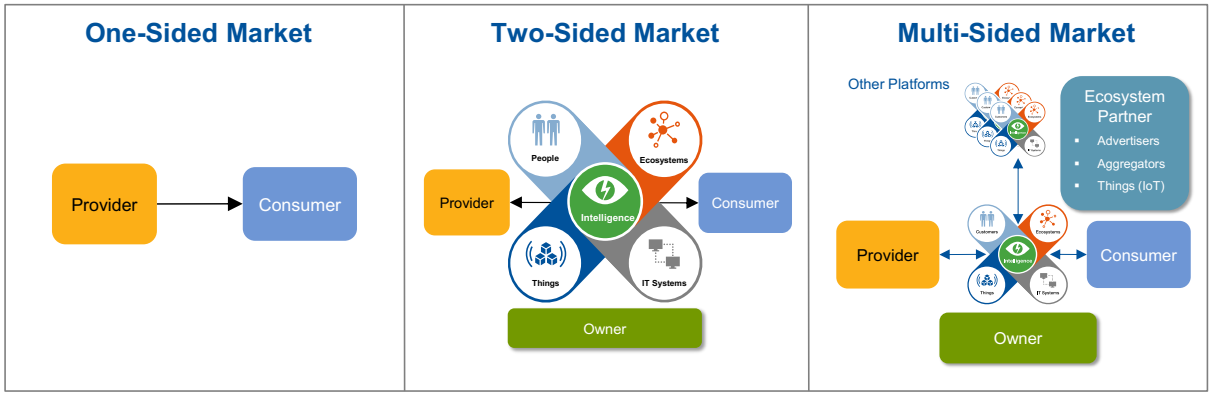
*A **platform business model** is a business design structure that leverages (indirect) network effects among providers and consumers and ecosystems of a platform to match, create and/or exchange assets such as goods, services, information or currency, so that all participants are able to capture value (multi-dimensional value creation).[19]*

[17] Based on Gartner Research: Brand, Saul. How to Evaluate Multisided Platform Investments. Gartner Research, 12 May 2017, ID G00327296
[18] Choudary, Sangeet Paul. Why Business Models Fail: Pipes vs. Platforms. Wired magazine, October 2010
[19] Based on Gartner Research: Winning in the Platform Game, Part 2: Create a Foundation for Platform Business Success, Kristin R. Moyer, Mary Mesaglio, Hung LeHong, Lee Weldon, Published 8 February 2017 - ID G00324943

Unlike pipes, platforms do not produce product and services through a linear process. They allow providers, consumers and ecosystem partners to all create and consume value.

In economics, platform business models only exist in markets known as "two-sided" or "multi-sided" where two or more types of participants are brought together by a platform to facilitate an exchange or a transaction that generates economic benefits for all participants. However, to date, there is no consensus definition of platform businesses, "two-sided" or "multi-sided" markets[20].

Figure 5. One-, two-, and multi-sided markets



Traditional direct consumer engagement.	An intermediary providing platform services brings providers and consumers together.	An intermediary and ecosystem partners provide complementarity platform services to providers and consumers.

- In **two-sided markets**, participants gain benefits from interacting with a separate, complementary class of participants. For example in the video game industry (e.g., Xbox or PlayStation), console owners are attracted to platforms with the most games, while innovative developers are attracted to platforms that have the most users.
  - Other private sector examples include Airbnb (apartment tenants and travellers), Uber (taxi drivers and travellers) and, eBay (buyers and sellers)
  - Public sector examples include the placement of jobseekers organised by public services (employers and job seekers)
- In **multi-sided markets**, participants with different business models are creating and exchanging value on the platform. For example, to provide an integrated travel experiences, companies such as travel agencies have served as focal points for multiple players — local transportation companies, event coordinators, tour guides, etc.
  - Other private sector examples: Amazon/Alibaba (cloud hosting, reseller, eCommerce platform owner, and more)
  - Other public sector examples: apps developed by third parties for public rail ticketing

[20]Martens, Bertin. An Economic Policy Perspective on Online Platforms. European Commission, Institute for prospective technological studies, Digital Economy Working Paper 2016/05

Economists initially became interested in platforms because of the indirect network effects: bringing more participants on board on one side of the market requires more participants on the other side and vice versa. In the early economic literature, if businesses experience indirect network effects, they classified as a multi-sided market according to the original Caillaud-Jullien (2003) definition of multi-sided markets.

Rochet-Tirole (2006) considered this definition to be over-inclusive precisely because any firm could be included in this definition. According to Jean Tirole[21], what makes a platform business different from a traditional one-sided markets is that the price charged between both providers and consumers for using the platform is not price neutral[22] (price externalities), complementary to the requirement of "indirect network effects":

"A market is two-sided if the platform can affect the volume of transactions by charging more to one side of the market and reducing the price paid by the other side by an equal amount. In other words, the price structure matters, and platforms must design it so as to bring both sides on board"[23]

This implies that the usage of the platform is sensitive to reallocations of the total price between the provider and the consumer. The value exchanged for providers and consumers needs to be set up in such a way that both providers and consumers benefit from interacting through the platform. This can be achieved by subsidising one side of the platform with the value gained from other sides of the platforms.

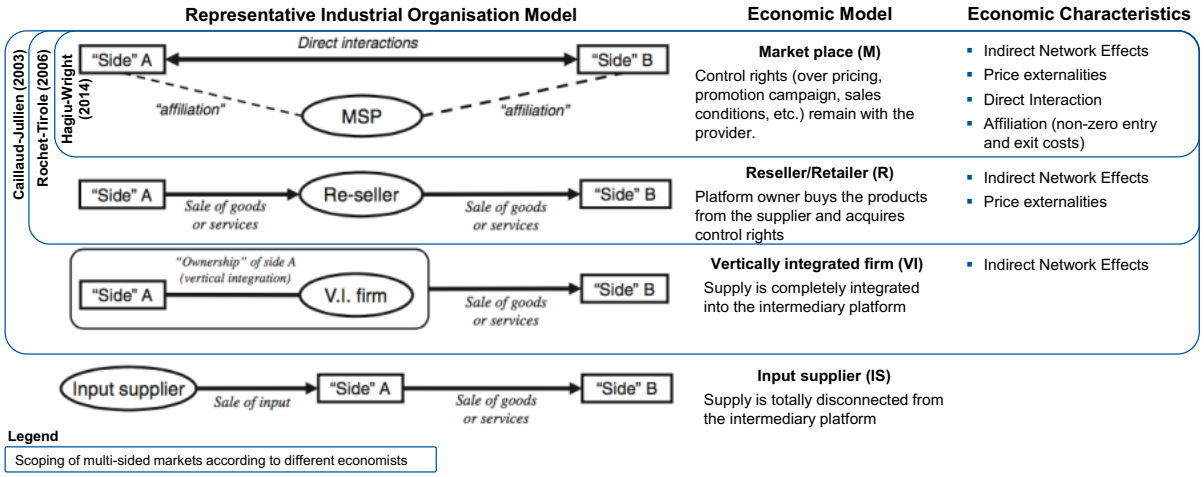
Hagiu-Wright (2014) proposed a further narrowing of the "multi-sided market" definition. By adding two conditions in addition to the indirect network effects:

a) direct interactions between sellers and buyers or between two or more distinct sides
b) each side is "affiliated" with the platform i.e., each side makes specific investments that binds them to the platform making it costly to leave (nonzero entry and exit costs)

At the same time Hagiu-Wright introduced a vertical integration dimension and distinguished between "marketplaces" and "retailers or re-sellers". The latter take control of the transaction while marketplaces let buyers and sellers interact more freely. The vertically integrated firm constitutes a separate group in the Hagiu-Wright categorisation because the platform operator "owns" the supplier. Retailers and vertically integrated firms fall outside the scope of a multi-sided market in the definition of Hagiu-Wright while Caillaud-Jullien would include them. Rochet-Tirole would only include retailers in the multi-sided market definition because, to the extent that they are market-makers, they can tweak the pricing structure of the inputs that they buy. Remark that an input supplier model (traditional market) is never considered to be a multi-sided market.

[21] Jean Tirole won the Nobel Prize for economics in 2014 and is a pioneer for defining a multi-sided platform (MSP), i.e. platforms with two or more sides in which the owner sets the rules for participation and pricing.
[22] Rochet, J.-C., & Tirole, J. Two-sided markets: a progress report. Rand Journal of Economics, 37(3), p.657, 2006
[23] Rochet, J.-C., & Tirole, J. Two-sided markets: a progress report. Rand Journal of Economics, 37(3), p.664-665, 2006

Figure 6. Different Types of Industrial Organisational Models



This short presentation of the history of economic research on platforms shows that, even at theoretical level, platform business models are a flexible concept. The empirical assessment of the magnitude of indirect network effects and the ability to manipulate the pricing structure will play a role in the classification of real-life cases. In practice, this implies that the classification into different types of industry organisation models (platforms, traditional business, vertically integrated firms or resellers) can only be done on a case-by-case basis, combining theoretical and empirical decision factors.

In the context of this report, the authors have opted to consider to the definition of Rochet-Tirole (2006) as a basis for considering platforms to operate in multi-sided markets. The minimum economic characteristics are limited to indirect network effects and price externalities.

Furthermore the authors have loosened the focus on the "price" aspect of the price externalities and have considered the condition of value to be captured by all sides of the platform (albeit it being through redistribution or subsidies) as a minimum criterion. The authors referred to this concepts as "multi-dimensional value creation". This is relevant in the context of many non-monetary transactions taking place on platforms, in particular in the context of public services where other (non-monetary) assets of value are more frequently transacted (e.g. data, social currency etc.).

The following subsections describe the economic factors of a platform business model in more detail:

- **Section 3.2.1: Indirect Network Effects ("Supply Economies of Scale")**

  This section introduces indirect network effects and explains how value to participants on one side of a platform typically increases with the number of participants on other sides of the platform.

- **Section 3.2.2: Multi-Dimensional Value Creation**

  This section explains how multi-dimensional value is created by reducing search costs and/or transaction costs for participants.

- **Section 3.2.3: Supply-Side Near-Zero Marginal Cost**

  This section outlines how economies of scale leading to near-zero marginal cost are achieved in case the average cost of serving a participant (on a given side) or the cost

of enabling an individual transaction declines with the total number of participants that participate or transact.

- **Section 3.2.4: Economic Barriers**

  This section indicates how high switching costs or high costs to belong to more than one competing ecosystem/network (multi-homing) are economic barriers to entry and/or exit for participants of the platform.

- **Section 3.2.5: Hybrid Business Models**

  This section exemplifies the complementary factor of linear and platform business models.

- **Section 3.2.6**: **Platform Business Model Types**

  This section distinguished and illustrates the four main platform business model types and their value creation mechanisms.

3.2.1 Indirect Network Effects ("Demand Economies of Scale")

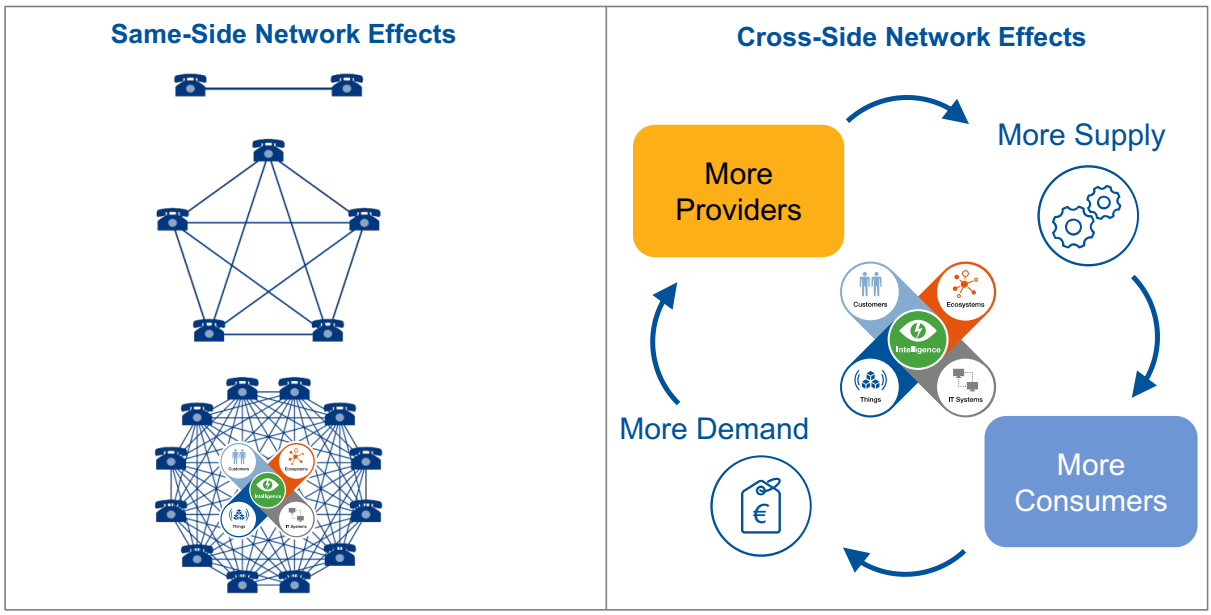
Economies of scale exist essentially in two variants, one which is driven by a function of production size (also usually referred as just 'economies of scale') and one variant which is driven by a function of usage (also referred to as 'network effects' or 'network externality'). In the former, scale leads to lower cost per unit of production (unit economic efficiency) while in the latter scale leads to more utility for the users (value). Both provide strong competitive advantages but network effects tend to be stronger and create higher barriers to exit for users.

Where supply economies of scale creating production efficiencies often drove strategic success in value chain models, platform businesses increase the potential impact of demand economies of scale as an equally viable strategy[24]. Demand economies of scale are driven by efficiencies in social networks, demand aggregation, app development, and other phenomena that make bigger networks more valuable to their users. They can give the owner of a platform market a network effect advantage that is extremely difficult for competitors to overcome. This focus on network effects drives growth for platform businesses; the value of the platform grows as it gains more users. Demand economies of scale are the fundamental source of positive network effects, and the chief driver of economic value in today's platform economy. Network effects or demand side economies of scale can broadly be further broken down into two categories:

- **"Direct" or "same-side" network effects:** An increase in usage leads to a direct increase in value for other users. For example, telephone systems, online gaming, and social networks all imply direct contact among users, i.e., users need to be in direct contact or "on the same side".
- **"Indirect" or "cross-side" network effects:** An increase in usage of one product or network spawn increases in the value of a complementary product or network, which can in turn increase the value of the original. This is why Apple iOS and Google Android might compete not just for users (consumers), but for software developers (providers) to create apps. The apps will increase the value for smartphones users (consumers) which will in turn make it more likely for new developers (providers) to produce more apps. Most platform-mediated businesses in two-sided markets are characterised by indirect network effects, including Digital Government Platforms. Once a critical mass of governments agencies is using a common platform to provide and or consume data that platform is likely to become the de facto standard for all data exchanges because of the network effects such as e.g. the case with X-Road in Estonia.

[24] Parker, G., Van Alstyne, M. and Choudary, S., "Platform Revolution: How Networked Markets Are Transforming the Economy — and How to Make Them Work for You," New York, NY: W.W. Norton & Company, 2016

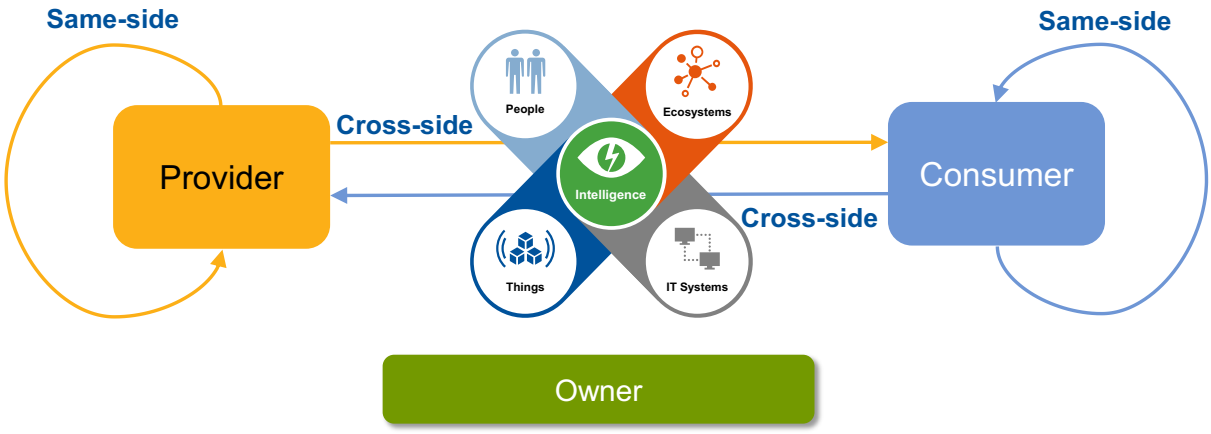
Figure 7. Same-side vs. cross-side network effects



Network effects should not necessarily be positive, negative network effects also exist, mostly in cases where the underlying infrastructure cannot scale as well as the network. This happens for example in the case of road infrastructure, because they do not scale exponentially, more users implies more congestion and leads to negative network effects.

Remark that a two-sided platform as described here is characterised by potentially four network effects, all of which can be both positive and negative.

Figure 8. Network effects in a two-sided platform businesses



3.2.2 Multi-Dimensional Value Creation

Platforms need to create value on each side of the platform in order to attract different participants (providers, consumers, ecosystem partners). Platforms can create value by reducing transaction costs for participants or by economies of scope in data collection and analysis for the platform owner:

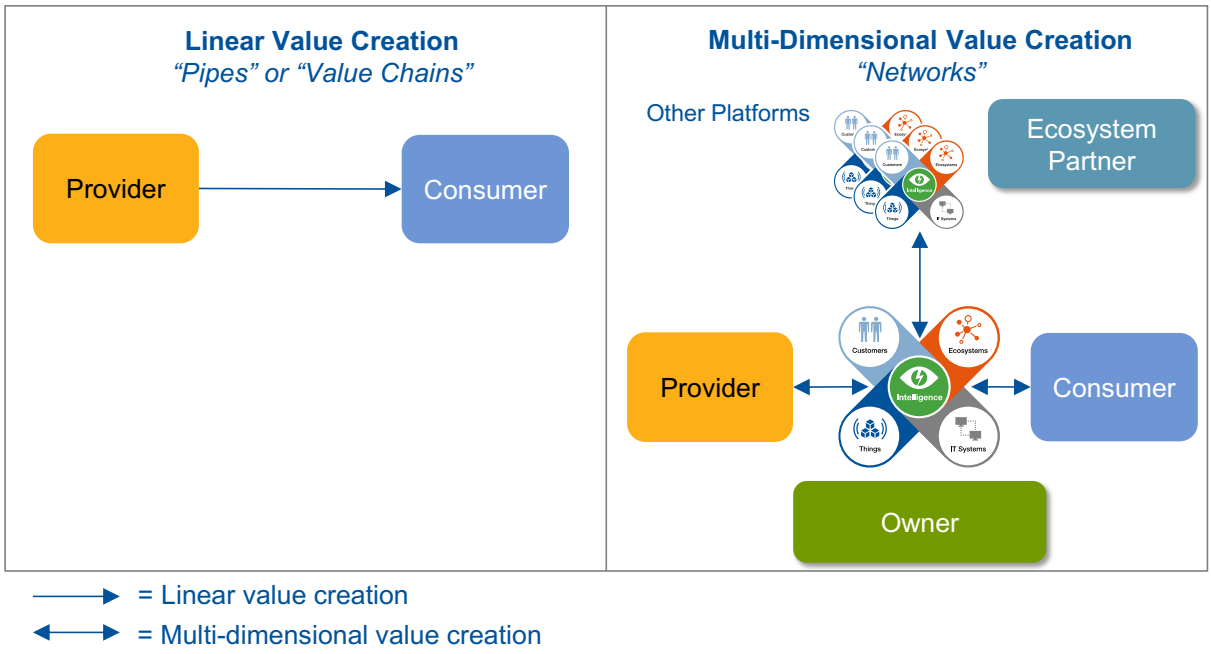
- **Reduction of transaction costs for participants**: The prime attracting factor of platforms is that it reduces transaction costs between distinct participants. It brings many consumers, providers and ecosystem partners together in a single place. That offers more variety to consumers and makes it easier to find the product or services they are looking for (reduction in search costs). For producers, it brings many consumers together in a single place and time slot and that generates economies of

scale in value generation. Both dynamics also apply in the context of Digital Government Platforms, the reason why many governments choose to develop Digital Platforms is to reduce the transaction costs for consumers of the platform by making it easier for e.g. service providers to find public auctions/procurements (e.g. Tender European Daily) or increase the use of open government data (e.g. Copernicus DIAS).

- **Economies of scope in data collection and analysis for the platform owner**: In a simple form, platforms offer a service helping participants to find each other in order to conclude a transaction. That puts the platform owner in a privileged position where they can observe and collect data on user behaviour, across all users and different sides of the market. The aggregation of this information gives the platform owner a comparative advantage over individual participants.

The task of the platform owner is to design a business and operating model where value is created and consumed on all sides of the platform in order to spike exponential growth of indirect network effects. This process might initially be characterised by the "chicken-and-egg" problem, i.e., one side of the platform needs to present on the platform to attract the other side and vice versa. To unlock this situation, the platform owner may temporarily need to invest in attracting an initial minimum critical capacity on either sides of the platform. The following Figure 9 depicts the multi-dimensional value creation process.

Figure 9. Linear vs. Multi-Dimensional Value Creation



Creating multi-dimensional value requires platform owners to think fundamentally different about various characteristics of their business and operating model. The below Table 1 summarises the key differentiating characteristics together with the mechanisms on either type of value creation mechanism.

Table 1. Linear vs. Multi-Dimensional Value Creation

Characteristic	Linear Value Creation	Multi-Dimensional Value Creation
Process	A linear business takes in components, creates finished products/services and sells them to consumers.	A platform business facilitates the exchange of value between two or more stakeholders, typically a consumer, a provider and other ecosystem partners.

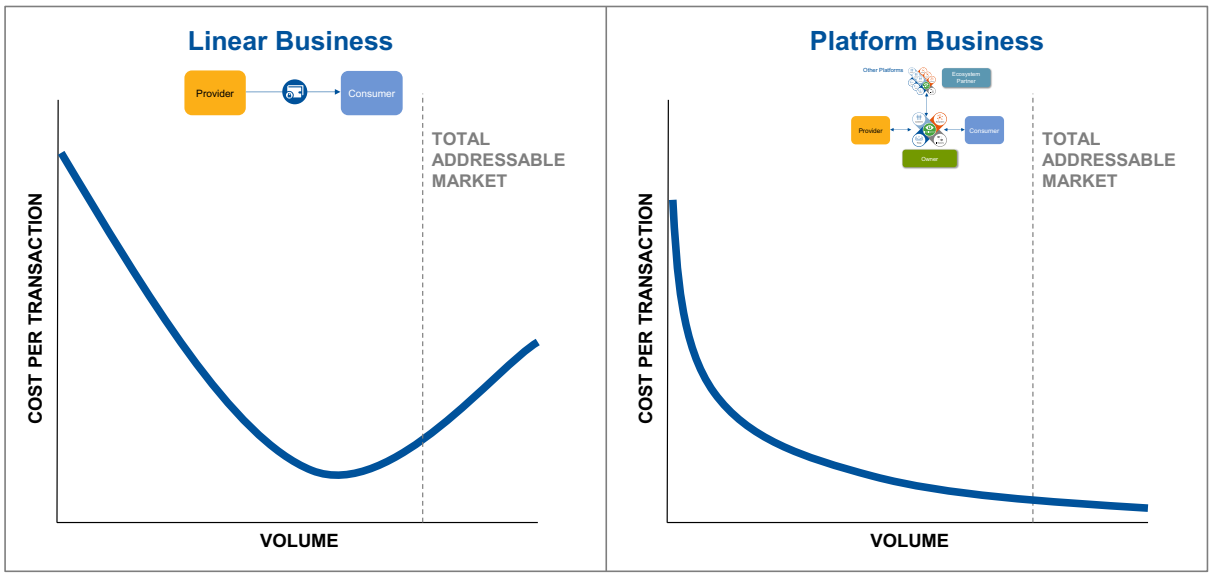
Characteristic	Linear Value Creation	Multi-Dimensional Value Creation
Value Creation	A linear business create value in the form of goods or services and then sell them to someone downstream in their supply chain.	A platform business is solely focused on building and facilitating an external network.
Scalability	A linear business generally scales linearly by adding staff or physical assets, or both. Since these tactics create value by controlling production, linear companies have to invest significant resources in expanding their capacity in order to sell more inventory.	A platform business scales exponentially as it becomes increasingly interesting for providers, consumers and ecosystem partners to join the same platform once
Design and Management	Creating a linear business requires to build with the consumer in mind.	Creating a business requires to build with multiple stakeholders in mind, producers, consumers and ecosystem partners.
User Acquisition	User acquisition is fairly straightforward for linear businesses. You get users in and convert them to transact. Much like driving footfalls into a retail or online stores and converting them.	Platform business suffer from a chicken and egg problem, they have often have no value when the first consumers come in and providers will not produce if there are no consumers. The initial focus of the platform owner is typically to get providers to produce.
Financial Planning	Linear business are typically capital intensive businesses. Financial success is often linked with the extent to which a linear organisation either makes the right capacity planning investments or successfully forward or backward integrates in the linear value chain.	Successful platform businesses typically have balance sheets with very limited equity capital. Inventory is owned by third parties and is not on the balance sheet of the platform owner. The network defines the financial success, not the financial investments themselves.
Monetisation	In a somewhat oversimplified view, monetisation for a linear business is based on the costs of running a unit through the value chain all the way to the end consumer while ensuring the price outweighs the costs made.	To understand monetisation on platforms business, more of a systems view is needed to balance out subsidies and prices (typically transaction cuts), and determine the traction needed on either side for the business model to work.

3.2.3 Supply-Side Near-Zero Marginal Cost

Successful platforms are not constrained by the typical U-shaped cost curve that characterise most linear businesses. U-shaped cost curves run into economic limits that make it at some point unprofitable to convert an additional consumer to buy a product or service, i.e., the market optimum has been achieved. Or in economic terms, the marginal cost of producing one additional unit outweighs the price for a product or service at that optimum.

Platform businesses typically have L-shaped cost curves, meaning that after an initial investment to produce the original version of a product or service, creating a copy of that product or service will cost next to nothing. In the language of economics, the product or service has near-zero marginal cost. Instead, these unit economics at near-zero marginal cost make it possible for successful platforms to grow to near the total size of the market. Consequently this means that usually only one or two platform companies will come to dominate a market.

Figure 10. U-shaped vs. L-shaped Cost-Volume Curves



The mechanism of near-zero marginal costs is not unique to platform businesses. Software business have also benefited from this economic characteristic on the consumer side i.e., producing a copy of a software is negligible once the software has been produced. E-commerce sites also benefit from this dynamic on the consumer side i.e., serving a large number of consumers becomes much cheaper and more efficient over time thanks to the near-zero marginal cost of serving one additional consumer.

Platform businesses however take this advantage even one step further. They remove the high fixed cost of creation and extend zero marginal costs to the supply side of the business. If Accor wants to add rooms, it needs to build more hotels, or as Marriott did, it needs to acquire them at great cost. When Airbnb wants to add more rooms, it just needs someone to create a new listing on its website. This costs next to nothing. It doesn't have to build rooms or acquire companies — it needs to acquire users.

Marriot wants to invest several 100 million $ to add 30,000 rooms in the coming years, Airbnb will add those in 2 weeks at virtually no cost.

Brian Chesky, co-founder Airbnb, January 2014.

In the context of governments, the near-zero marginal cost driving scalability is an important consideration for governments to adopt platform business models. Governments could in this way pool supply (e.g., data providers, procurement needs, etc.) and connect it better to demand (e.g., data consumers, service providers, etc.) without incurring high fixed costs themselves. This mechanism may work at different governmental levels, being it local, national or supranational level and for various aspects e.g.,

- Procurement: a platform pooling government supply or service requests and match them with supply or service providers.
  - ❑ Example: Tenders European Daily (TED)
- Service development: a platform business model where others may create and consume services.
  - ❑ Example: Copernicus DIAS
- Public service integration: a platform to connect government agencies with other government agencies or private stakeholders
  - ❑ Example: X-road

3.2.4 Economic Barriers

Platforms businesses have high barriers to entry or exit stemming from network effects. These barriers exist because of[25]:

- High switching costs implies it becomes increasingly difficult for competitors to enter the market as it would require deep pockets to switch consumers from the established network to join their new network. E.g., Apple's and Android's millions-strong network of app developers is a key reason they both dominate the premium smartphone market.
- High multi-homing costs implies that neither consumers nor providers will achieve any economies from actively using two platforms if those platforms offer the same functionality and market coverage i.e., "low niche specialisation". From a user perspective there would consequently be no incentive to multi-home on both platforms as it would only increase their costs.

Those barriers and related costs tend to lead to monopolistic and oligopolistic market structures (whereby only a limited number of platforms compete) when platforms are not interoperable. In that case the participants are forced to choose which platform they prefer and are likely to make their decision depending on the already established network, leading to further consolidation of the market.

3.2.5 Hybrid Business Models

While not adequate for every organisation or industry, combining both linear and platform businesses can be tremendously effective and lucrative — allowing a business to capitalise on the strengths of each business model. For example Apple takes a hybrid approach that combines linear and platform business models:

- On the one hand Apple's core revenue generator is still a linear business: designing and selling hardware, most notably iPhones, iPads, and iMacs. But, hardware and design innovations become quickly commoditised or replicated by competitors.
- On the other hand it initially differentiated itself from other smartphone manufacturers with its development platform (iOS) with 2 billion iOS app downloads in the first year alone after the App Store was launched. The core value to consumers is based on the large network of apps and app developers, which can't be replicated so easily by competitors as they would need to:
  - Attract/convert developers to develop services on their platform instead
  - Achieve at least the same base level of available services to attract the same consumers
  - Convert each consumer individually

3.2.6 Platform Business Models Types

The study distinguishes four platform business model[26] types that are changing the way organisations create business value in a platform business. The differentiation of those platforms business models resides in the mechanisms the platform uses for the ecosystem to create value. Four dominant mechanisms exist; collaboration, orchestration, creation or matching. Those mechanisms are not necessarily exclusive, meaning that on a single platform, multiple of these mechanism may enable value-creating interactions.

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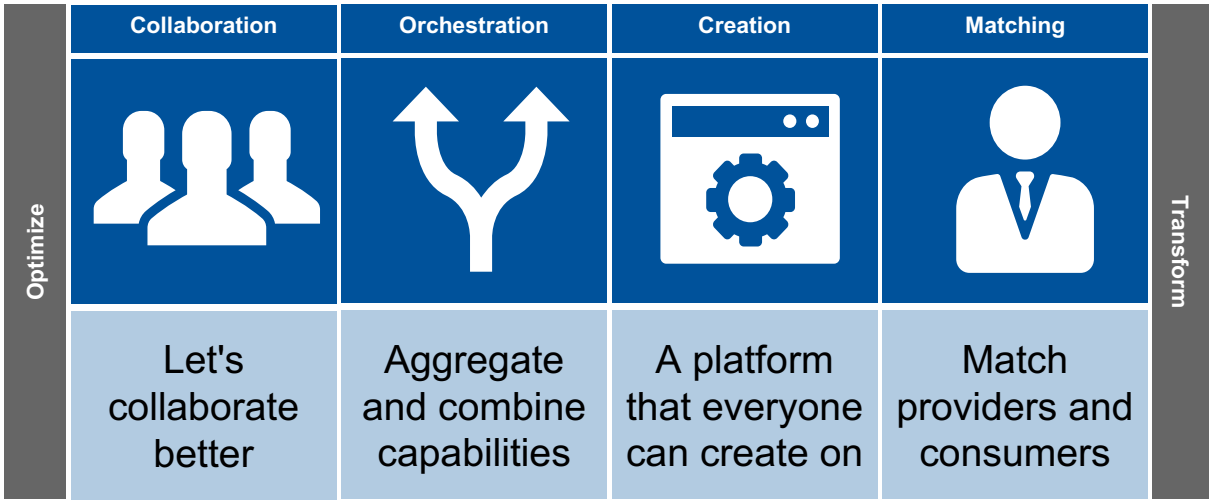
[25] Eisenmann, Parker, Van Alstyne, 2006. "Strategies for Two Sided Markets." *Harvard Business Review*

[26] Based on Gartner Research: Platform Business Models That Adapt and Disrupt, Kristin R. Moyer, Mary Mesaglio, Hung LeHong, Lee Weldon, 1 May 2017, ID G00322502

Figure 11. Platform Business Types



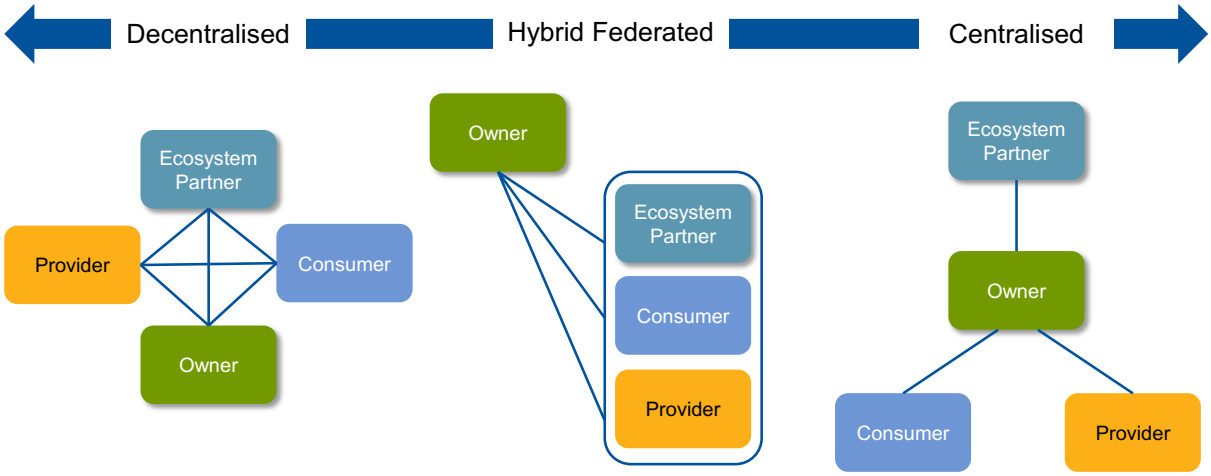
Definitions

- ***Collaboration Platform Business Model****: A type of platform business model that enables internal and/or external participants to work together in new ways. Collaboration can occur within the same ecosystem (such as e.g., between government agencies) or between different ecosystems (such as e.g., in public-private collaborations).*
  - ❑ For example a platform that enables teachers to share ideas with a community of students and get feedback.
- ***Orchestration Platform Business Model****: A type of platform business model that enables integration of business processes between providers and consumers or broader for a broader ecosystem. Orchestration platforms can also integrate with platforms of other business ecosystem partners.*
  - ❑ For example a platform that enables more seamless transactions to occur between healthcare payers, providers and consumers. It orchestrates and connects activities like scheduling, identity management, connectivity and payments for the business ecosystem.
- ***Creation Platform Business Model****: A type of platform business model that enables providers and business ecosystem partners to create new apps, products/services, capabilities and business models.*
  - ❑ For example a platform that provides APIs or software development kits (SDKs) to developers so they can create apps for that platform.
- ***Matching Platform Business Model****: A type of platform business model that enables providers to find consumers.*
  - ❑ For example a platform that matches property owners with people who need a place to stay.

3.3 Governance Perspective: Platform Governance Models

In the context of this study, governance refers to governance of the platform[27] or more specifically, from the perspective of directing and orchestrating the future developments of the platform and its ecosystem.

Figure 12. Platform Governance Models



Definition

*A **platform governance model** defines the decision rights and accountabilities empowering the set of rules concerning who gets to participate in the platform and its ecosystem, how to divide the value, and how to resolve conflicts.*

According to definition, platform governance covers a set of activities that may include:

- Defining policies and practices for providers, consumers and ecosystem partners to participate in the platform
- Monitoring and enforcing adherence to policies and practices by all platform participants
- Decision making on value redistribution of the platform (e.g., "subsidies" from one side to the other side)
- Ensuring that processes, behaviours, and procedures integrated by providers and ecosystem partners in accordance with policies (e.g., check whether applications created on the platform do not contain illegal content)
- Monitor value-generating interactions that occur on the platform
- Directs investments in accordance with platform objectives
- Direct resource allocation in accordance with platform and business priorities
- Provide assurances to stakeholders that good governance practices are applied (e.g., GDPR compliance)

This study distinguishes three governance model styles, ranging on a continuum from fully centralised governance models toward fully decentralised models. The below three provide examples at two ends and the mid-point of the continuum.

- **Decentralised:** Authority, responsibility, and decision making power are vested in and delegated to individual stakeholders who do not have a hierarchical, management, ownership or personal relationship. Individual stakeholders establish their own policies, standards, guidelines, procedures, and processes for ensuring the

[27] In the context of this report, platform governance does not cover, governance over the platform (such as e.g. rules imposed governments or multi-stakeholder self-regulations) or governance by the platform (e.g. governance over the usage of the platform compliant with applicable regulations).

development and implementation of Digital Platforms and mechanisms to communicate.

- **Centralised:** Authority, responsibility, and decision making power are vested solely within a central body. The centralised body establishes the policies, standards, guidelines, procedures, and processes for the development and implementation of Digital Platform strategies as well as in the creation of internal and external communication mechanisms.
- **Hybrid Federated:** Combines elements of both centralised and decentralised governance. Many variants exist of this model exist, e.g.:
    - The central authority may, based on its own preference, delegate part the platform responsibility to a decentralised community that may independently decide within the defined scope;
    - The central authority may consult a decentralised community for input on how to evolve the platform; or
    - An independent decentralised community may create certain leverage over the owner of the platform and direct the future evolutions of the platform.

As stated above, the three governance model styles operate in a continuum and often platforms apply a variant or combination of those governance models simultaneously. As platforms may build on top of other platforms, complex combinations may arise for which the analysis goes beyond the objectives of this study. For the purpose of this study the most dominant governance model will be considered as the reference model.

3.4 Technological Perspective: Digital Technology Systems

Technology is an important enabler for platform businesses and platform business models, but, as outlined above, using modern technology does not automatically make a business a platform business neither does it make a business model a platform business model. For example, Netflix is not a platform business despite being a technology company. Netflix is essentially a linear TV channel with a high technology-leveraged business model. Like HBO or Canal+, Netflix licenses or creates all its content, i.e., value is created (content producers/licensors) on one side of the platform and consumed on the other side (subscribers). There is no interaction between different stakeholders, neither directly, nor indirectly. Contrary, YouTube as a technology platform supports a platform business model because content is provided by various independent content producers and shared with many content consumers and both can interact (directly). Moreover, advertisers can leverage the data collected by the platform owner (Google) to place targeted ads based on the data collected through platform interactions.

Digital Platforms are enabled by digital technologies that extend beyond traditional IT systems to include user experience, Internet of Things, data analytics and a business ecosystem, all of which enable participation in a digital ecosystem. So in essence, where the business and business model define the differentiating characteristics for a “platform”, the technology perspective provides the essential characteristics for it to be a “digital” platform.

Definition

*A **digital technology system** is a set of cross-cutting, integrated, horizontal technology capabilities that enable platform business models. Those capabilities, described through the lens of applications and business capability components, coordinate business services across multiple domains such as user experience, ecosystem, Internet of Things, IT systems and data analytics.*[28]

[28] Based on Gartner Research: A Digital Government Technology system Is Essential to Government Transformation, Bill Finnerty, 23 January 2018, ID G00344044.

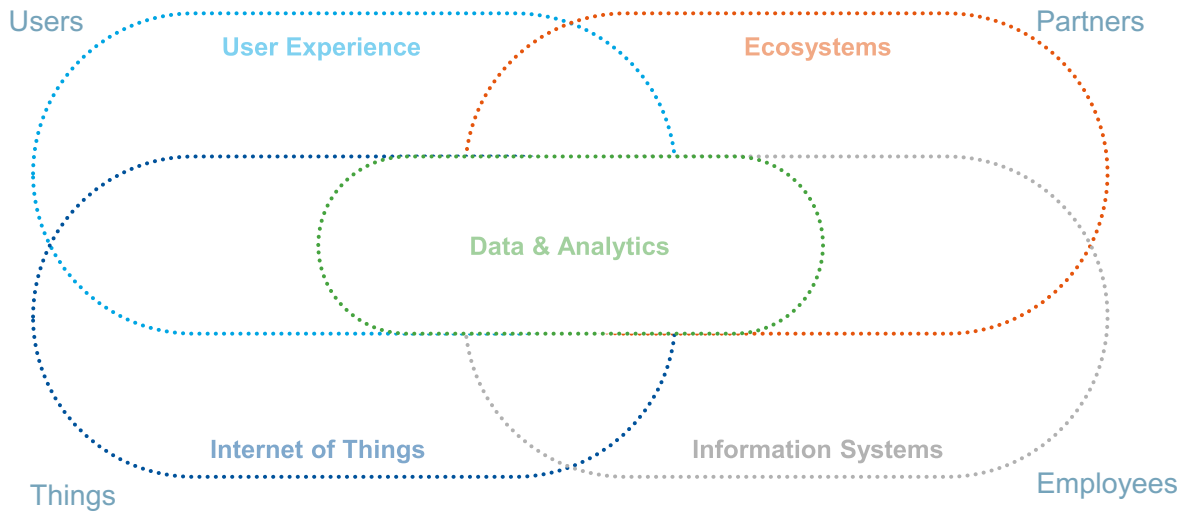
The goal of a digital technology system is to create a symbiotic collection of technology capabilities and components that form a technology system in support of platform business models. A business service-first model is one of the main attributes of a loosely coupled, interoperable digital technology system — think of building blocks (services) that can be easily rearranged to meet any need. The openness and composite nature of such a technology system is ideally suited to the external-facing capabilities required by new digital business processes and models. Consequently the digital technology systems described in this report are not typically purchased from a technology vendor as a single unit but consist of a combination of loosely coupled but tightly integrated set of technology building blocks. In the context of platform businesses, these building blocks typically extend beyond traditional IT systems to include user experience, things, intelligence and a business ecosystem, all of which enable participation in a digital ecosystem. Often, to meet these criteria, an organisation's IT landscape will need to evolve into a digital business technology system.

Definitions

Digital Platforms are typically supported by up to five cross-cutting, integrated, horizontal technological systems[29]:

- ***User Experience*** *— this technology capability covers the main customer-facing elements such as internet portals, mobile applications and other technology interfaces.*
- ***Ecosystems*** *— this technology capability supports the creation of, and connection to, external ecosystems, marketplaces and communities. API management, control and security are main supporting capabilities.*
- ***Data Analytics*** *— this technology capability contains information management, analytical and artificial intelligence (AI) capabilities. Data management programs and analytical applications fuel data-driven decision making, and algorithms automate discovery and action in the context of Digital Platforms.*
- ***Internet of Things (IoT)*** *— this technology capability connects physical assets for monitoring, optimisation, control and monetisation. Capabilities include connectivity and integration to core and operational technology (OT) systems.*
- ***Information Systems*** *— this technology capability supports the back office and operations such as ERP and core operational systems.*

Figure 13. Five horizontal digital technology systems that support a Digital Platform

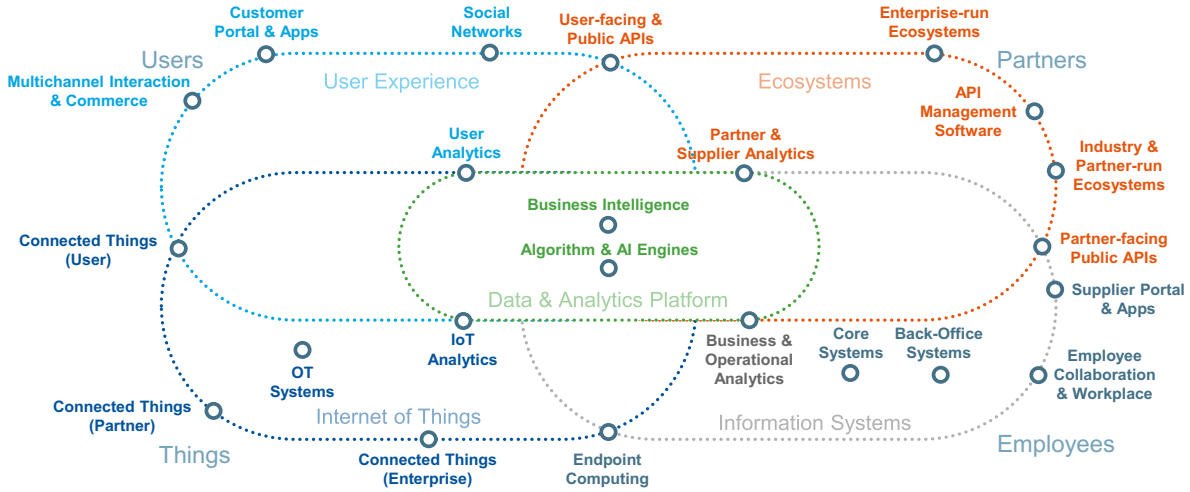


[29] Based on Gartner Research: A Digital Government Technology system Is Essential to Government Transformation, Bill Finnerty, 23 January 2018, ID G00344044.

Many organisations will emphasise some digital technology systems of the Digital Platform more than others. For example, many organisations have yet to leverage the Internet of Things to deliver value to customers. Some organisations are investing heavily in artificial intelligence, while others have not begun to use it.

The five horizontal technology systems outlined above can be broken down into numerous other more fine-grained technology systems that emerge, hype, become obsolete or mature throughout their lifecycle. The below Figure 14 provides an overview of the main sub-categories reflecting market trends at the time of writing of this report, without necessarily being exhaustive.

Figure 14. Fine-grained digital technology systems



3.5 Conclusions on key characteristics of Digital Platforms

The previous sections provided an overview of the main characteristics of Digital Platforms. Not all characteristics are considered to be essential. The overview presented below summarises the various characteristics outlined above and makes a distinction between the ones considered critical and the optional ones.

A platform is considered to be a Digital Platform if it at least has the following critical characteristics. The platform:

- **operates in a platform business,** this means the platform at the minimum:
  - facilitates **interactions between at least two distinct groups of participants**
  - **supports participants in creating or exchanging "something of value"** as part of the interactions that take place on the platform
  - establishes the **standards, conditions and rules** for the value-creating interaction to take place among the participants
- **operates a platform business model,** this means the platform at the minimum:
  - leverages **indirect network effects (demand economies of scale)**
  - creates **multi-dimensional value** (value for all distinct groups of participants)
  - is characterised by **supply-side near-zero marginal cost**
  - exploits **at least one of the four platform business model types:**
    - collaboration platform business model
    - orchestration platform business model

- creation platform business model
- matching platform business model

- has set up a centralised, decentralised or hybrid federated **platform governance model**
- **combines up to five cross-cutting, integrated, horizontal technology systems:**
  - user experience
  - Internet of Things
  - data analytics
  - information systems
  - ecosystems

In Appendix III — Digital Platform Case Study Overview, a high-level summary of the analysis of the various essential characteristics is included for each of the platforms that were selected to be included in the study.

Optionally, platform business model owners may actively seek to establish stronger platform businesses by:

- **adding additional sides/participants** to the platform business to strengthen the exponential effect of the indirect network effects, e.g., adding advertisers, developers, platform envelopment etc.
- **establish direct interactions between the platform participants**
- **create stronger affiliation with the platform**, this affiliation can be created by increasing the economic barriers for participants on the platform:
  - **increase switching costs** by e.g., reducing interoperability with other platforms
  - **increase multi-homing costs** by ensuring the platform offers similar functionality as competing platforms
- **maximise and monetise the data economies of scope** (information asymmetry)
- **complement the platform business model by a linear business model**

Those characteristics, although not essential, are often identified in the context of the various platforms analysed in the context of this study.

4.0 Case Study Analysis of Digital Platforms

This chapter presents the case study analysis of the Digital Platforms analysed in the context of this study. This chapter covers three sections:

- **Section 4.1 Digital Platforms and the role of governments in these platforms**
- **Section 4.2 Drivers and Challenges for Digital Platforms owned or funded by Government**
- **Section 4.3 Cost and Benefits of Digital Platforms**
- **Section 4.4 The role of location information in Digital Platform environments**

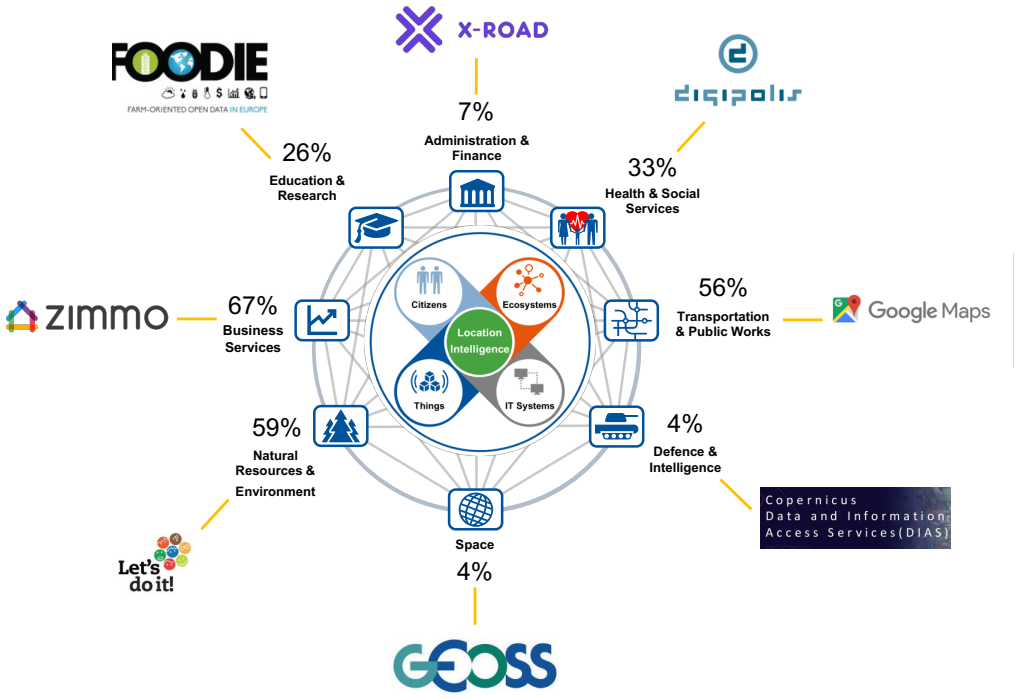
The Digital Platforms were selected to represent a distribution in order to reach the following research objectives:

- Understand what Digital Platforms environments are
- Identify potential implications for governments
- Evaluate the role of location in Digital Platform environments

Firstly, case studies were selected based on ownership type with 9 platforms owned by government, and 18 platforms owned by private sector stakeholders. Hybrid public-private partnerships for digital platforms were not observed.

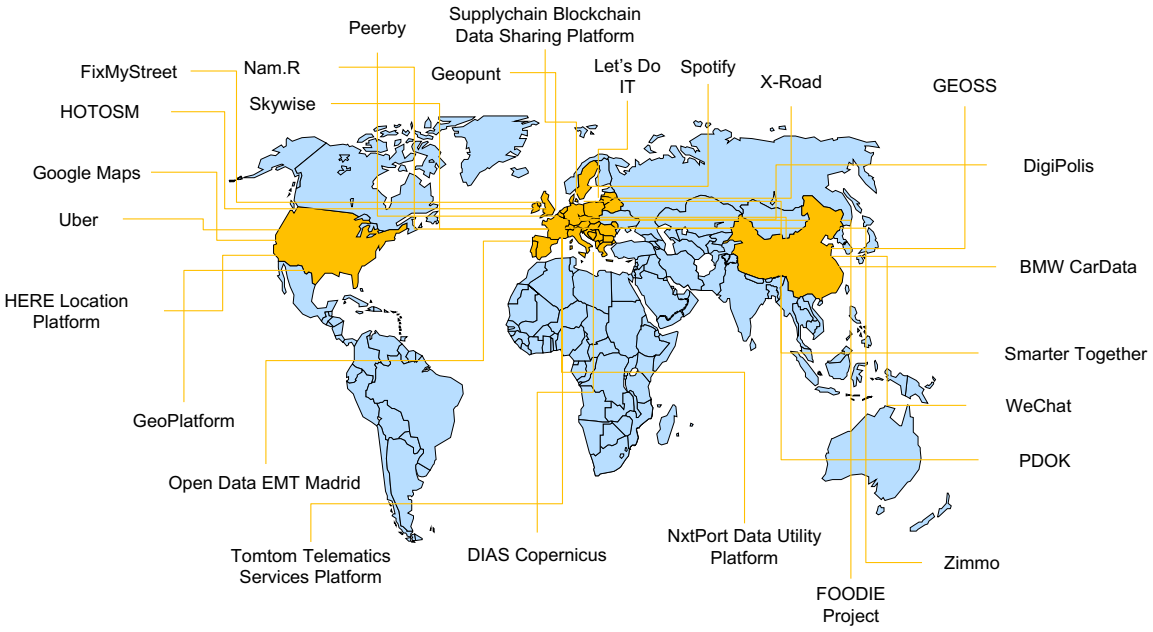
Secondly, case studies were selected based their distribution of the sectors in which they operate. Digital Platforms typically operate across multiple sectors, as for example Google Maps applies to both the business (e.g. providing advertisements for private sector firms on maps) and transport sector (e.g. integrating with public transport real-time information in the city of New York), as well as the business services sector. Most platforms included in the analysis are operating in the business sector. Also, more than half of the selected platforms contribute to the natural resources and environment sector, as well as the transportation and public works sector. An overview of the distribution of the sectors to which Digital Platforms apply is provided in Figure 15.

Figure 15. Overview of Digital Platform domains



Thirdly, cased studies were selected based on geographic distribution of their origin. An overview of geographic distribution of the origin of the selected Digital Platforms is displayed in Figure 16.

Figure 16. Geographic distribution of the origin of the 27 Digital Platforms



4.1 Digital Platforms and the role of governments in these platforms

The role of government perspective captures the different approaches that governments can take for the delivery of digital public services. Governments can play an internal or external role in a Digital Platform:

- **Internal roles** include those where the government is an internal participant in the Digital Platform by creating its own Digital Platforms or by participating in the ecosystem as consumer or provider, including those operated by other governments and commercial organisations.
- **External roles** include those where the government regulates or influences platform ecosystems and markets by developing and enforcing guidelines, policies and regulations. External roles may also include cases whereby the government engages in indirect funding initiatives (e.g., organising hackathons, grant and funding programmes targeted at specific digital technology developments, incubator hubs etc.).

External roles of governments in Digital Platforms were not explicitly analysed in the context of this report. A brief summary of some of the key messages and areas for further research is provided in Section 4.1.4.

The active government roles observed in this work include:

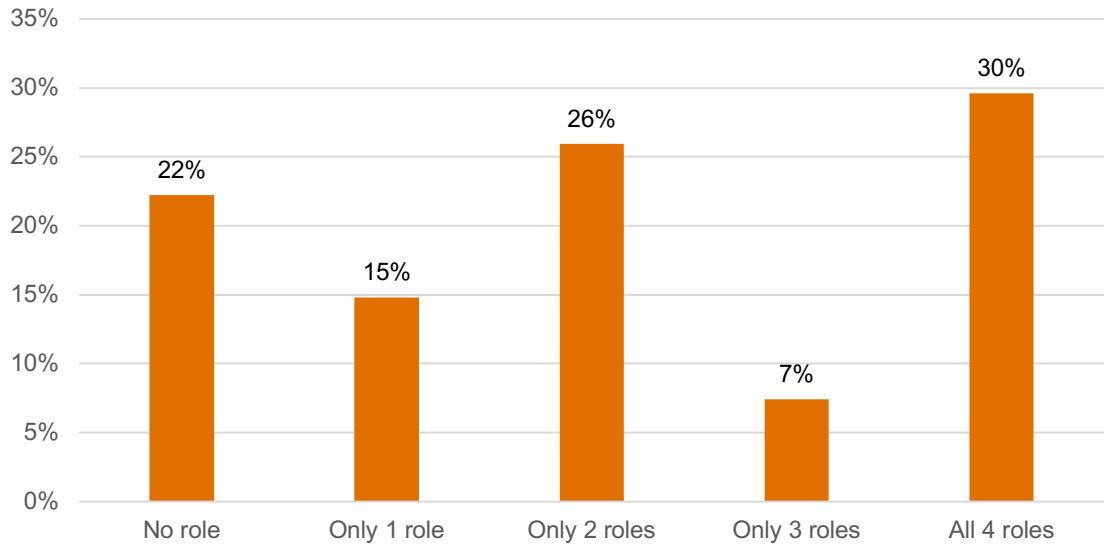
- **Owner** of a Digital Platform where governments establish their own Digital Platforms, including the cases of publicly owned corporations and public-private-partnerships (PPPs) which blur the boundaries between the public sector and private sector.
- **Funder** of Digital Platform services covers cases where the government actively engages in direct funding initiatives to create Digital Platform services.

- **Provider** of digital public services as input to Digital Platforms, these cases include making available data and supporting services that feed Digital Platform services (e.g., open data, actively supporting third party app development, etc.).
- **Consumer** of Digital Platform services (these services can be delivered by commercial enterprises, non-profit organisations, citizen or other public authorities).

A Government organisation can take multiple internal roles in a Digital Platform, and various combinations have been observed during the interviews and data analysis.

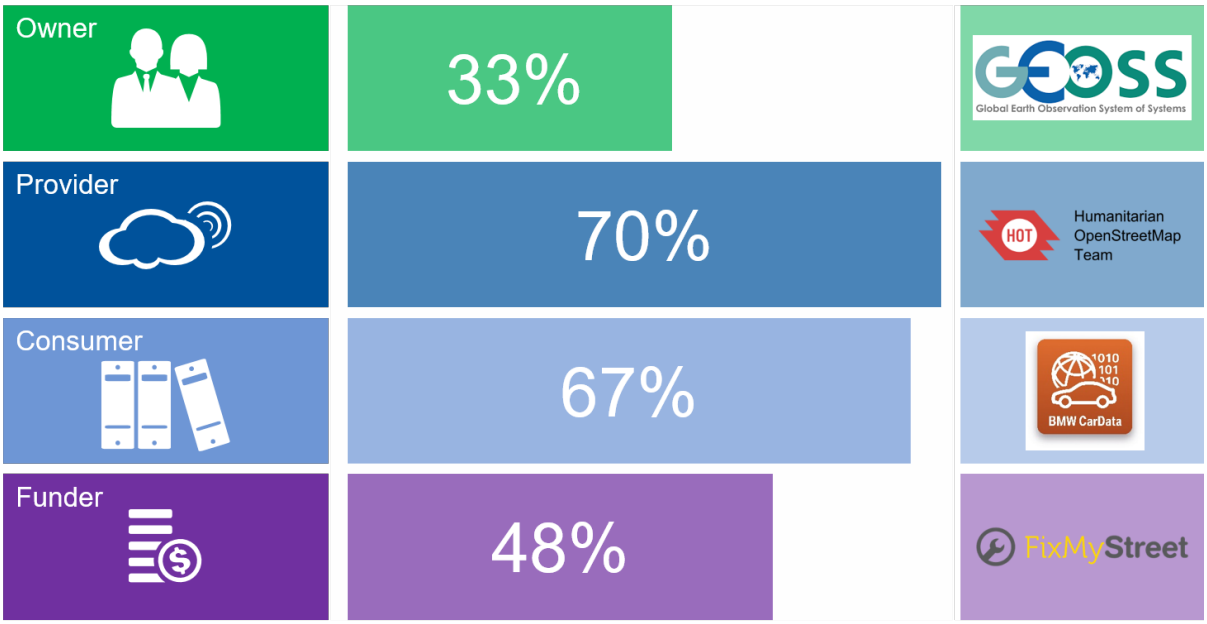
Governments play an internal role in almost 80% of the platforms studied. Governments are flexible in terms of which internal roles they play on these platforms and the different combinations of internal roles they play. In 30% of the cases, they are active in all four internal roles. Figure 17 below illustrates these combinations of roles.

Figure 17. Number of internal roles that government plays in platforms



The Figure 18 below demonstrates that government assumes the internal role of provider and consumer in about 70% of the cases, funder in half of the platforms, owner in a third of the platforms analysed. It also provides examples of platforms where these internal roles for governments were clearly observed.

Figure 18. Internal roles of government

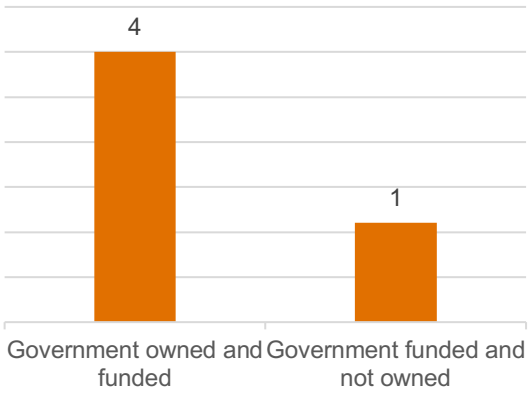


The following sections provide a further analysis of the different internal roles in which government can act on Digital Platforms.

4.1.1 Government in the role of owner of a Digital Platform

A first role for government is to create a Digital Platform, either by owning it or by directly funding it. (For example: Copernicus DIAS, see text box on the right). In all cases analysed, funded and/or owned, the government took control of the platform and steered its developments. Four of the platforms analysed in the context of this study are government owned and funded, and one of them is only government funded, as depicted in the Figure 19.

Figure 19. Number of platforms when government is owner/funder



The following sections of the study cover a comparison between Digital Platforms owned by Governments and the ones owned by private sector (some of which are directly funded by government grants and other means of financial support mechanisms).

The analysis highlights:

- **Section 4.1.1.1 Differences in lifecycle stage**
- **Section 4.1.1.2 Differences in business models**
- **Section 4.1.1.3 Differences in values propositions**
- **Section 4.1.1.4 Differences in number of providers and consumers**
- **Section 4.1.1.5 Differences in incentives mechanisms**
- **Section 4.1.1.6 Differences in technologies deployed**
- **Section 4.1.1.7 Differences in governance models**

COPERNICUS DATA AND INFORMATION SERVICES (DIAS)

The DIAS Platform is an European data access and cloud processing service, open for entrepreneurs, developers and the general public to build and exploit the Copernicus data services. By providing data and information access alongside processing resources, tools and other relevant data, it will boost user uptake, stimulate innovation and the creation of new business models based on Earth Observation data and information. This includes a marketplace for services and offerings using the Copernicus data. The providers are the Sentinel Satellites of the Copernicus programme. The DIAS program intends not just to bring the data to the end user, but to have the data already service ready.

4.1.1.1 Differences in lifecycle stage

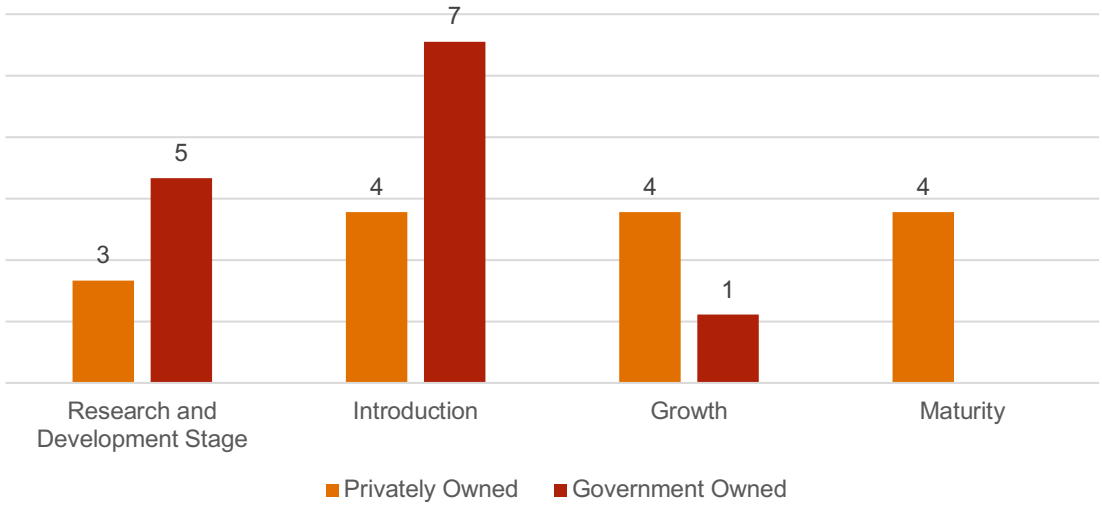
The following comparative analysis demonstrates the differences in lifecycle stage between Digital Platforms owned by governments and the ones owned by private sector stakeholders. The analysis is based on the data presented in Appendix III of this report. Table 11 in the Appendix provides an indication of the lifecycle stage in which the Digital Platform currently is:

- **Research and Development Stage** – In this stage of the lifecycle, a Digital Platform is on the table of design, experiment and research. The platform owner devises a

strategy, business case and designs for the future state Digital Platform and addresses aspects such as identifying providers, consumers, which business model, which governance model and which technology systems to use.

- **Introduction Stage** – In this stage of the lifecycle the platform is launched and made available to its target providers, consumers and ecosystem partners. This stage is typically the most expensive for an organisation launching a Digital Platform. The number of providers and consumers of the platform is still small, which means the number of interactions are low, resulting in limited economies of scope for the platform owner. On the other hand, the costs of marketing, promotions and subsidies needed to launch the Digital Platform can be very high, especially if the platform is launched in a competitive sector or the platform competes with a traditional "linear value chain" and needs to capture the market.
- **Growth Stage** – The growth stage is typically characterized by strong growth in usage of the Digital Platform. The platform starts to benefit from indirect network effects and as the number of interactions increases, the economies of scope increase. This allows organisations to derive value from the interactions and data collected, which can in turn be invested in promotions and competitive acquisitions to maximize the potential of this growth stage. In the growth stage the platform also typically has established mechanisms for various stakeholders to identify themselves on the platform which allow the owner to start tracking and collecting information about the different interactions occurring on the platform.
- **Maturity Stage** – During the maturity stage, the Digital Platform is established and the aim for the owner is now to maintain the market share they have built up by exploiting the network effects, increasing exit barriers for users and fighting off competition by matching the quality and functionality provided by peers and start-ups.

Figure 20. Differences in lifecycle stage between Digital Government Platforms and privately owned Digital Platforms (number of observations)



The analysis in Figure 20 demonstrates that in the context of the platforms analysed in this report, the ones considered from the private sector were more developed (with more than 50% in either growth or maturity stage) than the ones owned by governments (with only 11% of the platforms in growth stage and none in maturity stage). This could be explained by the fact that the concept of a Digital Platform originated in the private sector, and the concept of Digital Platforms penetrated the public sector later.

The analysis shows a large number of platforms that are currently in the introduction lifecycle stage. In this stage, the platform is already launched and made available to its target providers,

consumers and ecosystem partners. Although the platforms do not have the large amount of customers and providers as in the growth stage, the platform owners already made significant investment in setting up the platform, doing initial marketing and connecting to providers and consumers. A large number of government-owned platforms have made these investments and are expected move towards the growth stage in the (near/medium-term) future.

In addition, the distribution of lifecycle stages across the platforms that are considered from the private sector are much more evenly distributed (in terms of percentage of platforms in each maturity stage). The government owned platforms are less evenly distributed, indicating a later entry into the concept but an increase in interest over the last period. More than 30% of the government-owned platforms analysed are still in R&D phase and are expected to move to more mature lifecycle phases throughout the coming years. One theme that surfaces from the interviews and research around maturity of government Digital Platforms is the concept of "digital identities". Currently elements of what constitutes a "digital entity" from a legal, technical and economic point of view are not fully established across the EU and is considered to be an important area for further research and policy making.

An example of a Digital Platform owned by a government is X-Road. This Digital Platform with an orchestration model is the infrastructure for all Digital Government services provided by the Estonian Government, and it allows various public and private sector e-Service databases to link up and function in an orchestrated way. Multiple public organisations (as well as private ones) are using the platform continuously. They are now exploring the expansion to other countries as well, hence this platform is in the Growth lifecycle stage.

4.1.1.2 Differences in business models

This section provides a deep dive into the current state of play of Digital Platforms from a Business Model perspective. As described in section 3.2.6, a platform business model is a non-linear, multi-dimensional design leveraging network effects. The business models are not necessarily exclusive, meaning that on one single platform, multiple business models may enable value-creating interactions. Digital Platforms analysed in this study often contained multiple business models.

In Figure 21, an overview of the business models underlying Digital Platforms is provided. Orchestration business models are dominantly observed in Digital Platforms analysed in the context of this study. An example of a Digital Platform with an orchestration business model is Digipolis (see textbox on the right). Collaboration business models are least often observed in these case studies analysed.

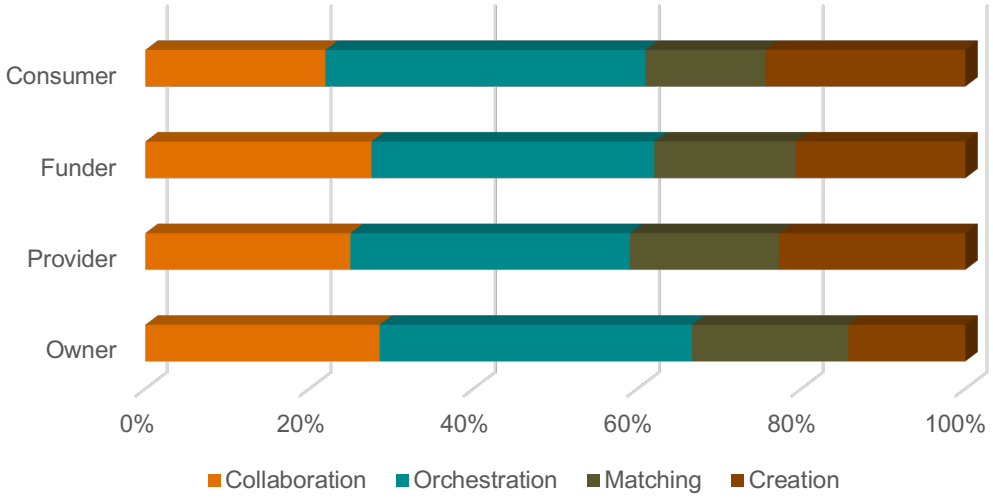
Figure 21. Overview of Business Models (number of observations)

The platform business model type is linked with the type of platform governance model (see also Section 4.1.2), whereby creation and matching models tend to have more centralised governance models and collaboration and orchestration models are more likely to have decentralised governance models. This can be explained by the fact that collaboration and orchestration models depend more heavily on the cooperation of consumers, providers and ecosystem partners in defining the rules and ways of operation of the Digital Platform. Creation business models are rarely observed when a decentralised governance model is present. Also, when a Digital Platform is focused on collaboration, a hybrid-federated governance model is observed half of the time. If the business model of the Digital Platform is focused on matching, the platform is likely to have a centralised governance model.

Digital Government Platforms are most often making use of the orchestration and collaboration business models, regardless of the government's role on the platform. This observation fits naturally with the current trend towards a more connected Digital Government, requiring stronger integration and collaboration between a diverse set of stakeholders.

Digital Platforms that are characterised by a creation and matching business model are less often used by Digital Government Platforms, with some specific exceptions such as the DIAS, Digipolis and Geopunt platforms. However, governments often act as providers and consumers in privately owned Digital Platforms with creation or matching business models.

Figure 22. Role of government in relation to business models



4.1.1.3 Differences in value propositions

GEOPLATFORM

GeoPlatform supports geospatial resource sharing across the U.S. Government, allowing users to use web services or access one of the 160.000 geospatial datasets. The platform also provides a domain for communities to collaborate and share experiences. The platform is clearly founded on a number of information systems. Web services are at the core of the GeoPlatform; their goal is to encourage dynamic geospatial data sharing online. The GeoPlatform Cloud allows data providers to share their geospatial data online. User assistance is provided by sharing tutorials and training material for producing compliant metadata, registering data, and Community administration. Digital maps can be accessed via ArcGIS Online and GeoPlatform Map Viewer.

The value proposition of Digital Platforms differ between government and private Digital Platforms. The key difference observed is that for private Digital Platforms the value proposition is more focused on leveraging network effects for one specific service ("demand-oriented") compared to government Digital Platforms where the value creation is linked to public policy objectives such as open data and citizen engagement ("supply-oriented").

Government Digital Platforms

In government Digital Platforms the value proposition is often focused at creating value of open data (for example Nam.R), combining various public services (for example GeoPlatform) and tailoring public services based on citizen preferences and location (for example FixMyStreet). This can be explained by the motivation of governments to participate in these ecosystems, as these value propositions clearly bring benefit to important policy domains. For cases where government owns the platforms, the value proposition is most often focused on creating multiple services on top of (open) datasets. One example is GeoPunt, where the value proposition is "*to provide the central gateway to geographic government information of the Flemish Government and provide tailored services for citizens and businesses.*"

Private Digital Platforms

In private sector platforms, the value proposition is often focused on leveraging network effects for one specific service. An example is Booking.com that "*provides travellers the ability to book hotels online while browsing through user reviews and visuals at best available price, while providing additional travel services like transport as well.*" The services are created driven by a need of the customer and not by the data that is available as often is done in platforms where governments are in the lead. The main focus of the value proposition is to leverage the network effects for the specific core service and generate value for both the consumer, the providers and the owner of the platform by doing so.

4.1.1.4 Differences in number of providers and consumers

The number of providers and consumers differ slightly between government and private Digital Platforms. The main difference is observed in the amount of providers. Private sector platforms use a larger amount of providers to create value on the platform compared to government Digital Platforms. It is difficult to assess the total amount of consumers, as the public information for this is limited.

Government Digital Platforms

Government Digital Platforms focus much more on gathering and combining multiple datasets than on having a variety of suppliers. One example of this can be found at PDOK, where the

government is a platform owner in a collaboration between the Cadastre, the Ministries of Infrastructure and Environment, Economic Affairs, Rijkswaterstaat and Geonovum; which are all public actors. The datasets are provided by the Dutch government and public administrations, and the incentives for public organisations to provide these datasets and put effort into it, is to reuse public sector data, stimulate innovation and provide better services to society (as well as complying with Dutch and European policies for providing geospatial data from the government). The amount of providers is limited, yet the value is created by the total amount of different datasets and the combination thereof.

Private Digital Platforms

The focus of private Digital Platforms is often more targeted at leveraging network effects for a specific service (as elaborated in section 4.1.1.3). This also causes the platform to incorporate a larger variety of providers and preferably a large variety of consumers as well. Looking at Spotify, for example, providers are two-fold:

- Providers of the music: artists, labels and record companies
- Providers for the advertisements: advertisement companies.

The incentive to be a provider to the platform, is additional exposure to fans, the ability to publish music, the possibilities to collaborate with other artists and increased royalties for the artists. For the advertisers, it is a channel that allows for detailed personal marketing campaigns. The more complete and varied this set of providers is, the more value Spotify is able to create. Therefore, the effort these platforms put into building and expanding the provider network is significant, leading to a greater amount of providers compared to government Digital Platforms.

4.1.1.5 Differences in incentives mechanisms

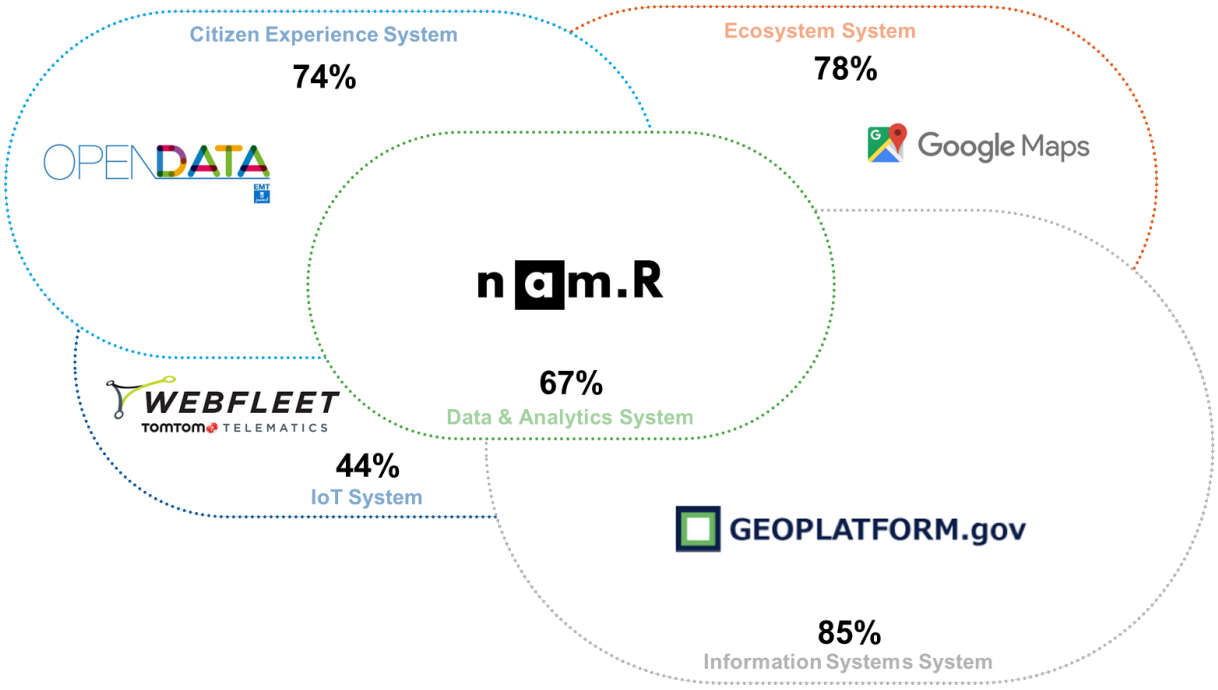
The incentives for providers to participate on the Digital Platform was already briefly elaborated in section 4.1.1.4, and the differences in focus between government and private Digital Platforms also result in differences in the incentive mechanisms between the two types. The incentive mechanisms are separated for consumers and providers.

- **Providers**: The key difference is that providers are often driven by either policy goals or compliance with regulation in government Digital Platforms. Providers in private Digital Platform are more incentivized by the additional revenue potential and the network effects that are leveraged from the consumer side of the platform.
- **Consumers**: The difference between private and government Digital Platforms is limited for the consumers, as in both types of platforms, the consumer is driven by the ability to receive the services provided on the platform itself (that can range from insights into the right neighbourhoods to build a house to the match between a driver and a passenger). The difference is that often consumers are incentivized by the variety of providers on private sector Digital Platforms (for example Booking.com), and that consumers are incentivized in government Digital Platforms by the fact that often the service can only in a limited way be obtained in other platforms (for example GeoPunt).

4.1.1.6 Differences in technologies deployed

This section presents the current state of play of case studies from the perspective of the technology systems which are the technical foundation of Digital Platforms. Digital Platforms can be composed of one or more of the following systems: user experience, ecosystem, data analytics, IoT and information systems. Figure 23 provides an overview of the distribution of the technology systems of Digital Platforms.

Figure 23. Overview of technology systems used across the full set of Digital Platforms



Based on the case studies collected, the empirical analysis of this study concludes that information systems are the most commonly found systems in Digital Platforms. An example of a Digital Platform that contains a large number of supporting information systems is GeoPlatform (see textbox on the left of this page). Most Digital Platforms build further on existing IT systems and this explains that those systems still often are the cornerstone of the Digital Platform architecture. In addition, an IoT system is found in less than half of the Digital Platforms because of the technology still being relatively new and not as widely adopted yet. Also, in over three quarters of the Digital Platforms, an ecosystem system is found. Ecosystems are essential to open up the platform to ecosystems partners and essential to designing and developing the ecosystem. User experience systems are found in just under three quarters of the Digital Platforms. Lastly, Data analytics systems are observed in two-thirds of the Digital Platforms.

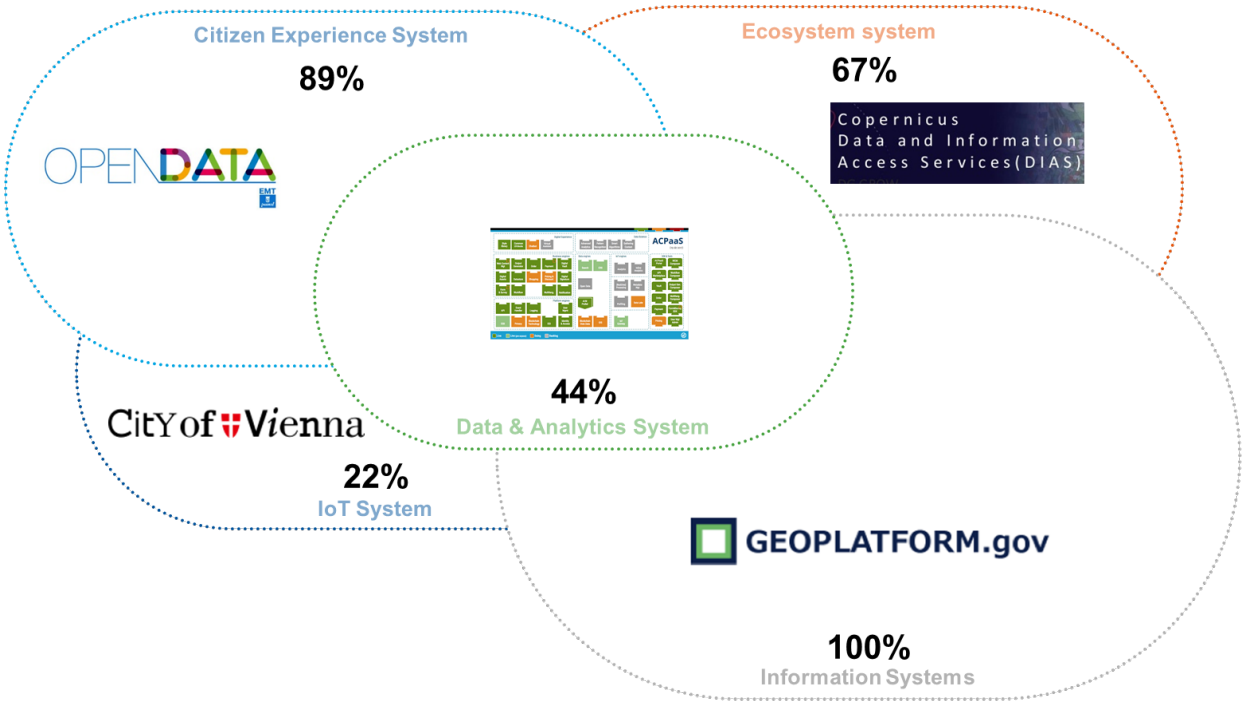
Some technology systems are found more often than others, depending on the business model of the Digital Platform (see also section 4.1.1.2):

- Information system platforms are apparent regardless of the business model but is most often found in Digital Platforms that contain an orchestration business model
- In creation business models, ecosystem systems are often found as they are an essential component to engage ecosystems to operate on the platform (e.g. application developers using APIs)
- IoT systems are found in less than half of the Digital Platforms that contain a collaboration or matching business model

IoT implementations are not yet widely spread, however Digital Platforms that are more mature in their development lifecycle tend to include more IoT system components (see also section 4.1.1.1)

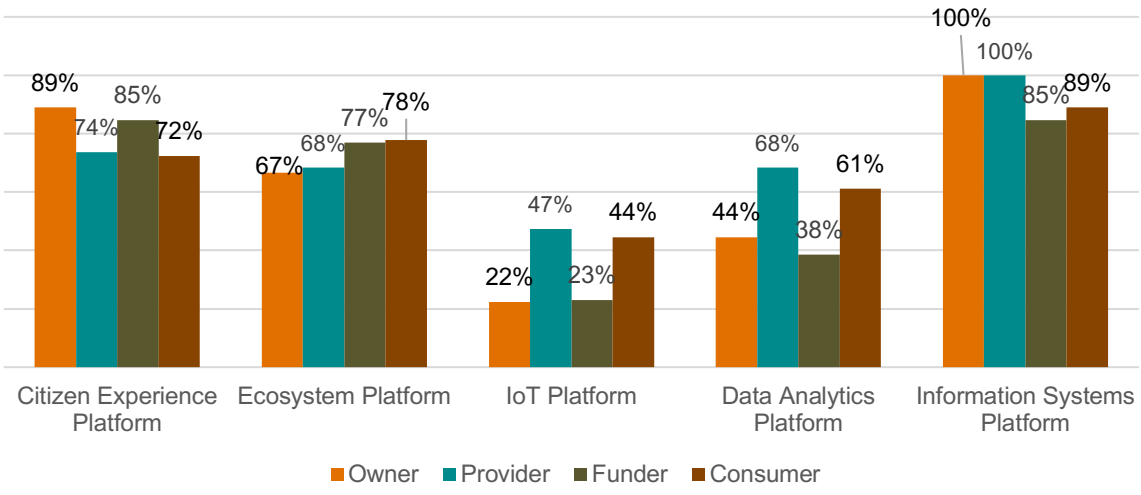
When government is owner, the technologies are mainly user (citizen) experience and information system and there are less often IoT and data analytics systems than when government provides or consumes data from a privately owned Digital Platform (see Figure 24).

Figure 24. Government owned platforms and the technology systems



As indicated in Figure 25 below, Governments play very often a role in information systems, with owner and provider in all cases and funder and consumer in almost all of the cases. Governments play also often a role in user experience systems, with owner and funder in most of the cases and provider and consumer in near 75% of the cases.

Figure 25. Platform technology and role of government

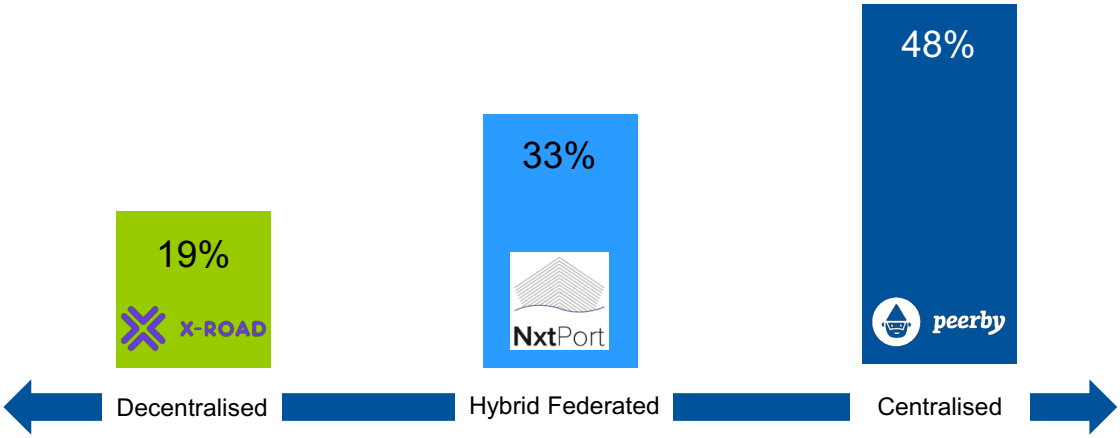


4.1.1.7 Differences in governance models

Digital Platforms are governed by a wide range of governance models, ranging from highly centralised toward fully decentralised models. In light of this study, a governance model is the conceptual structure of the platform that combines decision-making structures, operating procedures and collaboration enablers in order to govern the platform (see section 3.3). Figure 26 provides an overview of the most commonly observed governance models. Centralised governance models are dominant in Digital Platforms. Also, hybrid-federated governance models are observed in one third of the case studies. An example of a Digital Platform with a hybrid-federated governance model is NextPort (see textbox on the left). Lastly, decentralised

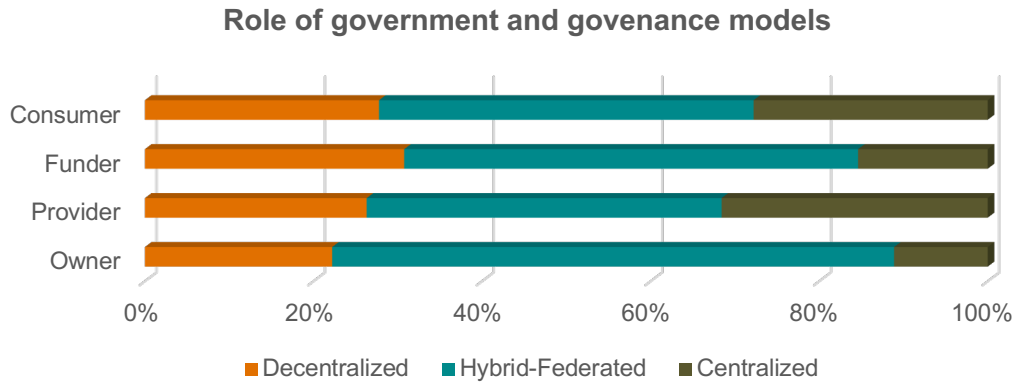
governance models are only found in one fifth of the platforms. The tendency toward mostly centralised governance model is likely to be driven by the economic characteristics of Digital Platforms and the focus of the platform owners to exploit economies of scope to their benefit, for example by monetising the data collected on the platform through advertisements.

Figure 26. Overview of Governance Models



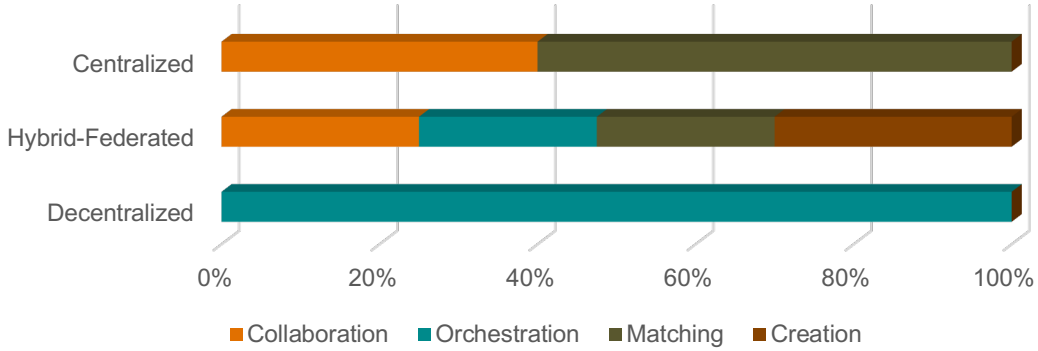
When governments own or fund digital platforms, the hybrid-federated governance model dominates strongly. Digital Government Platforms linked to the EU government context tend to focus on this governance model because it fits very well with the subsidiarity and sovereignty principles on which the European Union is founded.

Figure 27. Role of government and governance model



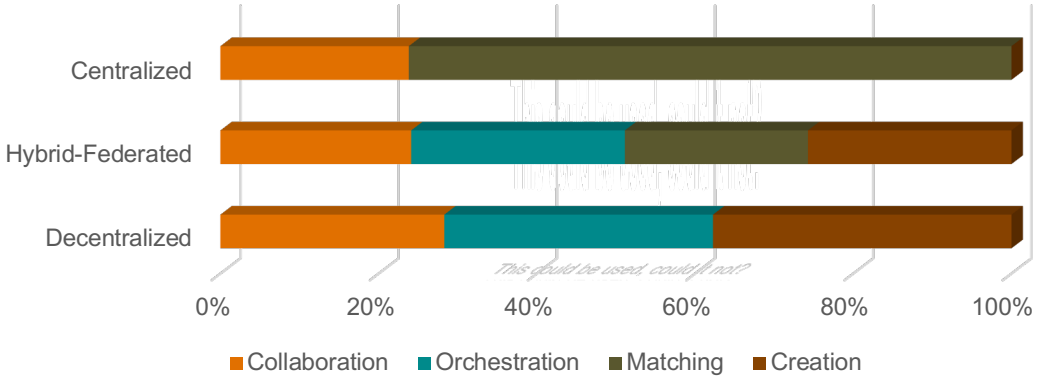
As indicated in Figure 28 below, when government is owner, and there is a centralised governance model, the business model is either collaboration or matching. When there is a decentralised governance model, there is only one business model: orchestration.

Figure 28. Business models and governance models when government is owner



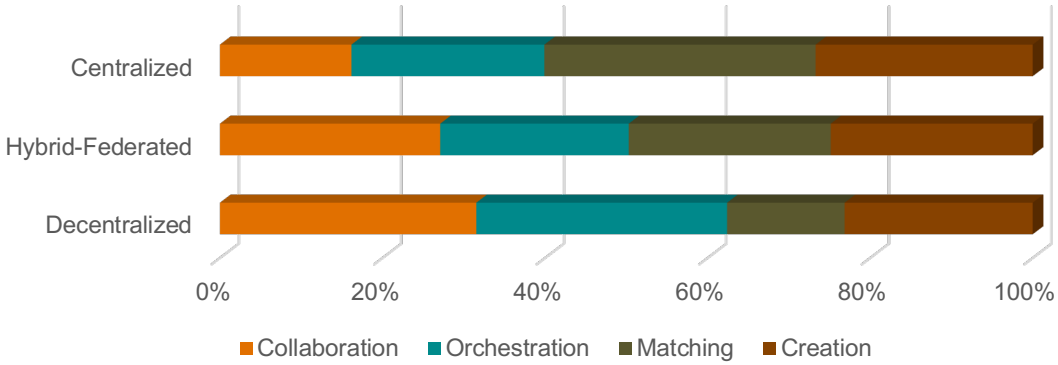
As indicated in Figure 29 below, when government is funder, and there is a centralised governance model, the business model is either collaboration or matching. When there is a decentralised governance model, there is no matching business model.

Figure 29. Business models and governance models when government is funder



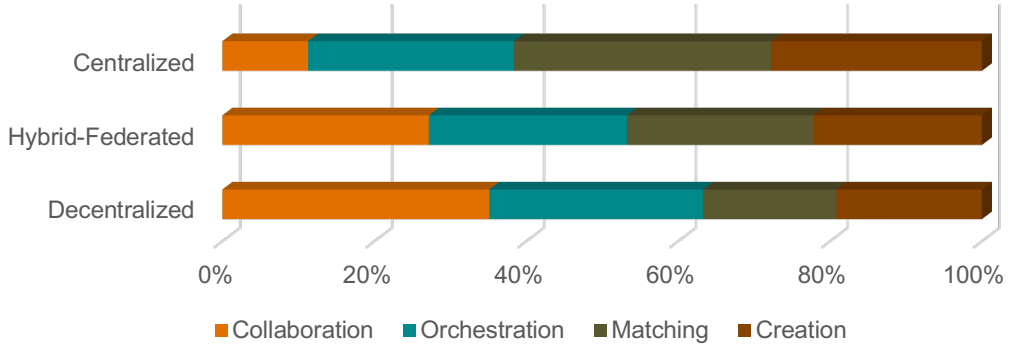
As indicated in Figure 30 below, when government is provider, there is no specific typology identified.

Figure 30. Business models and governance models when government is provider



-
- As indicated in Figure 31 below, when government is consumer, there is no specific typology identified.

Figure 31. Business models and governance models when government is consumer



NAM R

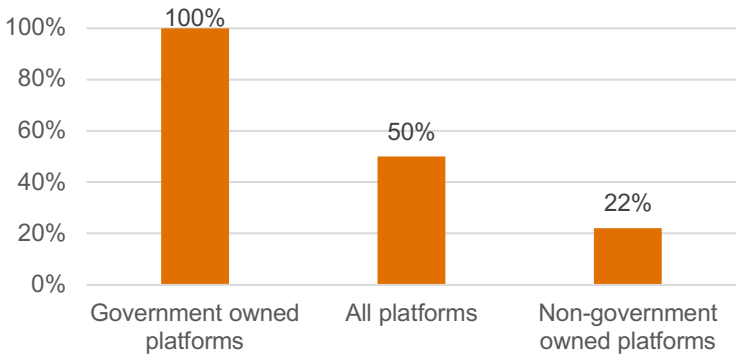
nam.R develops customized data packages for different sectors, that are updated on a continual basis. The nam.R platform is connected to open data platforms, and it customizes it with geolocation information and specific industry data. For example, the French schools use data form nam.R to create the lunch menus based on seasonal products available from local farmers.

4.1.2Government in the role of provider to a Digital Platform

Sharing data on a platform does not limit the role of government to funding or owning a platform. Governments can provide/share government data and services on another government or private Digital Platform.

On the selected set analysed we have observed the role of government as provider for all government Digital Platforms (9 cases). Government provides data to half of the platforms studied. Whereas government is data provider to all government owned platforms, government does provide data to non-government owned platforms in almost quarter of the cases (4 cases), as depicted in the Figure 31 below. Example: Nam.R (see box on the left).

Figure 32.Platforms when government is data provider

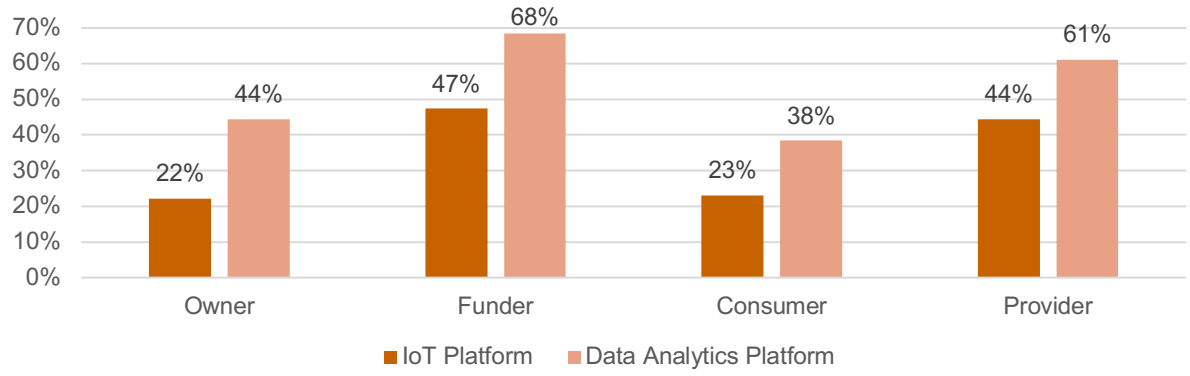


However, when it comes to government owned platforms which would also host/provide data from the private sector, this has not been observed, at least not in the area of Spatial Data Infrastructure (SDI) related Digital Platforms.

The added value from government as data provider is also seen when they provide/combine open geospatial data and other open data in the same service.

However, the interviews highlight that there is room for a creation platform run by the private sector to enhance public data quality (completeness, correctness, metadata completion, predictions etc…) with the use of analytics, as the example of NamR. Governments need predictive capabilities, more information and knowledge, rather than only data on their platforms. This observation aligns with benchmark data which highlights that the government's role in data analytics and IoT systems is higher as funder and data provider than as owner or consumer, as shown in the Figure 33 below.

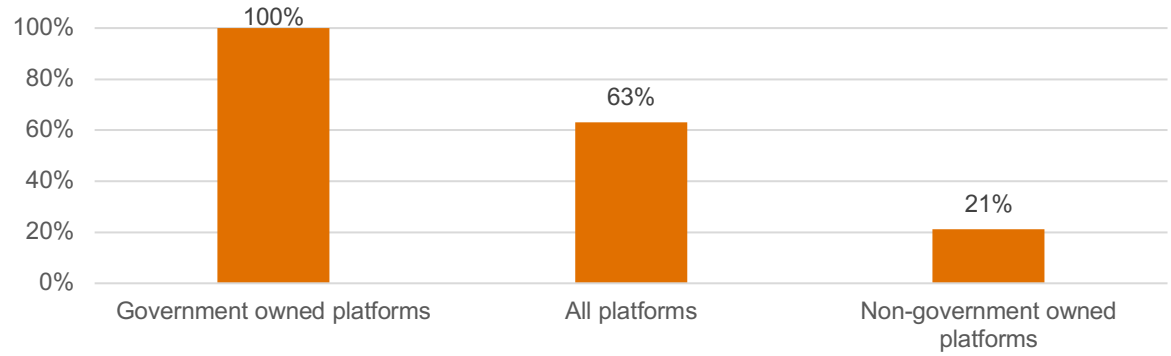
Figure 33. Government's role in data analytics systems



4.1.3 Government in the role of consumer of a Digital Platform

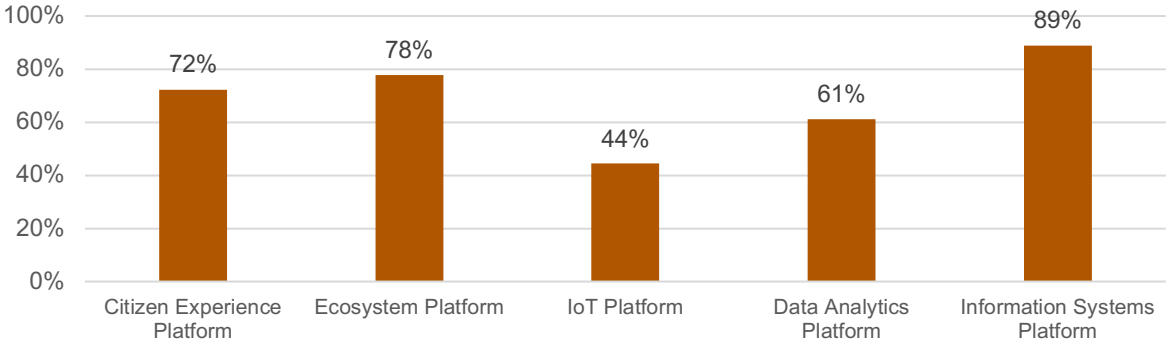
Besides acting as providers of data services to Digital Platforms, governments are also typically heavy consumers of such platforms. As depicted below in Figure 34 below, governments consume data and services from both public and private Digital Platforms. In all cases (9) government Digital Platforms were consumed by other governments. In the list of case studies analysed, governments were consuming data from more than half of the Digital Platforms analysed and of about one out of five non-government owned Digital Platforms.

Figure 34. Platforms when government is data consumer



Governments also connect to various types of technology systems to consume data with the majority of connections still via more traditional information systems, there is however already a good representation of the use of ecosystem and citizen experience technology platform components. The consumption of IoT technology systems, data and services has been observed the least in the context of this study with only 44% (or 4 cases) of where governments consumed data or services directly from IoT technology components. See below Figure 35 for further details.

Figure 35. Platforms government consumes data from all types of technology systems



4.1.4 External roles of Government for Digital Platforms

Government can create an enabling environment ensuring inclusiveness: it is a necessity to adapt to digitalisation, so governments should ensure infrastructure and skills are up to speed in order to reduce the digital divide. However throughout the analysis it became clear that this is an important area for further research as the regulatory and legislative system needs to evolve at the same pace as the technology and ecosystems evolve. The current trends towards global monopolisation, 'uberisation' of the labour market and privacy concerns are just but few of those challenges that Digital Platform pose for society today.

The role of public authorities will need to adapt, as explained by the French Council of State in its report from 2017[30] stating: "*Thinking disruption — behind the term "uberisation", a powerful, emerging phenomenon is disrupting the benchmarks and balances of the traditional economy with, at the centre of the phenomenon, Digital Platforms and the technological ecosystem they entail. The power of the changes taking place calls for an analysis of the strengths and weaknesses of our legal system to anticipate legal and public policy developments and provide comprehensive answers, on a European and national scale*"[31].

The European Commission has made a public consultation in 2016 on the regulatory environment for platforms, online intermediaries and the collaborative economy, pointing to benefits and emerging issues linked to online platforms[32]. The Commission's Communication on Online Platforms[33], published on 25 May 2016 identified the main areas where further attention is needed. The guiding policy principles pursued by the Commission are:

- A level playing field for comparable digital services; and
- Ensuring that online platforms behave responsibly to protect core values; and
- Fostering trust, transparency and ensuring fairness; and
- Keeping markets open and non-discriminatory to foster a data-driven economy.

Rather than regulating on the business models, governments can be providers of proportionate policy measures which can influence the way the platform is managed. They can create a fairer ecosystem by changing the governance surrounding the business model of platforms which can abuse a unique/dominant position versus their users. Such governance measures would relate to transparency and issue solving mediation between the platform owner and the data provider.

[30] http://www.ladocumentationfrancaise.fr/rapports-publics/174000714-etude-annuelle-2017-du-conseil-d-etat-puissance-publique-et-plateformes-numeriques

[31] http://www.conseil-etat.fr/content/download/112373/1132737/version/1/file/EA17_synth%C3%A8se_d%C3%A9finitive_EN.pdf (English summary)

[32] https://ec.europa.eu/digital-single-market/en/news/full-report-results-public-consultation-regulatory-environment-platforms-online-intermediaries

[33] https://ec.europa.eu/digital-single-market/en/policies/online-platforms

4.2 Drivers and Challenges for Digital Platforms owned or funded by Government

This section summarises the results of analysis of the 'public task' in relation to Digital Platforms. It describes, based on data collected through interviews and desk research, what are the reasons/drivers for governments to own or fund Digital Platforms.

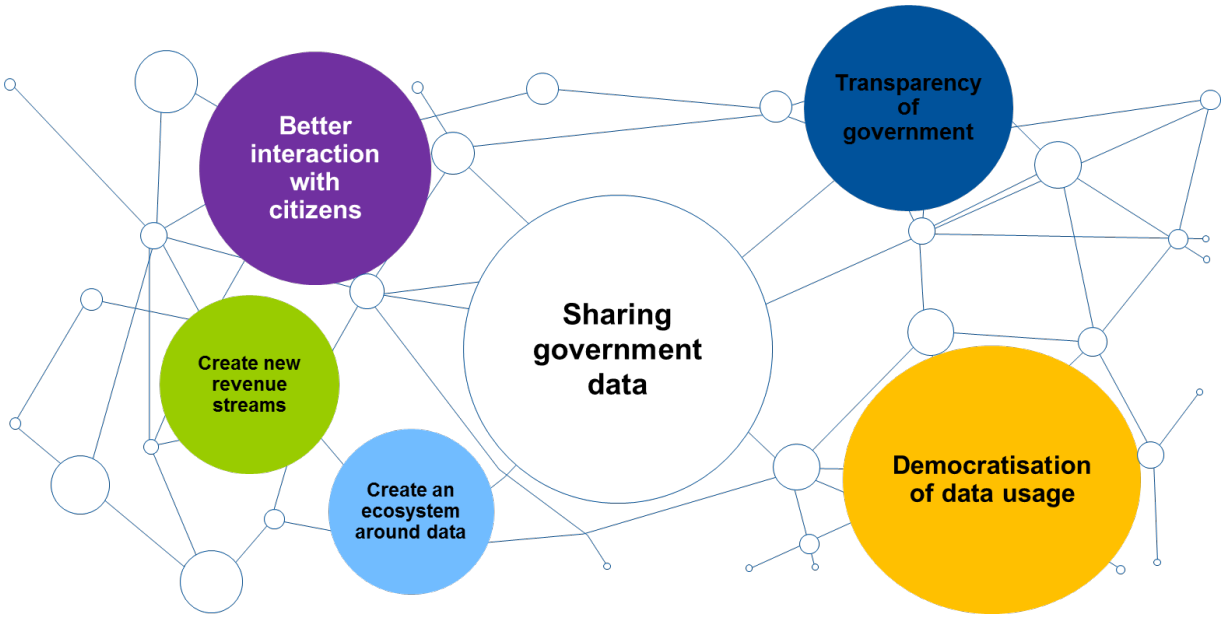
Note on references: For each of the findings in this section, the references to the data sources are codified as follows:

- [B]: results from the case study analysis and related data collection
- [I]: Outcome of an interview
- [R]: Findings from desk research

4.2.1 Drivers for Digital Platforms owned or funded by Government

Figure 36 below provides an overview of the various drivers for governments to own or fund Digital Platforms, also known as "Digital Government Platforms". The bubble size is representative for the number of times the driver was observed.

Figure 36. Drivers for Digital Government Platform



There are several **drivers for Digital Government Platforms** to exist, the main ones identified throughout in this study are introduced in the points below (in order of occurrence):

- **Sharing government data**

  Sharing government data is addressed in legislation, for example the PSI Directive[34] or the INSPIRE Directive[35] and in the Tallinn Declaration[36] with a policy action on "Once Only". As quoted by several interviewees:

  - "One of the main use cases for Digital Government Platforms lies in sharing government-generated data on a platform." [I]
  - "Open government data may bring huge benefits by generating reuse of data". [I]

[34] Directive 2003/98/EC on the re-use of public sector information
[35] Directive 2007/2/EC
[36] Ministerial Declaration on eGovernment - the Tallinn Declaration

Several interviewees and participants of the workshop, organised by Eurogeographics, highlighted the fact that when data was made open (this implies free and in a format that enables its reusability), the number of downloads grew exponentially. Openness was seen as having a positive impact on sharing. A study by the Geoforum in Denmark highlights the returns on investment which are positive when sharing open data. [R][37].

Contrary, a point of caution was taken about open data which is an indirect way for governments to provide funding:

- "When government publishes open data, it is a way of subsidising companies reusing the data, with tax payers' money" [I].

Governments should be cautious to ensure that the barriers to use the open data remain low. This is important because otherwise only a limited number of (larger) companies might benefit from the open data published by governments. This is particularly true if the data has specific niche applications and is complex to handle e.g., earth observation imagery (see also below point on democratisation of data usage).

- **Create an ecosystem around data shared**

  Creating a Digital Government Platform is a way of attracting different types of stakeholders and creating an ecosystem around the data shared. An example is Geopunt which aims at creating an ecosystem by attracting application developers on the platform who will reuse the data in their apps.

- **Democratisation of data usage**

  The added value of government in providing Digital Governments Platforms to share data is to make it easily reusable by various user communities, rather than just by the experts who understand the niche data and know how to use it. By democratising data with the creation of various user interfaces and clear descriptions of the data for a non-specialised audience, governments create wider opportunities of reuse of the data. "Digital Government Platforms pave the way for data usage democratisation, i.e., make data valuable not only for data scientists" [I].

- **Transparency of government**

  Government can use Digital Platforms to share data about government (i.e.: spending or results of government policies) or produced by government and therefore enhance transparency on areas which the data covers. "The value proposition for Digital Government platforms is often built around transparency" [I].

- **Better interaction with citizens**

  The use of Digital Platforms by government can facilitate its interaction with citizens and businesses. "Digital Platforms lower the barriers to access and collaborate with governments" [I]. Observations from the case study analysis enforce this point with 89% of government owned platforms making active use of user experience systems [B].

- **Create new revenue streams**

  Governments see the potential of leveraging platforms to create revenue streams by working with the private sector to create new services around the data that could generate revenue on the platform [I].

[37] https://www.osi.ie/wp-content/uploads/2016/06/6-Open-Data-and-SDI_Dublin2016.pdf

4.2.2 Challenges for Digital Platforms owned or funded by Government

This section presents data collected from interviews [I] and presents the threats to the creation and impact of digital platforms.

- Government funding and incentives can take various forms, one being the complete funding of the platform. This type of funding is perceived as a threat or tends to have a negative impact if the platform aims to change business model later on, because it creates a specific "business" model which is not self-sustainable, built on various service or data-generated revenue streams, warping the model from the start. Government incentives are often linked to legislation which makes any change process quite slow.
- Similarly, the speed of adaptation to the fast pace of technology evolution is a threat for governments who see their competitiveness hampered by the procurement processes.
- Data quality and interoperability are a challenge to achieve when they are not mandated by law. There is little incentive for data owners to share their data according to quality and interoperability specifications when there is no legal incentive. Reusability of data shared on platforms is therefore threatened by its low quality and low interoperability.
- Similarly, policy drivers (or currently the lack thereof) are seen as stimulating better than anything else a move from SDI websites to a full digital platform model.
- The impact on innovation of openness and of data reuse is not demonstrated (yet) for some stakeholders. [I] Openness impacting positively innovation is often mentioned, with the following citation as an example [R][38]: "*Europe's appetite for digital openness, exhibited by the Digital Single Market strategy, should extend beyond consumer markets. Greater openness in government, enabled by digital platforms, can make citizens more engaged and empowered. Greater openness in the exchange of ideas, data, technology and funding could supercharge Europe's innovation engine".* This challenge can be overcome with dissemination of evidence.
- Governments reusing open data from the private sector – often referred to as the reversed PSI Directive - may indirectly chill innovation because of the lack of financial incentives for producing this data. Similarly, some licenses used on data such as the open data base license[39] may hinder the potential of business models which leverage the selling of data. In relation to this, the lack of availability of data from the private sector may impact the potential that digital platforms could leverage from services combining private and public data.
- **Accessing the Internet is not a given**, creating a digital divide impacting the potential reach of digital platforms.

4.3 Cost and Benefits of Digital Platforms

Various cost and benefit categories are involved in Digital Platforms and apply differently from the perspectives of the owner, the consumers, the providers and the ecosystem partners of the Digital Platforms. The first section explores the cost categories involved in Digital Platforms, and the second one differentiates this by role of government in the Digital Platform. The third and fourth sections conduct the same analysis but from the benefits' angle.

[38] http://opendigital.economist.com/european-union
[39] https://en.wikipedia.org/wiki/Open_Database_License

4.3.1 Costs involved in Digital Platforms

For each platform, the cost categories were analysed that are applicable for each of the platform stakeholders. The following cost categories were analysed:

- **Expenses and Effort** — e.g., actual money spend by using the platform, working time e.g., development time of the platform, governance effort to explain each data contributor the rules, or data cleansing effort
- **Data and Privacy** — e.g., providing data to the platform, the costs of giving up some privacy
- **Services and Integration** — e.g., providing supporting services, setting up back-end service integration
- **Intellectual Property/Branding** — e.g., providing algorithms, patents or invest in branding

Each of these cost categories could apply to the owner, the consumers, the providers and the ecosystem partners of the Digital Platforms. For each cost category, numerous cost subtypes were observed.

Table 2. Breakdown of cost categories into observed cost subtypes

Cost Category	Observed Cost Subtypes
Data and Privacy	Data harmonisation
	Data preparation
	Data provisioning
	Providing (personal) data
	Providing ratings
Expenses and Effort	Co-development effort
	Communication effort
	Data license fees
	Development effort
	Infrastructure costs
	Investment costs
	License fees
	Maintenance costs
	Mining effort
	Organization effort
	Portal development effort
	R&D costs
	Security effort
	Set-up effort
	Specialized human resource cost
	Standards adoption effort

	Standards development effort
	Usage effort
IP / Brand	Bad publicity
	Providing real-time location data
	Reduced revenues
	Service functionality sharing
Services and Integration	Analytical services provisioning
	Co-creation costs
	Community building effort
	Creation of services effort
	Data integration effort
	Implementation guidance effort
	Integration effort
	Integration software development
	Providing Hardware
	Providing integration services
	Redundant proprietary services
	Set-up cost
	Systems integration effort

A full overview of the cost categories for all platform stakeholders, including the frequency of observation of each of the cost categories, can be found in Appendix IV — Detailed Cost and Benefits Data Overview. An overview of the frequency of observation of the cost categories is provided in Table 3.

Table 3. Cost categories observed in Digital Platforms

Cost category	Frequency of observation
Expenses and Effort	100%
Data and Privacy	96%
Services and Integration	93%
IP / Brand	37%

Key insights derived from the empirical analysis of the case studies:

- Expenses and effort are observed in all platforms, especially for owners of the platform. Building a Digital Platform requires significant effort and investments.
- Platforms that have no data or privacy cost are very rare, almost all platform require one of the platform stakeholder to provide (personal) data to the platform and give up privacy by doing so. Data and privacy cost most often occur for providers of the platform, in over three-quarters of the Digital Platforms observed.

- Costs around services and integration are also inherent to almost all platforms. Most platforms require the support of services that are provided or the integration with existing systems of at least one of the platform stakeholders (be it the consumer, the provider or the ecosystem partner). Costs to create supporting services are most often observed for owners, while costs to support integration are most commonly found for providers of the platforms.
- Giving up intellectual property or brand awareness (for example by providing algorithms and patents) are not major cost drivers in Digital Platforms. Those cost drivers are observed in just over a third of the platforms. For ecosystem partners, this cost category occurs most often. In just over a quarter of the cases, Digital Platforms require also the ecosystem partners to open up their services and or algorithms. This could go as far as co-creation and co-development of new services between the Digital Platform and the ecosystem partner(s).

4.3.1.1 Cost of Digital Platforms in the context of governments

Based on the 27 case studies collected, the key differences in cost categories, broken down by role of governments were analysed. The results are presented in terms of cost categories for platforms that analysed relative to the full total set of platforms.

Table 4. Cost categories in relation to the different government roles

Cost category	Platform stakeholder	Total Frequency of observation	Government Owner Frequency of observation	Government Provider Frequency of observation	Government Funder Frequency of observation	Government Consumer Frequency of observation
Expenses and Effort	**Total**	**100%**	**100%**	**100%**	**100%**	**100%**
	Owner	**100%**	100%	100%	100%	44%
	Consumer	**81%**	78%	79%	77%	72%
	Provider	**33%**	56%	42%	38%	78%
	Ecosystem	**59%**	67%	58%	69%	39%
Data and Privacy	**Total**	**96%**	**89%**	**95%**	**92%**	**94%**
	Owner	**7%**	11%	11%	8%	89%
	Consumer	**56%**	0%	42%	23%	22%
	Provider	**78%**	78%	84%	69%	61%
	Ecosystem	**0%**	0%	0%	0%	39%
Services and Integration	**Total**	**93%**	**100%**	**95%**	**100%**	**89%**
	Owner	**70%**	56%	74%	62%	39%
	Consumer	**19%**	33%	26%	31%	22%
	Provider	**81%**	89%	79%	85%	44%
	Ecosystem	**59%**	67%	63%	69%	67%
IP / Brand	**Total**	**37%**	**11%**	**37%**	**15%**	**89%**
	Owner	**0%**	0%	0%	0%	50%
	Consumer	**4%**	0%	5%	0%	83%
	Provider	**15%**	0%	11%	0%	28%
	Ecosystem	**26%**	11%	26%	15%	56%

Key insights derived from the empirical analysis of the case studies:

- *All platforms versus when governments owns the platform*
  - In government-owned Digital Platforms, expenses and effort costs are more often observed for providers. This is because the barriers to providing data to government-owned platforms are high, likely to be caused by the high quality of data standards and the high degree of standardisation required before providing the data to the platform.
  - Whereas in Digital Platforms in general, in more than half of the platforms, costs in terms of data and valuation occurs for consumers of the platforms, in government-owned platforms these costs for consumers are not observed at all. This is likely to be caused as the data on the platform is already open and public data.
  - Costs in terms of intellectual property or brand awareness are lower in government-owned Digital Platforms than in Digital Platforms in general. Currently, governments invest less in IP development and branding than general Digital Platforms.
- *All platforms versus when governments are providers to the platform*
  - In Digital Platforms were governments provide data, consumers have less costs in terms of privacy or personal data they have to provide. This could be caused by the quality of data that governments provide to Digital Platforms or that the service provided by the Digital Platform where governments provide is less focused on gathering data from the consumers of the platform.
- *All platforms versus when governments are funders of the platform*
  - In Digital Platforms that are completely or partially funded by governments, consumers have less costs in terms of privacy or personal data they have to provide. This could also be explained by the focus of the platforms that are funded by the government, which is more likely to be on providing a service where limited personal data or privacy is required by the consumer.
  - The cost in terms of integration and using service for consumers is lower for Digital Platforms that are funded by governments than for Digital Platforms that are not funded by governments. This could be explained by the necessary focus on user experience by Digital Platforms that are self-funded or funded by private parties.
  - Platform stakeholders, regardless of their role, are less likely to give up any intellectual property for government-funded Digital Platforms. Government funding lowers the barriers for providers to provide data, algorithms or services to Digital Platforms.
- *All platforms versus when governments are consumers of the platform*
  - In Digital Platforms where governments consume the services provided on the platform, they are more likely to have expenses and effort costs for ecosystem partners. These Digital Platforms are also more likely to have a focus on the services provided on the Digital Platform itself and have less of an ecosystem focus.

4.3.2 Benefits involved in Digital Platforms

For each platform, the study analysed what benefit categories apply for each of the platform stakeholders. The following benefit categories are analysed:

- **Revenues —** e.g., actual money gained by using the platform
- **Data and Valuation** — e.g., consuming data from the platform, data value created

- **Services and Personalisation** — e.g., services received, personalised offerings based on the platform usage
- **Intellectual Property/Branding** — e.g., goodwill and brand recognition established around the platform, brand recognition
- **Society/Positive Externality** — e.g., benefits for society as a whole inclusion, clean planet

Again, each of these benefit categories apply to all four of the stakeholders of Digital Platforms. Within each benefit category, numerous benefit subtypes were observed.

Table 5. Breakdown of benefit categories into observed benefit subtypes

Benefit Categories	Observed Benefit Subtypes
Data and Valuation	Access to additional data
	Data consumption
	Data integration
	Enhanced accuracy of data
	Enriched data
IP / Brand	Brand awareness
	Brand exposure
	Using ratings
Revenues	Additional revenue streams
	License revenues
Services and Personalisation	Access to additional services
	Additional functionalities
	Additional services
	Cost savings
	Efficiency gains
	Larger market reach
	New business models
	Personalized service offerings
	Reduced usage effort
	Service personalization
Society / Positive Externality	Enhanced efficiency in an industry
	Improved liveability
	Open government
	Transparency in an industry
	Transparency in a market

A full overview of the benefit types that are observed in all categories for all platform stakeholders, including the frequency of observation of each of the benefit types, can be found in Appendix IV — Detailed Cost and Benefits Data Overview. An overview of the frequency of observation of the benefit categories is provided in Table 6.

Table 6. Benefit categories observed in the Digital Platforms

Benefit categories	Frequency of observation
Data and Valuation	100%
IP/Brand	96%
Revenues	93%
Services and Personalisation	93%
Society/Positive Externality	96%

Key insights derived from the empirical analysis of the case studies:

- Digital Platforms always bring value through consumption, provision or enhancement of data on the platform for multiple platform stakeholders. Both consumers and providers benefit from the most diverse set of benefits — just under three-quarters of the platforms observed provide value to these platform stakeholders.
- Digital Platforms generally provide value across all benefit categories: data and valuation, intellectual property and brand awareness, revenue, services and personalisation of societal positive externalities, as in almost all platforms at least one platform stakeholder benefits in these benefit categories.
- Owners benefit most from the value a Digital Platform brings in terms of data valuation, as the set-up can enable the enhancement or combination of datasets and the addition of location elements to data points. Also the positive externalities platforms bring for owners of the platforms are high (for example by contributing to the enhanced usage of public data or increased decision-making within an industry), and those are observed in more than two-thirds of the platforms.

4.3.2.1 Benefits of Digital Platforms in the context of Governments

Based on the 27 case studies collected, the key differences in benefit categories, broken down by role of governments were analysed. The results are presented in terms of benefit categories for platforms that analysed relative to the full total set of platforms.

Table 7. Benefit categories in relation to the different government roles

Benefit category	Platform stakeholder	Total Frequency of observation	Government Owner frequency of observation	Government Provider Frequency of observation	Government Funder Frequency of observation	Government Consumer Frequency of observation
Data and Valuation	**Total**	**100%**	**100%**	**100%**	**100%**	**100%**
	Owner	**59%**	33%	58%	38%	44%
	Consumer	**70%**	78%	89%	69%	72%
	Provider	**70%**	89%	74%	85%	78%
	Ecosystem	**41%**	33%	42%	38%	39%
IP / Brand	**Total**	**96%**	**100%**	**95%**	**100%**	**94%**
	Owner	**85%**	89%	84%	92%	89%

Benefit category	Platform stakeholder	Total Frequency of observation	Government Owner frequency of observation	Government Provider Frequency of observation	Government Funder Frequency of observation	Government Consumer Frequency of observation
	Consumer	**22%**	11%	21%	8%	22%
	Provider	**59%**	78%	63%	62%	61%
	Ecosystem	**41%**	22%	32%	31%	39%
Revenues	**Total**	**93%**	**89%**	**89%**	**92%**	**89%**
	Owner	**59%**	33%	53%	23%	39%
	Consumer	**15%**	33%	21%	31%	22%
	Provider	**48%**	33%	37%	38%	44%
	Ecosystem	**67%**	78%	68%	69%	67%
Services and Personalisation	**Total**	**93%**	**89%**	**89%**	**92%**	**89%**
	Owner	**44%**	44%	58%	46%	50%
	Consumer	**85%**	89%	84%	85%	83%
	Provider	**22%**	11%	16%	15%	28%
	Ecosystem	**59%**	33%	47%	46%	56%
Society / Positive Externality	**Total**	**96%**	**100%**	**95%**	**100%**	**94%**
	Owner	**74%**	78%	74%	77%	78%
	Consumer	**33%**	33%	37%	38%	33%
	Provider	**56%**	67%	53%	69%	61%
	Ecosystem	**37%**	22%	37%	38%	39%

Key insights derived from the empirical analysis of the case studies:

- *All platforms versus when governments owns the platform*
  - In general, Digital Platforms realise more data and valuation benefits compared to government-owned Digital Platforms. Governments focus less on realising these benefits, and this presents the opportunity for government to get more out of their data.
  - Government-owned Digital Platform less often realise benefits in terms of revenue for the owner of the platform compared to Digital Platforms in general. Revenue oriented business models are mostly found in private Digital Platforms. This is in line with the open character and strategy of many government services, yet present the opportunity to rethink the revenue models of government-owned Digital Platforms.
  - Ecosystem partners of Digital Platforms that are not owned by governments are more likely to realise additional services or more personalised services for their customers compared to Digital Platforms that are owned by governments. Private platform are more focused on the creation of additional services in their business model. This is an opportunity for government-owned Digital Platforms to better leverage the ecosystem to enable the creation of more services.
- *All platforms versus when governments are providers of the platform*
  - Consumers of the Digital Platform more often realise value in terms of data and valuation if the government is (one of the) providers of the Digital Platform. This

highlights the value of public datasets for consumers and the importance to provide data in a way that Digital Platforms can create value.

- Digital Platform owners create more value in terms of the creation of services and the personalisation of services when governments are a provider of the Digital Platform. This underpins the importance of the openness of public datasets and services as they can result in extra services that create value for citizens and society.
- Ecosystem partners, however, are less likely to create value in terms of the creation of services and the personalisation of services when governments are a provider of the Digital Platform. This could be explained by the internal focus of the Digital Platforms that use public data, and highlights an opportunity to harness an ecosystem to generate even more services and value for citizens and society.

- *All platforms versus when governments are funders of the platform*
  - Digital Platforms that are funded by the government are less likely to generate revenue for the owner of the Digital Platform. This can be caused by the financing or funding mechanism that was chosen for the platform. The funding of Digital Platforms by government should be tailored to provide incentives to find business models that result in revenue streams for the owner of the Digital Platform.
  - Owners of Digital Platforms funded by governments also generate less value in terms of data and valuation. The focus of these government funded Digital Platforms is less on the value enhancement of the data and more on the distribution of data. There is an opportunity for government funded Digital Platforms to be more focused on the enhancement of the data used on the platform.
  - Consumers of Digital Platforms funded by governments are more likely to realise additional revenue than Digital Platforms in general. This highlights the importance of funding Digital Platforms as they do not only create opportunities for business and revenue models for owners of the platforms, but also for consumers of the data or services of the Digital Platforms.
- *All platforms versus when governments are consumers of the platform*
  - Digital Platforms that have governments as consumers are less likely to results in benefits for owners in terms of data and valuation. Digital Platforms where governments are consumers are more focused on the distribution on data and the one-way transactions in services.
  - The owners of Digital Platforms that have governments as consumers are less likely to generate revenue than owners of Digital Platforms in general. Governments are consumers of Digital Platforms that are less focused on generating revenue and more on providing benefit in terms of data or service distribution and generating positive externalities for society and citizens.

4.4 The role of location information in Digital Platform environments

This section addresses mainly the third objective of this study to assess the role of location information in Digital Platform environments. The section is further subdivided into three subsections:

- **Section 4.4.1 Location enablement of Digital Platforms**

  This section defines the role of location information and location intelligence in the context of Digital Platforms and how Digital Platforms can be leverage these to provide services on the platform i.e. “location-enabled”.

- **Section 4.4.2 Location Value Creation Mechanisms**

  This section describes five mechanisms how location information and algorithms create value on the Digital Platform answering the following research question:

  - *How does location information bring value to Digital Platforms?*

- **Section 4.4.3 API Models and Location Value Creation in Digital Platforms**

  This section identifies the main API models and the way location information creates value on the Digital Platforms which are analysed. The structure in terms of openness of the API, the standardisation of the API and the location elements of APIs are analysed. It provides an overview of the key trends form these perspectives, and the following research questions are answered in this section:

  - *What are the most commonly used API models and structures used in Digital Platform?*
  - *What are the key differences between different governmental roles in Digital Platforms in terms of the API structure, standardisation and location elements?*

4.4.1 Location in Digital Platforms

A Digital Platform in the context of this report is understood to be “location-enabled” if location information or location intelligence algorithms play a role in the value creation mechanism that underpins the platform business model. Consequently location information will also be created, consumed, stored or analysed by the digital technology system supporting it.

Definition

Location information is the combined set of data and metadata that identifies the geographic location of features and boundaries.

Location intelligence algorithms are a set of mathematical rules to derive meaningful insight from location information relationships to solve a particular problem.

4.4.2 Location Value Creation Mechanisms

In the context of this study, five mechanisms for location information to add value to the Digital Platform have been identified:

The location element of Digital Platforms creates value by leveraging location information and location intelligence algorithms to match, create and exchange services between providers and consumers of the Digital Platform or with ecosystem partners. Five main categories of location value creation are distinguished:

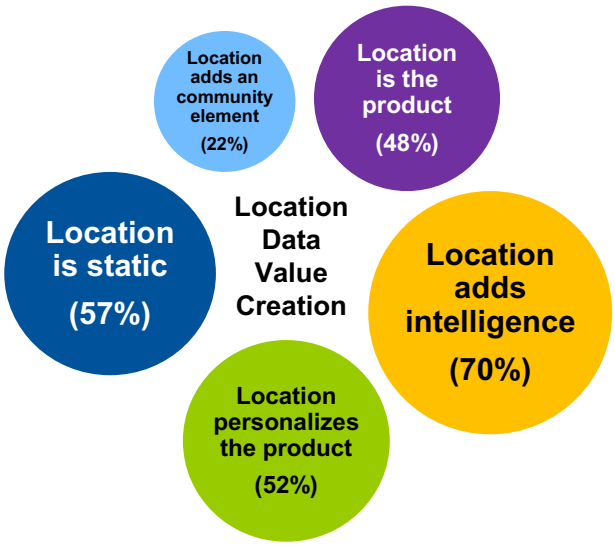
- **Location is the product or service:** Location information or location intelligence algorithms are the main value-generating component of one or more products or services offered on the Digital Platform.

- Examples:
  - Navigation services provided by the Digital Platform to guide consumers to providers or ecosystem partners
  - Marketplaces to exchange location information or location intelligence algorithms

- **Location personalises the product or service:** Location information or location intelligence algorithms enrich the value generated by products or services offered on the Digital Platform.
  - Examples:
    - Geofencing is used by the platform to personalise the service offering based on the location of the consumer
    - Location-based advertising whereby the provider or ecosystem partner provides specific products or services based on the consumer's location
- **Location adds a community element to the product or service:** Location information or location intelligence algorithms provides insights into the interactions of a community Digital Platform users.
  - Examples:
    - Location-based product or service reviews provided by a community
    - Friend locator allows to find other platform users (after they have given their consent) based their location
- **Location is static:** Location information is collected and stored by the Digital Platform but not actively as part of the service offered to the consumer.
  - Example: The consumer is asked to fill in his location but the location information is not used as part of the product or service offering
- **Location adds intelligence:** Location intelligence algorithms are analysing location information to make the product or service offering more intelligent.
  - Example: Shortest path algorithms for finding the shortest paths between nodes in road networks

All platforms were found to contain at least one location element. An overview of the different ways that location elements add value to the Digital Platform is provided in Figure 37. In Digital Platforms, the location aspect of the platform most often adds intelligence. In only a quarter of the cases, the location aspect of the platform adds a community element

Figure 37. Overview of Location Value Creation

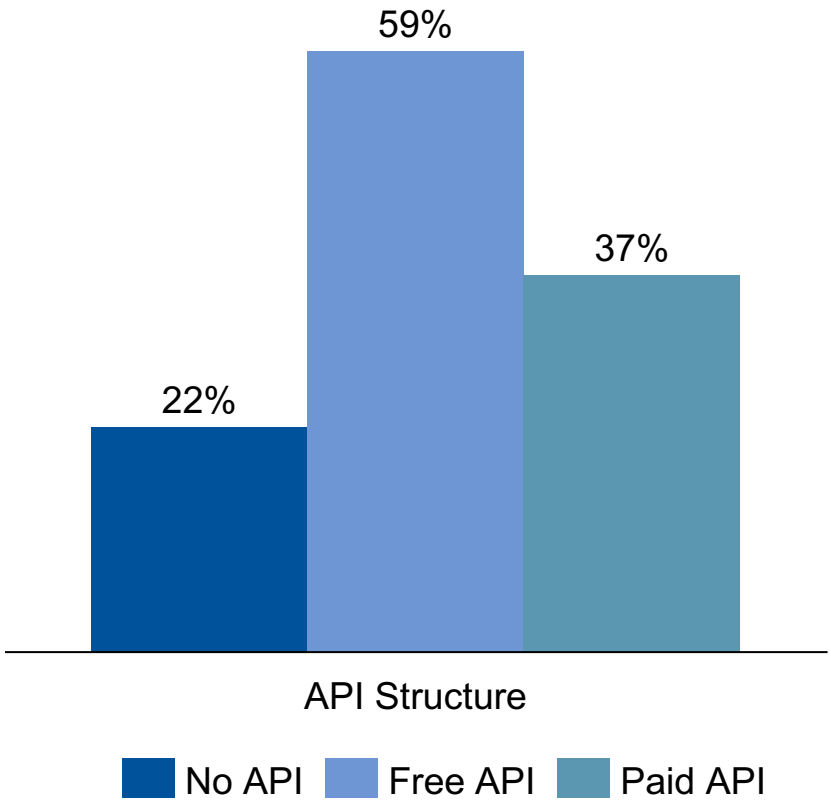


4.4.3 API Models and Location Value Creation in Digital Platforms

APIs are used as a means to share data and system functionality of the Digital Platform. APIs allow data to be shared with other systems, agencies, companies, and directly or indirectly to citizens, much more easy than before. It opens possibilities for the development of innovative service models, which can lead to new value and or revenue generation. APIs also allow for "platform envelopment", whereby one platform builds on top of another one (e.g., Uber runs on top of Google Maps).

Digital Platforms have different ways for leveraging APIs, both from a collaborative perspective and from and monetisation perspective. Three main API models are used in Digital Platforms: free APIs, paid APIs and no APIs. Digital Platforms can have multiple license models for their APIs: free, subscription and pay per use. As can be seen in the overview in Figure 38, over half of the platforms offer a free APIs. Also, in more than three quarters of the Digital Platforms, an API is provided to enable at least one specific service of the Digital Platform.

Figure 38. Overview of API Models



Location Element of APIs

Location opens up a world of opportunities for Digital Platforms. A location can be associated with other data (e.g. meteorological and sensor data) on Digital Platforms and can be used to tailor services towards the user, provide intelligence or be used during the delivery of the service. All Digital Platforms analysed were found to contain a location element, however not all that contain an APIs were found to include a location component. APIs that contain a location component range from APIs where a developer can dynamically serve up real-time and scheduled events on a map based on a user's search criteria to APIs which allow for notifications based on the geolocation of a user. APIs that contain a location API are dominant[40] compared to APIs that don't contain a location element. Figure 39 highlights the importance of the location components of the services provided on Digital Platforms.

[40] For the longlist of platforms the author's considered for this study, they identified that all of them included at least some location element. In fact it was not possible to identify a platform without any location element to it. However in the final selection for the data collection for this study, the authors have chosen specifically platforms with an clear location element, so there might be a bias in the occurrence of location APIs in this specific study.

Figure 39. Overview of Location Element of APIs

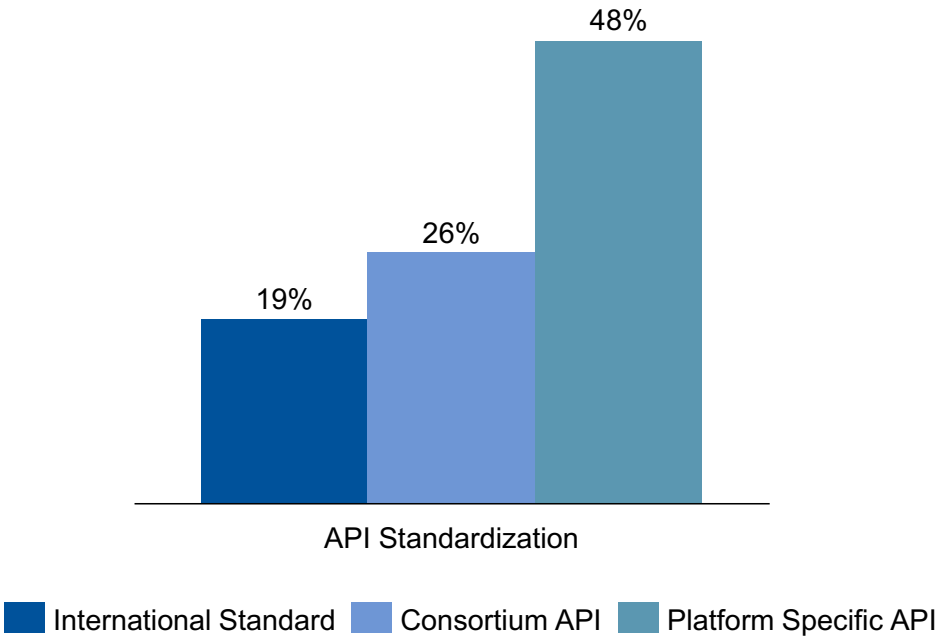
API standardisation

In Digital Platforms, there are three main categories for the way the APIs are structured:

- **Platform specific APIs** — the set-up of the API is specifically designed for the Digital Platform.
- **Consortium specific APIs** — the set-up of the API is based on a structure that various stakeholders use in a consortium.
- **International standards** — internationally recognised standards that are defined by a standardisation body or fora like ORC[41] and W3.

An overview of the distribution of these API standardisation categories can be found in Figure 40. Platform specific APIs are mostly observed in Digital Platforms and international standards are not widely spread as only just over a quarter use international standards for their APIs.

Figure 40. Overview of API Standardisation categories



[41] http://www.opengeospatial.org/

Location Value Creation

Whether a Digital Platform provides APIs, and if APIs are provided, whether they are paid or free, is linked to the business model.

- Free APIs are most often found in Digital Platforms that contain a collaboration business model.
- Digital Platforms that contain a creation business models have almost always APIs.
- Paid APIs are dominantly found in Digital Platforms with a creation business model

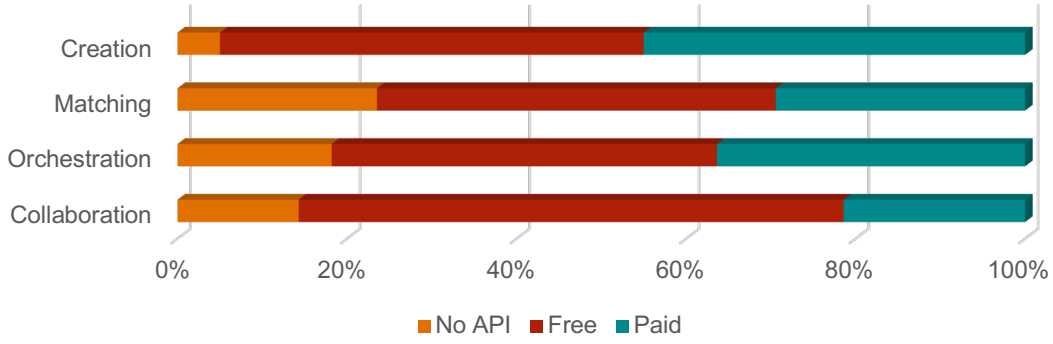
The business model of the Digital Platform is also linked with whether or not it contains a location API element.

- APIs that contain a location element are most often found in Digital Platforms with a collaboration model.
- Digital Platforms with a matching business model are more likely that have an API without a location element than an API that contain a location element.

The extent to which international API standards are used is also linked with the business model of the platform.

- In creation business models, APIs that are based on an international standard are rarely observed, while consortium specific APIs are observed in almost half of the cases.
- Platform specific APIs are dominant in Digital Platforms, irrespective of the business model of the platform.

Figure 41. Business Models in relation to API Model



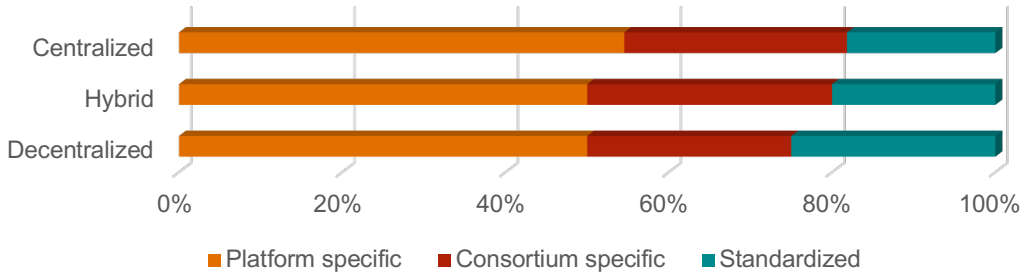
The structure of the APIs on the Digital Platform is dependent on the governance model.

- Digital Platforms with a decentralised governance mode, paid APIs are rarely observed.
- A hybrid governance model is often found in combination with APIs, free or paid.
- Finally, free APIs are observed most often in Digital Platforms with a hybrid governance model.

Whether or not a Digital Platform uses international API standards is also linked with the governance model of the platform.

- International API standards are most often observed in Digital Platforms with a decentralised business model.
- Platform specific API standards are found in Digital Platforms, irrespective of the governance model.

Figure 42. Governance Model in relation to API Standardisation



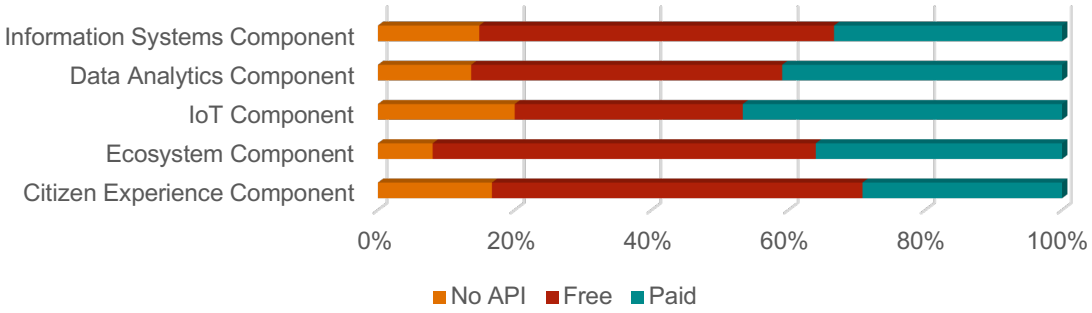
The technology systems that underline a Digital Platforms are linked to the structure of the API (free API, paid API or no API).

- In Digital Platforms that are an IoT system, paid APIs are more likely to be observed.
- In Digital Platforms that include an ecosystem system, APIs (paid and free) are more likely to be observed.
- Free APIs are found most often in Digital Platforms with an ecosystem system.

Not only the API model is linked with the technology systems of Digital Platforms, there is also a link between the technology system and the level of standardisation of the API.

- Platform specific APIs are mostly used, irrespective of the technology system of the platform.
- International API standards are rarely observed in platforms with an IoT system.
- API standards are most likely to be observed when a Digital Platforms is an Ecosystem or User experience system.
- Consortium specific APIs are observed most often in IoT systems.

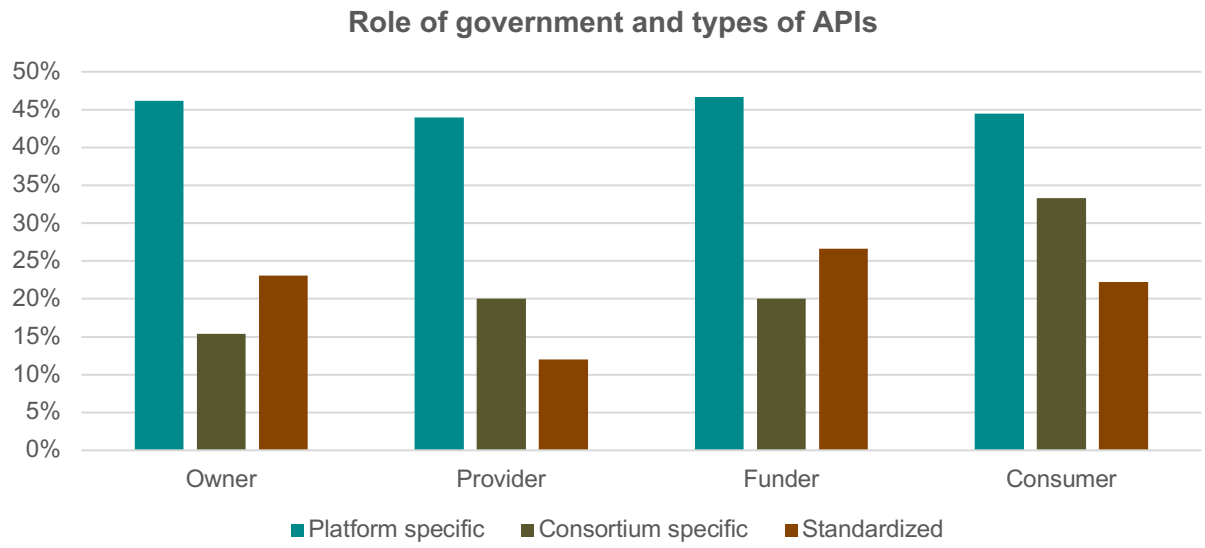
Figure 43. Technology systems in relation to API Model



4.4.3.1 Role of government in relation to APIs

When government is owner or funder, standardised APIs are more often used on platforms than when government is owner or consumer and more often used than consortium specific APIs.

Figure 44. Role of government and types of APIs



5.0 Conclusions and Recommendations

This chapter builds on the fourth objective of this study to derive conclusions on the current state and provide recommendations for the future of Digital Platforms in the context of government environments. This chapter provides conclusions, recommendations, in line with the three objectives of the study which are:

1. Define what Digital Platforms are and how they apply in the context of government environments
2. Analyse the different roles that governments may play in Digital Platform environments
3. Evaluate the role of location information and location intelligence in Digital Platform environments

The chapter is structured in four sections, each covering a number a number of conclusions and related recommendations:

- **Section 5.1** Digital Platforms
- **Section 5.2** Digital Government Platforms
- **Section 5.3** The role of Government in Digital Platforms is
- **Section 5.4** The role of location data and government data in Digital Platforms

5.1 Digital Platforms

5.1.1 Conclusion 1: Digital Platforms enable multi-directional network effects and value creation and allow platform owners to address the total market

As defined in the introduction, a Digital Platform is a business-driven framework that allows a community of partners, providers and consumers to share, extend or enhance digital processes and capabilities for the benefit of all stakeholders involved through a common digital technology system. Digital Platforms facilitate interactions between at least two distinct groups of participants (multi-sided) to create or exchange something of value as part of the interaction. Using a networked marketplace, the Digital Platform acts an intermediary providing platform services that brings providers and consumers together. Building on this network allows Digital Platforms to capture multi-directional network effects and value creation.

In additional, platform businesses do not follow the typical U-shaped cost curve of most linear businesses. Instead, platform businesses follow L-shaped cost curves. This implies that after an initial investment to produce the original version of a product or service, creating a copy of that product or service will cost next to nothing. This allows Digital Platforms, if successful, to platforms to grow to towards the total size of the market.

Supporting evidence from analysis:

- Chapter 3 provides the definition of Digital Platforms
- Section 3.1 introduces that Digital Platforms facilitate interactions between at least two distinct groups of participants
- Section 3.2. provides an economic perspective on how value is created on Digital Platforms and how platform business bring together providers and consumers
- Section 3.2.2 introduces the concept of multi-dimensional value creation
- Section 3.2.3 presents the theory of near-zero marginal cost of the products or services of platform businesses

5.1.2 Conclusion 2: The near-zero marginal cost curve of Digital Platforms create the possibility of market domination by one platform and the high barriers to entry or exit lead to monopolistic and oligopolistic market structures

Given the L-shaped cost curve that platform business follow, the platform business model has the potential to create winner-takes-all markets, where one platform dominates the full market. In addition, platforms businesses have high barriers to entry or exit stemming from network effects, including high switching costs and high multi-homing costs. The L-shaped cost curve and the high barriers to entry or exit have the potential to lead to monopolistic and oligopolistic market structures. A market monopoly can be considered as undesirable in specific markets.

Supporting evidence from analysis:

- Section 3.2.3 presents the theory of near-zero marginal cost of the products or services of platform businesses
- Section 3.2.4 introduces the barriers to entry or exit stemming from network effects. This section also presents the argument that the barriers and related costs tend to lead to monopolistic and oligopolistic market structures

5.1.3 Conclusion 3: Digital Platforms leverage network effects and information asymmetries that may lead to dominant market positions

The intrinsic economic barriers (especially the network effects, information asymmetry and zero marginal cost etc.) of Digital Platforms make that only a limited number of platforms may survive. Besides the intrinsic economic barriers that naturally exist in platform businesses, the owner may also actively seek to increase the cost of switching from one platform to another by:

- Increasing the cost of multi-homing which can be achieved by:
  - limiting integration with other platforms outside of the ecosystem
  - taking (hostile) ownership of competing platforms to embed or kill off innovation
  - actively mimicking functionalities from competing platforms so that it is no longer interesting to consider using alternative platforms
  - artificially reducing the importance, number of cross references and ranking of competing platforms
- Reducing the free flow of data / data portability which can be achieved by:
  - Making it extremely difficult to extract data out of the platform
  - Limiting the ownership rights and use of data created on the platform

The combination of intrinsic barriers combined with the one designed by the owner make that the owner could misuse its dominant position to exclude new entrants and kill of innovations to happen in the economy. This may lead to a favourable outcome for the owner but could lead to a suboptimal one for society overall.

Supporting evidence from analysis:

- Section 3.2.1 introduces Indirect Network Effects in the context of Digital Platforms and explains how those effects make it increasingly interesting for providers, consumers and ecosystem partners to join the platform once their direct peers are also interacting over that platform
- Section 3.2.2 introduces the importance of economies of scope in data collection and analysis that leads to information asymmetries and an information advantage for the platform owner

- Section 3.2.3 on Supply-Side Near-zero Marginal Costs explains that platforms can "infinitely scale" because adding the next additional user will be relatively cheaper
- Section 3.2.4 on Economic Barriers introduces the role of multi-homing and switching costs and the their role in creating monopolistic and oligopolistic market structures

5.1.3.1 Recommendation: Governments should adapt current economic, social and public policies to fairly regulate platform businesses

Target audience: citizens, businesses, governments and Digital Platform owners

Reducing economic barriers to create a single European market have been one of the flagship initiatives of the EU ever since its creation. The policies that have been developed to support these have largely been based on the economic conditions before the Digital Transformation of Business, Governments and Citizens/Consumers initiated the market revolution observed today. The way Digital Platforms businesses operate today however is intrinsically different from existing value chain businesses, as platforms:

- rarely have any significant assets on their balance sheet
- operate globally rather than regionally or locally
- employ less employees relative to their market capitalization

This makes that current public policies on:

- competition based on the "linear value-chain" era may no longer be suited to create fair market conditions for all participants in those platforms
- personal data privacy and ownership may require further updates beyond GDPR
- network neutrality may be put under pressure
- taxation mechanisms may be circumvented
- labour laws may need to be revised in light the "pay-per-use" or "commission-based remunerations schemes" that many Digital Platforms apply for charging or compensating their providers and consumers

Digital Platforms have a multi-dimensional impact on society. Governments should adapt current economic, social and public policies to fairly regulate platform businesses in the new Digital Economy. Those regulations should not only limit themselves to how to regulate privately owned Digital Platforms but also look into the rules of engagement for Governments to create and /or participate in the co-creation (e.g. via public-private-partnerships) of Digital Platforms

5.1.4 Conclusion 4: Developing Digital Platform businesses requires a shift in design thinking from resource ownership to resource orchestration

Digital Platform owners focus on bringing at least two distinct groups of stakeholders together on a common platform, whereby the platform owner acts as intermediary and sets the rules for the interactions to occur amongst the stakeholders. The transfer of services, products and/or data occurs from providers to consumers and as such the platform owner never owns the resources exchanged on its platform. It merely acts as intermediary of the transactions. The value created by the platform owner is therefore not created by owning and utilizing scarce resources but by orchestrating the resources available in the ecosystem. Digital platforms provide opportunities for governments to lower expenditure on fixed assets and operational costs by focusing on resource orchestration rather than resource ownership. For example:

- Instead of owning a traffic management infrastructure to monitor and direct traffic flows, governments could set up a platform to orchestrate the information already collected by car sensors (similar to Apple CarPlay, Android Auto, etc.)

- Instead of owning the services provided by geoportals, governments may seek to orchestrate an ecosystem of service developers that build applications and services or taking it further, it may license the development for such platforms to private sector stakeholders

Furthermore, the value created should benefit all stakeholders involved in the platform, providers, consumers and ecosystem partners should "win" by using the platform. This implies that when designing operating models for platform business, the owners should always take into account the considerations from different stakeholders. For example:

- To scale the number of application developers, service providers or data providers on a Digital Platform, it should be beneficial and easy (e.g. providing an software developer's toolkit (SDK), extensive API documentation, etc.) to develop or provide services on the platform; and
- On the contrary, consumers of applications want to have guarantees that the applications are tested and secure.

The owner of the Digital Platform will need to address the needs of both stakeholders to successfully scale the platform, i.e. the value creation should be multi-dimensional.

Supporting evidence from analysis:

- Section 3.2.2 explains how creating multi-dimensional value requires platform owners to think fundamentally different about various characteristics of their business and operating model
- Section 3.2.3 on Supply-Side Near-zero Marginal Costs explains that platforms can "infinitely scale" because they principles of near-zero marginal costs are extended to the supply-side in a platform business
- Section 4.1.1.2 indicates that orchestration is the most used business model regardless of the government's role on the platform

5.1.4.1 Recommendation: Governments should focus on orchestrating and reusing existing government services as a starting point for developing their Digital Platforms

Target audience: governments and Digital Platform owners

Based on the empirical evidence found in the nine government Digital Platforms that were analysed and supported by the feedback received from interviewees, the most logical starting point for governments that seek to explore platform business models is to start with orchestration business models, as it provides a natural role for government organisations to coordinate interaction between distant groups in society. Using a Digital Platform approach, this shifts towards facilitating the integration of business processes between different actors within an ecosystem.

- Well known examples of successful orchestration models include the Estonian X-Road platform and the Norwegian Altinn platform that orchestrate existing data services from various government agencies (as providers and consumers of data) and expose those to businesses and citizens.

As such, the government platform owner should not create all the services available on the platform but rather should focus on orchestrating the reuse of existing data services and match those with the needs of the consumers and ecosystem partners. To have both the providers and consumers to use the platform requires the government owning the platform to think about multi-dimensional value creation situations that benefit all stakeholders involved.

5.2 Digital Government Platforms

5.2.1 Conclusion 5: Digital Government Platforms are often in a less advanced lifecycle stage compared to private Digital Platforms

This study analysed 27 different Digital Platforms using the Digital Platform Canvas. The observations on these Digital Platforms covers multiple dimensions, including business models, governance models, technology systems, costs and benefits, location value creation mechanisms and usage of location APIs. As can be seen in Table 11, the Digital Platforms that are owned by governments, are often in a less advanced lifecycle stage compared to private Digital Platforms. Where the public Digital Platforms are often in the introduction phase, presenting an initial move towards a platform business model but not yet fully capturing network effects and leveraging ecosystem partners for additional services, the private Digital Platforms are more often in the growth or mature phase, where network effects create value for both consumers and providers and where ecosystem platforms create value-add services using the Digital Platform. The following key differences between public and private Digital Platforms were observed:

Supporting evidence from analysis:

- Chapter 5 provides the case study analysis of Digital Platforms analysed in context of this study
- Appendix III – Digital Platform Case Study Overview lists the Digital Platforms analysed along the Digital Platform Canvas in scope of this study, including the Digital Platform lifecycle stage of each case analysed

5.2.2 Conclusion 6: Government owned or funded Digital Platforms feature less often IoT and analytics systems than when government provides or consumes data from a platform

IoT and data & analytics systems are less often observed in Digital Platforms than other technology components such as information systems, citizens experience and ecosystem systems. In platforms where the government is either an owner or a funder, the IoT and data & analytics occur even less. Although there is often an ambition to develop the Digital Platform towards containing intelligence capabilities as well, government owned or funded Digital Platforms are often not yet at this maturity level.

Supporting evidence from analysis:

- Some interviewees managing government owned platforms shared the need for “more information” and “less data” on their platforms, referring to the wish to invest in analytics solutions
- Section 4.1.1.6: In the Digital Platforms analysed, IoT or data & analytics systems are less often observed in the government owned or funded platforms

5.2.2.1 Recommendation: Governments should start building IoT capabilities

Target audience: citizens, governments and Digital Platform owners

Governments should identify and leverage good practices in IoT and build capacity in developing Digital Platforms with IoT and analytics components. A future-looking analysis is required as various technologies are being developed that will impact governments and Digital Platforms, including:

- Autonomous Cars (e.g. better maintenance of road infrastructure based on data collected by sensors in autonomous cars)
- Smart cities (e.g. sensor technology to manage irrigation of public parcs)

- Smart grids (e.g. implementing smart metering capabilities to optimise electricity flows and shift to decentralised, local production of electricity)
- Health (e.g. collecting data on CO2 emissions and temperature in cities using sensors to monitor health conditions and the impact of global warming)

These technologies can be leveraged to enhance liveability for citizens but require the integration of IoT and Digital Platforms. For governments, it is critical to define their potential roles in order to reap the full benefits.

5.3 The role of government in Digital Platforms

5.3.1 Conclusion 7: *Government as a provider* - Providing reusable data to Digital Platforms beyond merely providing open data creates a window of opportunity for governments to stimulate new economic activity or develop self-sustaining business model

Making government information openly available requires significant effort to develop the initial open data services and thereafter to maintain the quality of service. For most governments these services have initially been set up in response to legislative acts (e.g. INSPIRE) or as part of their open government data strategies. Maintaining the quality of service has for most government organisations now become an inherent component of "business as usual" costs, adding to the fixed operational costs and putting further pressure on remaining budgets to invests in new innovations.

From the consumers' perspective of those services, there is typically still a lot of effort and expertise required to reuse this open data and to derive actionable insights out of them. This gap between raw open data sources on the one hand and reusable data and insights provides a window of opportunity for stimulating new economic activity (e.g. by organizing hackathons to attract new service providers) or for governments to provide additional services based on self-sustaining business models (e.g. premium services for data cleansing, providing higher quality of service levels etc.). Those add-on services may leverage the principles and characteristics of a Digital Platform approach whereby the government acts as platform owner to match service providers with consumers to reuse open data (e.g. in the form of setting up marketplaces for data, services and algorithms).

Supporting evidence from analysis:

- Several interviewees confirmed that the use of open government data is often limited to a few expert or global economic operators. This often is linked with the fact that only a limited number of consumers have the capabilities and knowledge to turn open data into actionable insights in their particular context
- Chapter 3 Several case studies (including Nam.R and DIAS) demonstrate that the gap between (open) government data (raw data) and the specific needs to use in a particular context (data mining) can generate new economic activity
- During the EuroGeographics General Assembly in 2017, various EuroGeographics members confirmed that sustaining the current quality of service for government open data services adds mostly to their fixed operational costs and that they are actively exploring routes to find more self-sustaining business models

5.3.1.1 Recommendation: Governments should optimise the use of their open data services by defining a service delivery approach that matches the needs of their target consumers

Target audience: governments as Digital Platform owners, funders or data providers

As concluded above, making government data openly available may not immediately result in optimal reuse of the data. Governments can optimise the reuse of their open data by defining a service delivery approach that matches the needs of their target consumers. One may consider open government data in this context as “crude oil”, and governments need to decide whether they:

- Provide just “crude oil” and leave all other activities to the “market” i.e. just making the data accessible through web services or APIs
  - This is the most commonly used approach of government organisations today. In this approach, most services are provided free of charge which only entails costs for the governments as data providers and no revenue. Alternatively, governments may explore a freemium model instead and provide additional quality of service levels for high-demanding consumers (similar to Google Maps APIs)
- Provide a “marketplace” where the “crude oil” is traded i.e. setting up data market place where providers of “refining services” and “consumers” meet
  - This approach focuses on leveraging an ecosystem to provide additional services and requires governments to invest in creating and designing an ecosystem. Governments may engage in activities such organising hackathons to develop the ecosystem, launch campaign to attract service providers etc.
- Provide “own pipelines and refineries” reused by “community partners” i.e. provide a storage and compute infrastructure for handling the data and work closely with a number of service providers that mine the data for the purpose of reuse by economic operators
  - This approach supports the creation of new services by making their data available on a common platform. The common platform reduces the barriers to reusing the data by lowering the investments required by economic operators to reuse the data. In cases where the number of community partners is limited, governments may also consider to engage in research programmes or set up public-private partnerships
- Distribute “refined oil” to the “consumers” i.e. providing data mining services to enrich the data in context of specific consumers
  - Following this approach, the government acts as owner and provider of services for consumers. The government will itself provide value added services to make the data reusable in the context of consumer needs

The above examples illustrate that there might a continuum of different service delivery models for governments to reuse their data, ranging from making openly available the data, over providing supporting platform infrastructure to engaging in value-add service delivery activities. These provide opportunities to stimulate new economic activity (engage the market) or for governments to find alternative ways for funding their new public services.

5.3.2 Conclusion 8: *Government as an owner* - Creating Digital Platforms in governments shifts design thinking from a focus on citizen value to a focus on ecosystem value

Ecosystems are an important driver of the network effects behind Digital Platforms. Creating platforms businesses shifts design thinking from internal optimization to external interaction, and requires a shift from a focus on citizen value to a focus on ecosystem value.

Supporting evidence from analysis:

- Section 1.2 Digital Platforms in the context of this report are considered as a framework that allows for these combinations of business models, governance models and

technology systems to create value across a connected ecosystem of people, organisations and things

- Section 3.2.3. Creating multi-dimensional value in Digital Platforms requires platform owners to think fundamentally different about various characteristics of their business and operating model

5.3.2.1 Recommendation: Governments should invest in creating and designing ecosystems

Target audience: governments as Digital Platform owners, funders or data providers

Governments cannot transform without understanding the impact of ecosystem changes or disruptors on their environment, including service providers, businesses and citizens. Government agencies need to take an outside-in view of the ecosystem, focusing on the businesses or citizens they serve.

Government should invest in creating and designing ecosystems. By fostering ecosystems, governments channel value to the Digital Platforms. They can either foster ecosystems around their platforms, or engage is supporting ecosystems on private platforms.

Government should support the creation of new services through Digital Platforms and leverage APIs to engage the ecosystem. Government APIs are critical enablers of interoperability across digital ecosystems. API services are the gateway for ecosystem partners to integrate into Digital Platforms.

5.3.3 Conclusion 9: *Government as an owner or funder* - Digital Platforms are leveraged in digital transformation initiatives in governments and blur the boundaries between traditional industry segments and government sectors

Digital transformation is the process that drives the organisational change required to embed digital technologies at the core of organisational processes. Digital transformation provides opportunities for fundamental business process redesign levering digital capabilities. Digital Platforms are often used as a mechanism to redesign business processes between various actors within an ecosystem. Often these redesigns entail interoperability, integration and ultimately automation across of number traditionally separate value chains and service delivery processes, for example:

- geolocation services that measure driving behaviour are being embedded in insurance sector processes
- traffic management and control processes are being integrated into car manufacturing processes
- earth observation and road infrastructure mapping services used to operate quite independently, today both sources of location information are being integrated in autonomous cars together with near-field sensors such as radar sensors, LIDAR sensors and image sensors

Many more of these examples exist already today and there is still great potential ahead for further blurring of traditional industry segments and government sectors e.g.

- vehicles collect more and more road condition information with the increasing number of embedded sensors that may be very useful for smartly improving road infrastructure and traffic safety
- dynamic routing information and traffic control information can be integrated into real-time location services

As the number of connections between different stakeholders across industry segments and government sectors increases, intermediaries, in the form of Digital Platforms, arise to support interactions between those stakeholders.

Supporting evidence from analysis:

- Section 1.2 Government's top business priority today is digital transformation[42]. Moreover, Gartner predicts that by 2023, more than 80% of the government's digital implementations that do not build on a technology platform will fail to meet objectives[43]
- Section 4.1 Various Digital Platforms analysed in the context of this study serve different industries e.g.
  - WeChat provides telecommunication services, taxi/transportation services, payment services and several more industry segments
  - Google Maps brings together advertising businesses, location services, traffic management services and public transport services (routing and rail-time information)
- Section 4.1.1.6 In the examples analysed in this study, governments that aim at building their own Digital Government Platforms mostly start by leveraging their existing IT systems and enable them to become Digital Platforms by investing in other components of Digital Platform environments such as (in order of occurrence) user experience systems, ecosystem systems, data analytics systems and IoT systems

5.3.3.1 Recommendation: Governments should consider Digital Platforms to be a cornerstone of their Digital Government transformation initiative

Target audience: citizens, businesses, governments and Digital Platform owners

As governments transform their organisations to adapt to the new Digital Economy, Digital Platforms should be considered as one of the key enablers of Digital Government Transformation:

- On the one hand governments will need to devise strategies how to operate with privately owned Digital Platforms as provider, consumer or ecosystem partner
- On the other hand governments can establish their own Digital Platforms or engage in platform “co-creation” with other public or private sector stakeholders

Developing an approach to both challenges will be an essential decision factor in Digital Transformation:

- Governments that seek to participate in Digital Platforms as providers, consumer or ecosystem partner should make sure that they safeguard all principles and values of public policies when doing so. Areas that might need specific attention include:
  - ensure transparency in the operations, expenses and dependencies on those platforms
  - safeguarding data handling in the interests of citizens
  - avoiding favourism for one platform over another

[42] According to Gartner's 2018 CIO Survey, digital transformation was the most common response from government CIOs who were asked what their organization's top business priority would be over the next two years. A record number of 3,160 CIOs from 96 countries responded to the 2018 Gartner CIO Survey. Their organizations represent a cross-section of industries, ranging from manufacturing, government, education and financial services to retail, media and telecommunications. The surveyed enterprises represent $13 trillion in revenue/public-sector budgets and $277 billion in IT spending. And 461 respondents identified themselves as government entities.

[43] Based on Gartner Research, A Digital Government Technology Platform Is Essential to Government Transformation, 23 January 2018, ID G00344044, Bill Finnerty

- Governments that seek to develop or co-create a Digital Platform should reuse as many existing components as possible (e.g. eID) while at the same time opening up their Digital Platform services for reuse by others.

5.4 The role of location data and government data in Digital Platforms

5.4.1 Conclusion 10: Location information is inherent for the value creation of Digital Platforms

Location information is the set of data and metadata that identifies the geographic location of features and boundaries. In this study, location information is observed to create value in all Digital Platforms Analysed, either by being the service delivered, by personalizing the service, by adding a community element, by being an integral element of the service or by adding intelligence to the service. Location is integral to the value creation of Digital Platforms. In the Digital Platforms analysed, it is demonstrated that location information can personalize the main product of the platform for users (for example the route advice in Google Maps). Other Digital Platforms highlight that localization of the data can be a specific service of the platform (for example Nam.R, where open data, data from data brokers, web pages, satellite and data from consumers are combined with location information creating a data platform with highly localized datasets).

Supporting evidence from analysis:

- Section 4.3.2 - A location can be associated with surrounding sensor data (e.g.: meteorological, chemical, monitoring) and leveraged by Digital Platforms to tailor services towards the user, provide a community effect, provide intelligence or actually enable the service. All Digital Platforms analysed were found to contain a location element
- Section 4.3.3 - APIs are an enabler of value creation using location information: APIs that contain a location component range from APIs where a developer can dynamically serve up real-time and scheduled events on a map based on a user's search criteria to APIs which allow for notifications based on the geolocation of a user. 81% of APIs observed contain a location component
- Section 4.3.2 - In Digital Platforms, the location aspect of the platform most often adds intelligence. In only a quarter of the cases, the location aspect of the platform adds a community element

5.4.1.1 Recommendation: Governments should enhance digital public services with location information and location intelligence

Target audience: citizens, governments and Digital Platform owners

Governments can leverage location information as a value creation, by enhancing services with location information. This can be done by:

- Enhancing public services with location information, making services location-enabled. An example could be for example be the optimization of public transport based on the location of citizens
- Ensuring open data is supported by location information, either using meta-data or as the data itself

Governments providing the service and sharing the data could benefit from this, as this can create tailored public services specific for citizens' needs.

5.4.2 Conclusion 11: Government data, including open data, is often leveraged in private Digital Platforms and thereby creates value for citizens and society

In 70% of the Digital Platforms observed, some type of government data is used to create location-based services. This government data includes open data sets but also data that is not open, as can be seen in the Copernicus/DIAS program. The value creation on Digital Platforms is often enabled by governments as the services of the platforms are often supported or supplemented by government data.

Supporting evidence from analysis:

- Section 4.2.3.1 - In Digital Platforms where government are data providers, value is more likely to be created in the form of the personalization of the services provide. The providing governmental data is therefore important to enable services that create value for citizens and society (section 3.6)
- Section 4.2.3.1 - In Digital Platforms were governments provide data, consumers have less costs in terms of privacy or personal data they have to provide. The services on these platforms are enabled by data provided by governments and focus less on gathering personal data of the users
- Section 4.2.3.1 - When governments provide data to the Digital Platform, the orchestration model dominates strongly, highlighting the value of governmental data for the orchestration between different organisations
- Section 4.2.2 - The added value from government as data provider is also seen when they provide/combine open geospatial data and other open data in the same service
- Section 4.2.2 - In 70% of the Digital Platforms analysed, the government provides data to enhance services on the platform

5.4.2.1 Recommendation: Governments could benefit from supporting location data offerings to match providers and consumers

Target audience: Governments and Digital Platform owners

Governments can support the creation of Digital Platforms by focussing on their location data offerings, as this will enhance the services and value created on both private and public Digital Platform. This can be done by:

- Focusing on assembling and integrating location data between governmental organizations to enhance location data capabilities in the public sector as a whole
- Creating a service-oriented architecture by providing location-based APIs to allow private parties to integrated government location information for their services
- Creating marketplaces around their location data offerings, to bring together supply and demand and tailor the offerings to the current needs of citizens and businesses

Governments benefit from enhanced location data capabilities, as it enables public organisations to address issues of citizens and companies more personally and support the creation of Digital Platforms. Digital Platform owners are able to enhance their service offering and citizens reap the benefits of more personalized services provided through Digital Platforms.

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Glossary

Table 8. Glossary Table

Term (Acronym)	Definition/Description
API economy	A set of business models and channels — based on secure access of functionality and exchange of data to an ecosystem of developers and the users of the app constructs they build — accessed through an application programming interface (API), either within a company or using the internet, with business partners and customers.
API structure	The way API's are used in this platform, both from a collaborative perspective and from and monetisation perspective.
Application Programming Interface (API)	A set of functions and procedures that allow the creation of applications which access the features or data of an operating system, application, or other service.
Benefits	The benefits of using the Digital Platform for the owner, providers, consumers and ecosystem partners.
Business model	A business design structure that guides an organisation in creating and retaining value.
Centralised governance	Authority, responsibility, and decision making power are vested solely within a central body. The centralised body establishes the policies, standards, guidelines, procedures, and processes for the development and implementation of Digital Platform strategies as well as in the creation of internal and external communication mechanisms.
Collaboration platform business model	A type of platform business model that enables internal and/or external participants to work together in new ways. Collaboration can occur within the same ecosystem (such as e.g., between government agencies) or between different ecosystems (such as e.g., in public-private collaborations).
Consumer	A person, organisation or other entity that consumes products or services through the platform.
Consumer incentives	A service consumed by the Digital Platform.
Costs	The costs of using the Digital Platform for the owner, providers, consumers and ecosystem partners.
Creation platform business model	A type of platform business model that enables providers and business ecosystem partners to create new apps, products/services, capabilities and business models.
Data analytics system	This technology capability contains information management, analytical and artificial intelligence (AI) capabilities. Data management programs and analytical applications fuel data-driven decision

Term (Acronym)	Definition/Description
	making, and algorithms automate discovery and action in the context of Digital Platforms.
Decentralised governance	Authority, responsibility, and decision making power are vested in and delegated to individual stakeholders who do not have a hierarchical, management, ownership or personal relationship. Individual stakeholders establish their own policies, standards, guidelines, procedures, and processes for ensuring the development and implementation of Digital Platforms and mechanisms to communicate.
Digital business	The creation of new business designs by blurring the boundaries between the digital and physical worlds due to the convergence of people, business and things.
Digital business ecosystem	A marketplace of functions and information that comprises a network construct whereby multiple value forms are exchanged for the benefit of all participants.
Digital Government	Leverages advances in technologies and relies on the use and reuse of data and analytics to simplify (digital as well as offline) transactions for end users (citizens, businesses and government agencies). It creates information from data to support and enhance decision making of government, businesses and citizens, and it fosters the creation of new, collaborative and more efficient service delivery models. In the process, underlying service models are redesigned and re-engineered to improve mission effectiveness and efficiency, to achieve optimised outcomes, such as transparency and openness, long-range cost savings, better governance and better quality of life for citizens.
Digital Government technology platform	A set of cross-cutting, integrated, horizontal capabilities that coordinate government services across multiple domains such as citizen experience, ecosystem, Internet of Things, IT systems and analytics. Governments, globally, need to architect a Digital Government technology platform approach that enables Digital Government, simplifies processes, improves citizen interactions and reduces expenditures.
Digital Platform	A business-driven framework that allows a community of partners, providers and consumers to share, extend or enhance digital processes and capabilities for the benefit of all stakeholders involved through a common digital technology system.
Digital technology system	A set of cross-cutting, integrated, horizontal technology capabilities that enable platform business models. Those capabilities, described through the lens of applications and business capability components, coordinate business services across multiple domains such as user experience, ecosystem, Internet of Things, IT systems and intelligence.
Digital transformation	The change process associated with the application of digital technology in all aspects of human society. The process covers

Term (Acronym)	Definition/Description
	renovating or optimising core IT and business services to enhance the existing business model and support digital business transformational opportunities.
Domain	The industry where this Digital Platform provides value.
Ecosystem	An interdependent group of stakeholders (people, business and things) sharing a networked marketplace where multiple forms of value are exchanged to achieve a mutually beneficial purpose. It enables various parties to expose their capabilities to others in order to achieve higher-level business value and outcomes.
Ecosystem partner	A person, organisation or other entity that works closely with the platform owner, often strongly affiliated with the platform and in return gaining some level of influence over its direction.
Ecosystems	This technology capability supports the creation of, and connection to, external ecosystems, marketplaces and communities. API management, control and security are main supporting capabilities.
Governance model	Defines the decision rights and accountabilities empowering the set of rules concerning who gets to participate in the platform and its ecosystem, how to divide the value, and how to resolve conflicts.
Information Systems	This technology capability supports the back office and operations such as ERP and core operational systems.
Internet of Things (IoT) system	This technology capability connects physical assets for monitoring, optimisation, control and monetisation. Capabilities include connectivity and integration to core and operational technology (OT) systems.
Location information value creation	The way the location information creates value in the platform.
Location-enabled public services	Public services provided by public authorities which depend on effective management or use of location information
Matching platform business model	A type of platform business model that enables providers to find consumers.
Orchestration platform business model	A type of platform business model that enables integration of business processes between providers and consumers or broader for a broader ecosystem. Orchestration platforms can also integrate with platforms of other business ecosystem partners.
Owner	The entity that owns and sets the platform rules (including their integrity and enforcement) and business model.

Term (Acronym)	Definition/Description
Platform business	A public or private organisation that enables value-creating interactions between participants using a common (technology) platform.
Platform business model	A business design structure that leverages (indirect) network effects among providers and consumers and ecosystems of a platform to match, create and/or exchange assets such as goods, services, information or currency, so that all participants are able to capture value (multi-dimensional value creation).
Platform domain	The industry where this Digital Platform provides its value.
Platform Governance Model	Defines the decision rights and accountabilities empowering the set of rules concerning who gets to participate in the platform and its ecosystem, how to divide the value, and how to resolve conflicts.
Platform origin	The geographic location where the Digital Platform was founded.
Platform owner	The enterprise that owns and manages the platform rules (including their integrity and enforcement) and business model.
Platform type	The sector in which this platform originated.
Programmable economy	The global-scale aggregation of algorithmic businesses and decentralised autonomous organisations enabled by metacoin platforms — a natively "smart" economic system that supports and/or manages the production and consumption of goods and services, enabling diverse scenarios of exchange of value (monetary and nonmonetary).
Provider	A person, organisation or other entity that provides products or services through the platform.
Provider incentives	A service provided by or for the providers of the data of the Digital Platform.
User experience system	This technology capability contains the main customer-facing elements such as internet portals, mobile applications and other technology interfaces.
Value Proposition	A statement of why consumers and providers should use the platform and how this will create value for them.

Appendix I — Stakeholder Engagement — Expert Interviews

The below table lists the interviews conducted in scope of this study as part of step 2A of the methodology.

Table 9. Overview of interviews with experts

Interview No	Interview	Role of the Interviewee	Type of Stakeholder	Relevance of the interview in the context of this report
1	Open Spatial Data Infrastructure (SDI)	Professor, Knowledge Centre Open Data of Delft University of Technology	Academic	Provides a point of view on Digital Platforms from an international SDI
2	Finnish Geospatial Platform	Director, Department: SDI services National Land Survey of Finland	Platform Owner	Provides a case study from an EU Member State platform under development
3	Belgian Geoplatform: Geopunt	Project Manager	Platform Owner	Provides a case study from an EU Member State platform under development
4	Global Earth Observation System of Systems (GEOSS)	Project Manager	Platform Owner	Provides a case study from an International Geoplatform under development
5	US Geoplatform	Department of the Interior DOI Geographic Information Officer	Platform Owner	Provides a case study from a U.S. Geoplatform under development
6	Copernicus- Data and Information Access Services (DIAS)	Policy Developer and Sponsor	Platform Owner	Provides a case study from a European Government platform under development
7	Google Maps	Geospatial Technologist	Platform Owner	Provides a case study from an International Technology Company
8	Humanitarian OpenStreetMap Team (HOTOSM)	Partnerships and external relations manager	Platform Owner	Provides a case study from an International NGO focussing on Humanitarian Aid
9	Let's Do It World	Product owner Head of Mapping & IT	Platform Owner	Provides a case study from a European NGO focussing on Environment and Waste Management

Interview No	Interview	Role of the Interviewee	Type of Stakeholder	Relevance of the interview in the context of this report
10	Nam.R	Chief Operations Officer Innovation Officer	Platform Owner	Provides a case study from a European startup SME in location-based Artificial Intelligence
11	EMT Empresa Municipal de Transportes de Madrid	Technology Director	Digital Transformation Programme Leader	Provides a case study related to Smart Cities
12	Digital City Wien	Chief Data Officer	Digital Transformation Programme Leader	Provides a case study related to Smart Cities
13	European Commission — Directorate General Communications Networks, Content and Technology	Head of Unit E-commerce and Platforms	EU Policy Development	Provides a policy development perspective on Online Platform
14	European Commission — Directorate General Joint Research Centre	Senior Expert — Growth and Innovation — Digital Economy	EU Policy Research	Provides an Economic Policy Perspective on Online Platforms
15	Gartner Research	Research Vice President, Digital Platforms	Business and Market Research	Provides a global market research perspective on Digital Platforms
16	Gartner Research	Research Vice President, Digital Government and Smart Cities	Business and Market Research	Provides a global market research perspective on Digital Government and Smart Cities
17	Gartner Research	Research Vice President, API Economy	Business and Market Research	Provides a global market research perspective on API Economy

Roundtables and workshops conducted in scope of this study include:

- INSPIRE Conference: 4-5 September, Kehl Germany and 6-8 September, Strasbourg France
- Eurogeographics General Assembly: 1-3 October 2017, Vienna, Austria
- Disseminating the work done in the study and the different workshops via an internal webinar for ISA Working Group Members, Interviewees and other interested stakeholders at JRC. The webinar was held on Thursday April 19th 2018

Appendix II — Digital Platform Canvas Explained

The below table lists the various building blocks of the Digital Platform Canvas. Definitions of each of the building blocks are supported by key questions and an example from Google Maps to illustrate step 2B of the methodology.

Table 10. Overview of building blocks of the Digital Platform Canvas

Building Blocks	Definition	Key Question	Google Maps Example
Platform Type	The sector in which this platform originated	Is this a public platform, a private platform or a hybrid platform (public-private collaboration)?	Private platform
Platform origin	The geographic location where the Digital Platform was founded	Where was this platform created?	Mountain View, California, United States
Domain	The industry where this Digital Platform provides value	In what industry is your Digital Platform mostly used?	Google Maps is mostly used for transport and business purposes.
Platform owner	The enterprise that owns and manages the platform rules (including their integrity and enforcement) and business model.	Who is the owner of the platform?	Alphabet
Value Proposition	A value proposition is the statement of why consumers and providers should use the platform and how this will create value for them.	How does your platform create value for all participants and what are the different elements that contribute to this?	Google Maps is a web-based platform that provides mapping and geolocation services worldwide, as well as navigation, traffic services and business user ratings/comments. In addition, a service allows developers to build their own services on top of the platform using various API's.
Governance Model	A platform governance model defines the decision rights and accountabilities empowering the set of rules concerning who gets to participate in the platform and its ecosystem, how to divide the value, and how to resolve conflicts.	Which governance model style is this? How do you structure the governance of the Digital Platform?	The governance is centralised. Alphabet develops the policies, standards, guidelines, procedures, and processes for the development and implementation of Google Maps.
Business model	A platform business model is a business design that	Which business model category is this?	Creation Business Model

Building Blocks	Definition	Key Question	Google Maps Example
	leverages networks among providers and consumers and ecosystems of a platform to match, create and/or exchange assets such as goods, services, information or currency, so that all participants are able to capture value.	How do you structure the business model of the Digital Platform?	Google Maps is a Digital Platform that allows third parties to build their own services and business models using the location information. Users can also provide data to refine the maps — so it is a co-creation model. In the background it also orchestrates different services (data streams) to provide a single interface to the consumer.
Technology system	A digital technology system is a set of cross-cutting, integrated, horizontal technology capabilities that enable platform business models. Those capabilities, described through the lens of applications and business capability components, coordinate business services across multiple domains such as user experience, ecosystem, Internet of Things, IT systems and intelligence.	What are the technologies underlying the platform and in which technology system categorisation would your platform fall?	Google Maps covers the full scope of technology systems: ■ User Experience Platform: User interfaces Web and Mobile. ■ Data analytics system: Navigation Algorithms and Traffic Control ■ Ecosystem system: Google APIs ■ IT Systems: Integration with other Google IT system ■ IoT system: Data collection from consumer Mobile Devices
Platform Type	The sector in which this platform originated	Is this a public platform, a private platform or a hybrid platform (public-private collaboration)?	Private platform
Platform origin	The geographic location where the Digital Platform was founded	Where was this platform created?	Mountain View, California, United States
Platform domain	The industry where this Digital Platform provides its value	In what industry is your Digital Platform mostly used?	Google Maps is mostly used for transport and business purposes.
Ecosystem partner	A person, organisation or other entity that works closely with the platform owner, often strongly affiliated with the platform and in return gaining some level of influence over its direction.	Would there be other parties with similar goals with whom you could partner for mutual benefit?	Thousands of third party applications with a Google Maps developer's platform supporting them.

Building Blocks	Definition	Key Question	Google Maps Example
Provider	A person, organisation or other entity that provides products or services through the platform.	Who are the key providers for your Digital Platform products and services?	Users (drivers, smartphone owners), business owners, Re-Captcha users, DigitalGlobe, and many more.
Provider incentives	A service provided by or for the providers of the data of the Digital Platform	What are the incentives for providers to contribute to your Digital Platform? What are the key activities providers perform on the platform?	Personification for companies and rating services.
Consumer	A person, organisation or other entity that consumes products or services through the platform.	Who are the key consumers (segments) of your Digital Platform products and services?	Citizens, travellers, drivers and businesses who can advertise their businesses on the map.
Consumer incentives	A service consumed by the Digital Platform	What incentives do consumers have to use your Digital Platform? What are the key activities consumers perform on the platform?	Services include navigation, but also vacation booking (Airbnb), taxi services (Lyft) and many other services.
API structure	The way API's are used in this platform, both from a collaborative perspective and from and monetisation perspective.	Are the API's that your platform provides open or proprietary? How does the platform monetise the value of these API's?	The API's are proprietary. Various versions of the paid API subscription are offered.
Location information value creation	The way the location information creates value in the platform.	In what way is value created on your platform? Is it the product itself, does it personalise the product, does it adds a community element or is it static?	Location is the product (GPS navigation), it personalises the product (recommendations on routes) and it adds a community element (ratings)
Costs	The costs of using the Digital Platform for the owner, providers, consumers and ecosystem partners	What are the different cost categories for the platform owner, provider, consumer and ecosystem partners?	*Owner* ■ Expenses and Effort *Consumer* ■ Data and Privacy ■ IP/Brand *Provider* ■ Data and Privacy ■ IP/Brand *Ecosystem Partner* ■ Expenses and Effort
Benefits	The benefits of using the Digital Platform for the owner, providers, consumers and ecosystem partners	What are the different benefit categories for the platform owner, provider, consumer and ecosystem partners?	*Owner* ■ Revenues ■ Data and Valuation ■ Service and Personalisation

Building Blocks	Definition	Key Question	Google Maps Example
			■ IP/Brand *Consumer* ■ Data and Valuation ■ Service and Personalisation ■ Society/Positive Externality *Provider* ■ IP/Brand *Ecosystem Partner* ■ Revenues ■ Data and Valuation ■ Service and Personalisation ■ IP/Brand

Appendix III — Digital Platform Case Study Overview

The below table lists the Digital Platforms analysed along the Digital Platform Canvas in scope of this study as part of step 2B of the methodology.

The table provides the platform name, the owner, origin and also provides an indication of the lifecycle stage in which the Digital Platform currently is:

- **Research and Development Stage** – In this stage of the lifecycle, a Digital Platform is on the table of design, experiment and research. The platform owner devises a strategy, business case and designs for the future state Digital Platform and addresses aspects such as identifying providers, consumers, which business model, which governance model and which technology systems to use.
- **Introduction Stage** – In this stage of the lifecycle the platform is launched and made available to its target providers, consumers and ecosystem partners. This stage is typically the most expensive for an organisation launching a Digital Platform. The number of providers and consumers of the platform is still small, which means the number of interactions are low, resulting in limited economies of scope for the owner. On the other hand, the costs of marketing, promotions and subsidies needed to launch the Digital Platform can be very high, especially if the platform is launched in a competitive sector or the platform competes with a traditional "linear value chain" and needs to capture the market.
- **Growth Stage** – The growth stage is typically characterized by strong growth in usage of the Digital Platform. The platform starts to benefit from indirect network effects and as the number of interactions increases, the economies of scope increase. This allows organisations to derive value from the interactions and data collected, which can in turn be invested in promotions and competitive acquisitions to maximize the potential of this growth stage.
- **Maturity Stage** – During the maturity stage, the Digital Platform is established and the aim for the owner is now to maintain the market share they have built up by exploiting the network effects, increasing exit barriers for users and fighting off competition by matching the quality and functionality provided by peers and start-ups.

For each of the Digital Platforms analysed, a number of the key characteristics (see section 3.5) are summarised in Table 11. The table focuses on the organisational, governance and technology characteristics considered to be essential for a platform to be considered a "Digital Platform" based on the definitions provided in the context of this report[44].

[44] The specific economic characteristics (multi-dimensional value, indirect network effects, near-zero marginal cost and economies of scope) related to Digital Platforms have not been analysed in the context of this report. As those economic features are mostly based on economic theories, the required data were not publicly available and the economic methodologies for providing empirical evidence are not readily available. Nevertheless, the economic features have been observed to lesser or stronger extent by the authors of this report and no factual evidence proving that those economic features do not apply are known or have been made known to the authors throughout this study.

Within the organisational model column, one of the criteria listed below covers the way the participants interact (see “Interaction Method” in Table 11 below). Direct interaction implies that the platform allows providers and consumers to connect through the platform by e.g. allowing to chat and exchange information, products, services etc.

Table 11. Overview of Platform Data Collection

No	Platform Name	Platform Owner (Ownership Type: Private/Government)	Lifecycle Stage	Origin	Organisational Model			Platform Governance Model (Critical)	Platform Technology Systems (Critical)
					Two distinct groups (Critical)	Create, match or exchange something of value (Critical)	Interaction Method (Optional)		
1	Google Maps	Alphabet Inc. (Private)	Maturity	United States	▪ Users ▪ Advertisers ▪ Data Providers	Match advertisers with users	Direct	Centralised	▪ User Experience ▪ Data Analytics ▪ Ecosystem ▪ Internet of Things ▪ Information Systems
2	Geopunt	Agentschap voor Geografische Informatie Vlaanderen (Government)	Introduction	Belgium	▪ Data Consumers (Business, Governments, Citizens) ▪ Data Providers (Flemish Sector Organisations) ▪ Digital map providers ▪ App Developers ▪ App Users	Exchange data Orchestrate services Create new services	Indirect	Hybrid Federated	▪ User Experience ▪ Data Analytics ▪ Ecosystem ▪ Information Systems
3	Let's Do It!	Let's Do It Foundation (Private)	Introduction	Estonia	▪ Data providers of geotagged garbage ▪ Providers of facilities and materials ▪ Cleaners/Volunteers	Match places to be cleaned with volunteers and facilities/materials	Indirect	Hybrid Federated	▪ User Experience ▪ Ecosystem
4	FOODIE project	European Commission (Government)	Research and Development	Europe	▪ Public authorities ▪ Farmers (sensor data ▪ Commercial parties (VHR, satellite images) ▪ Copernicus ▪ Researchers ▪ Policymakers ▪ Foresters	Create agriculture specific applications and services and providing a match-making marketplace where data can be discovered and exchanged.	Direct	Decentralised	▪ Data Analytics ▪ Ecosystem ▪ Internet of Things ▪ Information Systems
5	Global Earth Observation System of Systems (GEOSS)	Group on Earth Observations (GEO) (Private)	Introduction	Global	▪ Data Providers (public/private organisations) ▪ Data Consumers (planners, emergency responders, scientist) ▪ App Developers ▪ App Users	Exchange data Orchestrate services Create new services	Indirect	Hybrid Federated	▪ User Experience ▪ Data Analytics ▪ Information Systems

6	Copernicus Data and Information Access Services (DIAS)	European Commission/European Space Agency (Government)	Research and Development	Europe	▪ App Developers ▪ App Users ▪ Data Providers	Create new services Orchestrate data/services Exchange information Match data providers with consumers	Direct	Hybrid Federated	▪ User Experience ▪ Data Analytics ▪ Ecosystem ▪ Information Systems
7	GeoPlatform (U.S.)	Member Agencies of the Federal Geographic Data Committee (FGDC) (Government)	Introduction	United States	▪ Data Providers (US Agencies) ▪ Data Consumers (US agencies) ▪ App Developers ▪ App Consumers	Exchange data Orchestrate services Create new services	Direct	Hybrid Federated	▪ User Experience ▪ Ecosystem ▪ Information Systems
8	Nam.R	Nam.R (Private)	Introduction	France	▪ Data Providers ▪ Data Consumers	Create new services Exchange data/services	Indirect	Centralised	▪ Data Analytics ▪ Information Systems
9	X-Road (Estonia)	Estonian government (Government)	Growth	Estonia	▪ Data Providers (Estonian Authorities) ▪ Data Consumers (Estonian Authorities) ▪ Businesses ▪ Citizens	Exchange data/services	Direct	Decentralised	▪ User Experience ▪ Ecosystem ▪ Information Systems
10	OpenData EMT Madrid	Empresa Municipal de Transportes Madrid (EMT) (Government)	Introduction	Spain	▪ Data providers ▪ Government authorities ▪ Citizens	Match buses with the needs of travellers (safety, autonomy) Exchange data	Indirect	Centralised	▪ Ecosystem ▪ Information Systems
11	Skywise	Airbus (Private)	Research and Development	France	▪ Airliners ▪ Airbus ▪ Aircraft maintenance providers ▪ Aircraft safety inspectors	Orchestrate data/services Match maintenance providers with airliners	Direct	Centralised	▪ Data Analytics ▪ IoT ▪ Information Systems
12	TomTom Telematics Services Platform	TomTom (Private)	Growth	Netherlands	▪ Vehicle data providers ▪ Vehicles providing sensor data ▪ Car owners ▪ Fleet owners	Orchestrate data/services Create new services	Direct	Centralised	▪ User Experience ▪ Data Analytics ▪ Ecosystem ▪ IoT ▪ Information Systems
13	HERE location platform	Consortium of automotive companies (Audi, BMW, and Mercedes) (Private)	Introduction	Netherlands	▪ Data providers ▪ Data consumers	Orchestrate data/services Create new services	Direct	Hybrid Federated	▪ User Experience ▪ Data Analytics ▪ Ecosystem ▪ IoT ▪ Information Systems

14	Supply chain Blockchain Data Sharing Platform (Maersk & IBM)	Consortium including IBM & Maersk (Private)	Research and Development	Denmark	▪ Shipping companies ▪ Freight forwarders ▪ Ocean Carriers ▪ Port and custom authorities	Exchange information Match trading partners Orchestrate data/services	Direct	Decentralised	▪ Data Analytics ▪ IoT ▪ Information Systems
15	Uber	Uber Technologies Inc. (Private)	Growth	United States	▪ Taxi drivers ▪ Taxi riders	Match taxi drivers with riders Create new services	Direct	Centralised	▪ User Experience ▪ Data Analytics ▪ Ecosystem ▪ IoT ▪ Information Systems
16	BMW CarData	BMW (in collaboration with IBM) (Private)	Introduction	Germany	▪ Car owners ▪ App developers ▪ Data providers	Orchestrate data/services Create new services	Indirect	Centralised	▪ User Experience ▪ Data Analytics ▪ Ecosystem ▪ IoT ▪ Information Systems
17	NxtPort Data Utility Platform	Port of Antwerp (Private)	Research and Development	Belgium	▪ Port operator ▪ Shipping companies ▪ Container companies ▪ Other supply chain stakeholders	Exchange/orchestrate data Create new services	Direct	Hybrid Federated	▪ Data Analytics ▪ Ecosystem ▪ IoT ▪ Information Systems
18	Smart City Wien	Smart City Wien Agency (Government)	Research and Development	Austria	▪ Fi-ware open ecosystem ▪ Government Authorities ▪ Citizens and businesses	Orchestrate services to make data real-time available	Indirect	Hybrid Federated	▪ User Experience ▪ IoT ▪ Information Systems
19	Antwerp City Platform as a Service (ACPaaS)	DIGIPOLIS (Government)	Introduction	Belgium	▪ Developers ▪ Local authorities in the city administration	Create new services Exchange data Match developers with projects	Direct (procurement perspective)	Hybrid Federated	▪ Data Analytics ▪ Ecosystem ▪ IoT ▪ Information Systems
20	Humanitarian OSM Team (HOTOSM)	Humanitarian OSM Team (HOTOSM) (Private)	Growth	United Kingdom	▪ Volunteer map creators ▪ Humanitarian Organisations ▪ Governments ▪ First responders	Match volunteers with those in need Create services for people in need	Indirect	Decentralised	▪ User Experience ▪ Ecosystem ▪ Information Systems
21	Peerby	Peerby (Private)	Growth	The Netherlands	▪ Item Owner ▪ Item Borrower	Match owners with borrowers	Direct	Centralised	▪ User Experience ▪ Ecosystem
22	FixMyStreet	mySociety (Private)	Growth	United Kingdom	▪ Citizens spotting problems in their neighbourhood	Collaboration between citizens and governments	Direct	Centralised	▪ User Experience ▪ Ecosystem

					▪ Local authorities taking responsibility				
23	PDOK	Collaboration between the Cadastre, the Ministries of Infrastructure and Environment, Economic Affairs, RWS and Geonovum. (Government)	Introduction	The Netherlands	▪ Data Providers ▪ Data Consumers ▪ App Developers ▪ App Users	Exchange data Orchestrate services Create new services	Indirect	Hybrid Federated	▪ User Experience ▪ Ecosystem ▪ Information Systems
24	Zimmo	Mediahuis (Private)	Maturity	Belgium	▪ Real Estate Owners ▪ Real Estate Buyers ▪ Renter ▪ Advertisers	Match owners, buyers, renters and advertisers.	Direct	Centralised	▪ User Experience ▪ Data Analytics ▪ Information Systems
25	Booking.com	The Priceline Group (Private)	Maturity	The Netherlands	▪ Hotel/B&B/Hostels/Apartment Owners ▪ Travellers ▪ Advertisers	Match owners, traveller's advertisers. Create new services	Direct	Centralised	▪ User Experience ▪ Data Analytics ▪ Ecosystem ▪ Information Systems
26	Spotify	Spotify AB (Private)	Maturity	Sweden	▪ Music Producers ▪ Advertisers ▪ Music Listener	Match advertisers with music listeners	Direct	Centralised	▪ User Experience ▪ Data Analytics ▪ Ecosystem
27	WeChat	Tencent (Private)	Maturity	China	▪ Advertisers ▪ Mobile Users ▪ Taxi Drivers ▪ Payment Providers ▪ Business Owners ▪ Etc.	Match users via social media Create new services Exchange money and data Etc.	Direct	Centralised	▪ User Experience ▪ Data Analytics ▪ Ecosystem ▪ IoT ▪ Information Systems

Appendix IV — Detailed Cost and Benefits Data Overview

Table 12. Detailed Breakdown of Cost Categories by Platform Stakeholder

Cost categories	Platform stakeholder	Frequency of observation
Expenses and Effort	**Total**	**100%**
	Owner	100%
	Consumer	81%
	Provider	33%
	Ecosystem	59%
Data and Privacy	**Total**	**96%**
	Owner	7%
	Consumer	56%
	Provider	78%
	Ecosystem	0%
Services and Integration	**Total**	**93%**
	Owner	70%
	Consumer	19%
	Provider	81%
	Ecosystem	59%
IP / Brand	**Total**	**37%**
	Owner	0%
	Consumer	4%
	Provider	15%
	Ecosystem	26%

Table 13. Detailed Breakdown of Cost Categories by Platform Stakeholder

Benefit categories	Platform stakeholder	Frequency of observation
Data and Valuation	**Total**	**100%**
	Owner	59%
	Consumer	70%
	Provider	70%
	Ecosystem	41%
IP / Brand	**Total**	**96%**
	Owner	85%
	Consumer	22%

	Provider	59%
	Ecosystem	41%
Revenues	**Total**	**93%**
	Owner	59%
	Consumer	15%
	Provider	48%
	Ecosystem	67%
Services and Personalisation	**Total**	**93%**
	Owner	44%
	Consumer	85%
	Provider	22%
	Ecosystem	59%
Society / Positive Externality	**Total**	**96%**
	Owner	74%
	Consumer	33%
	Provider	56%
	Ecosystem	37%

Appendix V — Action Plan

Action 1: Capacity building in using the Digital Platform model and approach and support for government stakeholders to create their own Digital Platform

Actions may include:

- Providing training services to government stakeholders on how to design and model their own Digital Platform using the Digital Platform canvas developed in the context of this study
- Support government stakeholders in applying a structured analysis framework to develop their Digital Platform model
- Consulting government stakeholders on good practices to implement and share innovative use cases for inspiration with (future) Digital Platform owners
- Providing Digital Platform review services to government stakeholders for their Digital Platform models and services
- Collecting data on the current state of play of Digital Platform developments as a source for Digital Government observatory activities

Action 2: Research and assess the impact of Digital Platforms on existing economic, social and public policies

The action may include:

- Conducting policy research across different thematic clusters (competition, labour, tax, technology, etc.) to develop a consolidated view on the impact of Digital Platforms on the EU (Digital) Single Market
- Provide guidelines to government authorities on how to use Digital Platforms
- Provide guidelines, best practices and support on how to create and participate in co-creation of Digital Platforms
- Providing guidelines to Member States and other government stakeholders on how to address policy impact in their local context

Action 3: Identify mechanisms to build location-aware IoT technologies and capabilities into Digital Platforms

The action may include:

- Identification of the potential of real time location data streams for Digital Platforms
- Analyse the threats and opportunities when integrating IoT in Digital Platforms
- Define various strategies and roles for governments on platforms with IoT integrations

Action 4: Conduct an analysis of the various service delivery models and actively support government stakeholders in designing and implementing their service delivery model for government data, with a special focus on the underpinning value that location information brings

This action may include:

- Definition and SWOT analysis of the different service delivery mechanisms, including guidelines on which service delivery mechanism to apply in which context

- Collecting empirical evidence on the success and suitability of the mechanisms applied
- Setting up an expert community to share knowledge and experiences in implementing new service delivery models

Action 5: Analyse and provide guidance on how governments can sustain and fund their Digital Platforms

This action may include:

- Analysis of the sustainability of the current funding mechanism
- The identification of self-sustaining business models in terms of:
  - Service models
  - Financing schemes
  - Procurement methods
  - Charging mechanisms

Action 6: Mapping, Modelling and Monitoring Digital Government Ecosystems

The exercise of mapping the ecosystem is intended to deliver technical and business insights into the participants as well as an agile interaction between the different participants throughout the scenario. Government agencies will better understand their degree of influence over an ecosystem if they know the significance of their role in the ecosystem and focus on the direct and indirect wider ecosystem participants. For example, a building authority that issues building permits could map the ecosystem with themselves at the centre issuing permits. They will learn very little from this exercise for they are not at the centre of the home building industry. But when modelling the ecosystem with the housing developer, home owner or construction company at the centre of this ecosystem, they start to see other service providers and government agencies involved in the ecosystem. They see direct and indirect impacts of the performance of their services and they see opportunities for their service to be combined or delivered by others.

Ecosystem models describe the implications and impacts from anticipated or unexpected developments in the ecosystem dynamics, based on various external factors, including political change or macroeconomic failures or cybersecurity threats.

The objective of top-down modelling is to describe/capture the desired future state of the ecosystem. The future state can be aspirational and used to disrupt or deliver a step change to the ecosystem. For example, a taxation department might model a filing-free personal taxation ecosystem. Modelling from the bottom up allows the agency to take a "what if" approach to changes to the ecosystem, which may be out of their control.

The object of monitoring is to compare the actual behaviour of the ecosystem to the expected behaviour based on the modelled future states.

Action 7: Fostering ecosystem-based innovation with hackathons

Tap into the innovation potential of citizens, businesses, developers and data scientists to identify new services reusing data from Digital Platforms and applying location intelligence.

These collaborative innovation sessions tap into the potential of co-creation of services by supporting the open source developer's community and data scientists to provide development effort for reusing data, both geospatial and other open data. This action will provide guidance on how to set up a hackathon, study priority topics based on the

services identified in actions 1 and 2, analyse the expected outcomes for organising a hackathon.

The action may also create a "hackathon as a service" for Member States and other government stakeholders to organise locally. The “as a service” concept will help government stakeholders set up resources and elements that need to be considered in organizing effective and fruitful hackathon. These resources and components can include:

- Infrastructure (code repository, network, etc.)
- People (support for organizing the event)
- Data (focus of the hackathon on reuse of defined data)
- Funding (resources for hosting the event or providing prizes)

Action 8: Develop guidelines on how to embed Digital Platforms as part of their Digital Government transformation initiatives

The action may include:

- Assess which government sectors are most likely to reuse the same Digital Platforms and provide guidelines on how they could cooperate to share or co-develop a Digital Platform
- Provide guidelines on how to engage in privately-owned Digital Platforms

Action 9: Apply the principles of Digital Platform in the context of a Spatial Data Infrastructure (SDI)

This action may include:

- Assess the gaps in the current INSPIRE Geoportal(s) to be considered Digital Platforms
- Develop a strategy and roadmap for expanding INSPIRE Geoportal(s) to become a Digital Platform

Action 10: Benefits of Full Life Cycle API Management of Digital Government Platforms

To achieve large-scale interoperability across government, APIs must be programmatically consumable by other agencies and by the private sector. Government IT departments often lack experience in the delivery of APIs to a wide variety of consumers. APIs must be appropriately secured to ensure data privacy and to ensure business confidence in this service delivery channel.

Government leaders can mitigate concerns regarding API security, usability and scalability with good governance by utilizing a full life cycle API management solution. They can establish success criteria for government APIs.

Action 11: Standardising location APIs and the impact on the ecosystem

After a landscaping exercise on the geolocation APIs and their uptake in public services, this action will explore to which extent it is important to standardise and open the standard.

The action will analyse the current de-facto standards and the different community standards and identify if there is a gap in the standardisation landscape. It will identify the benefits of standardised location data APIs in terms of creating level playing fields in the ecosystem. It will analyse the impact of open standards on network effects, lowering barriers to entry to the Digital Platform ecosystem.

Action 12: Identify which public services supported by Digital Platforms can be enhanced by leveraging location information and location intelligence

This action may include:

- Create a model for assessing whether (public) services have opportunities for integration of location information in their public services
- Market analysis to provide overview of location information services provided by governments
- Analyse the fit-gap between (public) services that are already location-enable vs. the full market potential for those (public) services
- Develop policy initiatives to drive development of underdeveloped location information services and develop location intelligence capabilities