
Towards an internationally trusted exchange of data

THE DATA HYPERMARKET

AMdEX

Version 1.2
26 January 2018

Services for an open data market

Summary

#1

The open data market is offering mechanisms for trusted data use in between organisations, including for open data sharing.

#2

Stakeholders in the Amsterdam metropolitan area are aiming at developing a user-driven open data market: a transparent environment for sharing data between partners and for safe data transactions at different scales.

#3

The mechanism of Amsterdam Data Exchange (AMDEX) is explored to facilitate the open data market with infrastructure and common rules for trust.

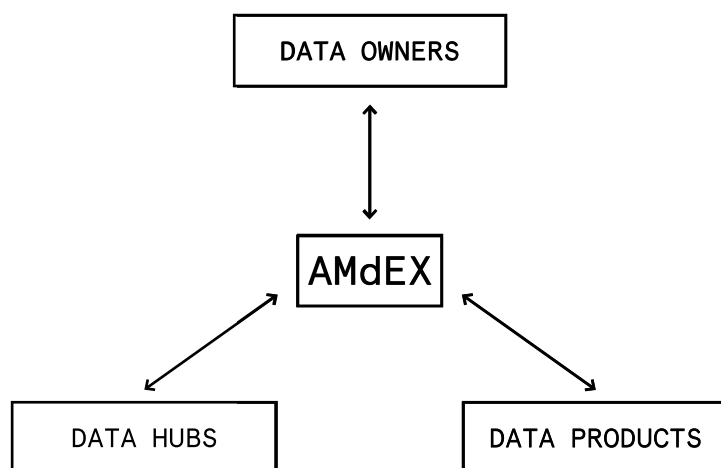
#4

Cooperation with other regions is recommended to establish a European open data market, to foster research, to promote innovation, and to serve public interests.

An open data market has to offer data producers, data-hubs, data processors and data consumers new opportunities for cooperation that each of them are not likely to achieve separately. The open data market will increasingly show a landscape with a variety of general and specialized providers of data and data products. These actors want to operate in a trusted data market allowing for controlled data sharing and for safe data transactions.

The Amsterdam Economic Board and Science Park Amsterdam explored the development of Amsterdam Data Exchange (AMDEX), serving as a mechanism to facilitate local, European or international cooperation in a transparent open data market. AMDEX will offer infrastructure and common rules to secure a trusted and safe environment that interested partners can join to create platforms for real-time data-driven cooperation. The European Open Science Cloud will strongly benefit from this service.

A developmental process with initiators willing to shape an open data market and to invest in actual implementation will be framed within a multi-years programme starting with design and research, up to development and operation.



European Open Science Cloud

Background

7 | Towards an international trusted exchange for data

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¹ ec.europa.eu/digital-single-market/en/european-open-science-cloud

Following the initiative of the European Commission to establish a European Open Science Cloud (EOSC)¹, stakeholders in the Amsterdam Metropolitan Region considered how to contribute to such developments. The EOSC is expected to provide the scientific community a virtual environment to store their data and to use these also beyond their disciplines and other borders. The vision is that researchers would have with a few clicks access to data of any laboratory or discipline in Europe. The foreseen European data infrastructure is expected to offer sufficient digital bandwidth with large storage facilities and super computer capacity. These ambitions follow the plan launched in 2015 for the European Digital Single Market, a new and innovative perspective for economic growth, job growth, competitive power, and scientific and commercial development. It is crucial that data can freely move over any borders.

The Amsterdam Economic Board and the Science Park Amsterdam studied the EOSC perspectives and developments in order to define an original contribution. It was considered that the Amsterdam Metropolitan Region has much to offer with its large Internet Exchange, its strong data storage capacity, the international scientific community, an excellent start-up ecosystem, and with its wide international networks over all sectors. In addition, the City of Amsterdam is a European leader in practicing an open data policy.

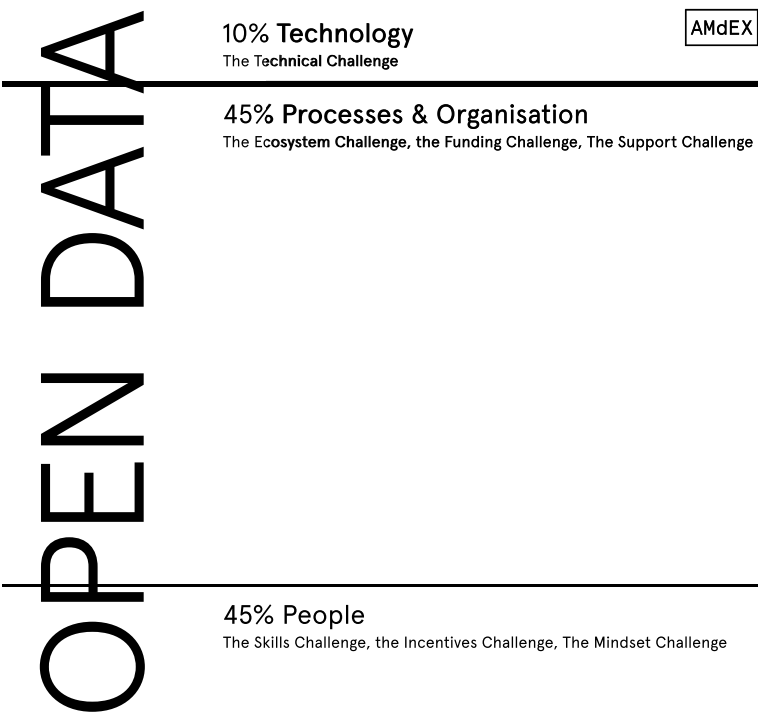
At the EOSC summit conference in 2017, the EU Commissioner Carlos Moedas stated: "We are not short of (cloud) initiatives. But there is no one-stop-shop for researchers. No overall architecture that allows them to connect". The DG Research Robert-Jan Smits added: "The science cloud will not be a physical place. It's an ecosystem, involving ministries, funders, universities and data service providers". It is this interaction between governing bodies, companies, universities, and e-infrastructures, that is shaping the power of regional cooperation in developing large undertakings such as a wider ambition to create an Open Data Market. In cooperation with other smart city regions, it becomes possible to address the related challenge dimensions as depicted in figure 1.

Opportunities for the Amsterdam region and the Netherlands

Chapter 1

FIGURE 1
Open Data
after: Deetjen, U. E.T.Meyer
and R.Schroeder (2015)
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The challenges in this figure 1, including ethical issues challenges, require the cooperation of different societal sectors. Initiatives and experiences from a variety of actors in the Amsterdam region show their strong interest in implementing an Open Data Market to share data between cooperating organisations or wider with all kinds of interested parties. This is a market in which data owners retain their rights and may open up selected data (components) for selected others and with their conditions. Data transactions will become interesting and maybe profitable when the Open Data Market provides a trusted and transparent environment. It must be avoided that separate initiatives are forced to invent the wheel each time. Supporting the Open Data Market with facilities and rules would be a novel approach for promoting new market mechanisms.



Considerations

More than scientific data

The EOSC is primarily focused on scientific data, and specifically from the public sector with publicly financed data. Considering the larger private investments for research, such data could also be included, and some companies appreciate the opportunities for sharing digital information with others to create new products and services with jointly shared data. This is also true for data from processes, logistics, material or sensors. Similarly, the public sector is increasingly embracing new data-driven services for citizens. A typical example is the Amsterdam municipality with its Data Lab². An Open Data Market should offer groups of cooperating data producers/owners opportunities that they cannot realize individually. This is without prejudice that data producers will continue be the owners of their data. They know the value of the data, how to curate these, and which data could be shared with others.

² data.amsterdam.nl

More than primary data

Primary data from measurements or observations can only be understood in the context of the methods and software that generated them, and data become interesting when visualized or otherwise processed in models. As such, data include software, models and even objects when connected to the Internet (as for example sensors). A functional data market place, including the EOSC, has to provide targeted services from direct data upload, data processing, data search, up to data output in supporting virtual environments for interaction with users. Such services may be provided by several organisations, but will require a supporting infrastructure and common rules to secure the integrity and ownership of the data products.

Towards a landscape of data products and data services

There are good reasons to share data for scientific progress, for the public interest, and for innovative data products. Data sets will originate from different organisations and should be accessible based on consensus, and useful for developing new data products by any provider. This does not imply a single central data storage and service provision. It can be foreseen that a range of providers becomes active with data products for general or specific markets. DataHubs and service providers each have their missions, but may cooperate to reach common advantages that otherwise cannot be realized.

How would a Data Market operate, what is the role of and the relation between different providers, how to scale up operations, what are required infrastructure and rules to facilitate the Data Market and to reduce risks? Infrastructure is required for a functioning landscape of DataHubs, for access to digital connectivity, and for digital enforcement of market rules. Such rules relate to the conditions to support anyone willing to enter the Open Data Market in an efficient way, and to contractual conditions, safely and ethical. In summary: Rules to organise trust as means to reduce risks.

An open Data Market

Chapter 3

The data cycle in an Open Data Market

The above considerations of a landscape with different cooperating or competing providers are currently not part of the EOSC discussions. However, such considerations are mentioned and supported by consulted parties in the Netherlands. Most of these parties are active in related on-going projects and data market prototypes. Their experiences and visions contributed to shaping this report about an Open Data Market.

Figure 2 presents the data cycle in an Open Data Market. This view assists in shaping the implementation process and defining project proposals.

FIGURE 2

Data cycle in an
Open Data Market

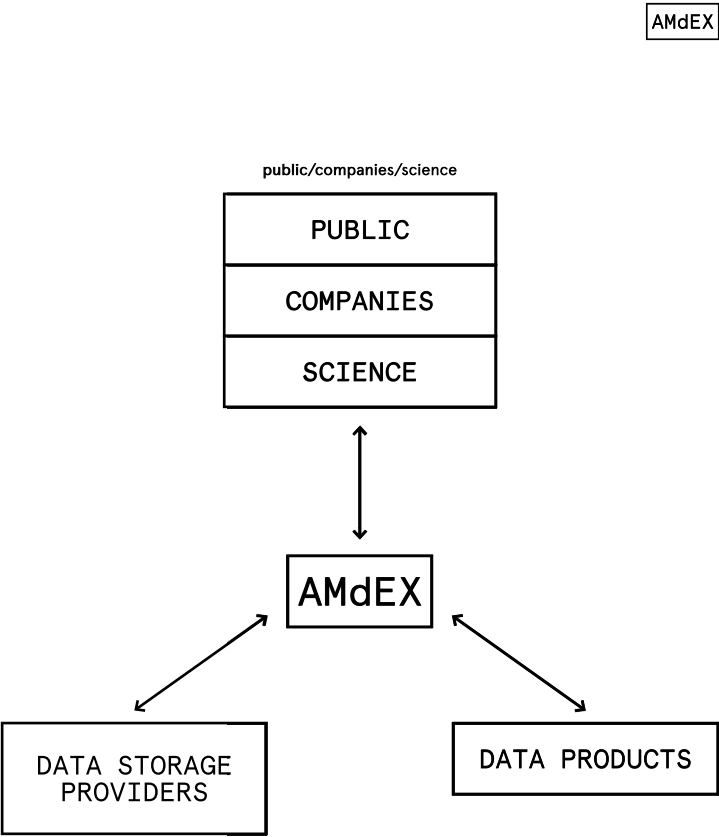
Public/Companies/Science
The organisations and communities producing data, and sharing these with their conditions. Data producers own their data and may decide which data to be shared with whom.

Data storage providers
Data storage providers (DataHubs) in the Open Data Market offering services and support (e.g. for data upload, persistency, facilities for data curation). Such providers operate in a landscape of different providers; for only a discipline, an economic sector, or with a generic public mission.

AMDEX
The planned "Amsterdam Data Exchange" facilitating on the back-ground:
– Infrastructure services (e.g. data interoperability, scalability, safety, performance)
– Rules (with contract models, legal interoperability)
– Support (for providers operating in the Open Data Market)

Data products
Providers offering "data products" based on available shared data in DataHubs. Such providers operate in an Open Data Market allowing users to shop, compare, and agree on service provision.

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A cooperating ecosystem of DataHubs

It is expected that a variety of providers will become active with data, data processing services and with data products for generic and specialized markets. Currently, quite some initiatives in Europe are focusing on specific (research, public, corporate) markets and these are often coined as Digital Innovation Hubs, Industrial Data Platforms, Personal Data Platforms, Competence Centres or Centres of Excellence. Such initiatives are aiming at promoting digital cooperation in a specific sector or region, or at creating environments for data-driven innovation. A recent study of the Dutch TNO technical organisation concludes that such concepts are key for adopting digitisation and new technologies, but too often are hampered by insufficient financial sustainability³. An underlying problem is that such initiatives are aiming at offering services for their user groups while each of these initiatives are too small to maintain full services.

Another relevant issue is the value proposition of the separate initiatives and how these are mutually related. The developing data market shows quite some initiatives but is chaotic with an blurred picture for customers with respect to who is offering what. Where to knock on the door for specific demands when is not known or clear what individual initiatives are offering and how these meet market demands. Currently, separate DataHubs have each defined their missions, but are they mostly not clearly positioned in the full data landscape to show their unique strengths. In addition, it is not known how to contribute to cooperation for reaching common benefits that otherwise would remain unattainable. An ecosystem with such engaged Data Hubs would also show competition, predation (takeover), and cooperation resulting into innovative dynamics.

Crucial is to identify and define the complex and costly services to be positioned as generic services. These concern the services such as networks for data connectivity, support for interoperability, enforced principles for trust, and conflict resolution. This ends up in the plan for a Data Exchange facility.

³ publications.tno.nl/publication/34625484/BABho6/TNO-2017-R10964.pdf

Amsterdam Data Exchange (AMDEX)

In an Open Data Market, the Amsterdam Data Exchange (AMDEX) would offer international participants the facilities for processing and delivering data between participants on their conditions. A safe and effective Open Data Market has to rely on a supporting infrastructure and trust for data transactions on demand and with real-time functionality. Such functionality is comparable with a physical marketplace where stalls are offered and set up, and with logistic support for supplies and cleaning, as well with market rules. Similarly, the Open Data Market has to offer a trusted and safe environment for cooperation between companies, academic institutions and other public and private organisations. Data providers and users may decide to participate in a Data Market facilitated by AMDEX to agree on data sharing and on offering new data-driven services. Such data sharing requires technological infrastructure, but also arrangements with respect to quality assurance, liability, auditing, enforcement and conflict resolution. While cooperating participants will shape the Open Data Market, AMDEX has to operate in the background to facilitate market functioning. This proposition does not present AMDEX as a monopolist, and it should be encouraged to promote similar developments elsewhere in Europe and internationally. AMDEX is not only meant for the Amsterdam region, but builds on the local digital infrastructure to offer facilities supporting an international neutral data market with capabilities that individual organisations and communities are not likely to establish themselves. There is clear added value with a generic approach offering cost effective services with accepted rules for cooperation and trust. A flexible approach, and adaptable to specific demands. Together these define the AMDEX functionalities.

Technical infrastructure

- Architecture to access and operate the Digital Market;
- DataHubs support for generic services to data producers;
- Support for accessing connectivity and bandwidth in between services in the data cycle;
- Computational software enforcement of Rules in the Digital Market.

Rules for trust (and risk reduction between participants)

- Framework to participate in and cooperate with parties in the Digital Market;
- Conditions and endorsement for data access, connectivity and other infrastructure;
- Models for agreements between parties in the Digital Market and end users, with engineering for scalable (software) contracts and supporting architecture;
- Auditing for performance and disputes.

Matching of parties

- Findability of data and services, including of data providers, data use by others, conditions, annotations, etc.;
- Data filtering services, algorithms, data processing, service/product offerings, user interactions;
- Operating with other European and international initiatives.

This results in a relative small organisational set-up. Monitoring the development of the Open Data Market will learn about experiences for future adaptations in the ecosystem of cooperating regions.

Increased supply of competent data scientists

The ambitions as outlined in this report depend on available competent data scientists. The data explosion and increased data use in science, public services, and in companies resulted in a growing gap between demand of expertise and supply from higher education. This is not restricted to information technology, but is primarily important for expertise on handling of big and complex data with respect to data management, data analytics, data engineering, methods for applications in research and business, and the competences to introduce novel solutions in different disciplines and sectors. Data scientists have to deal with all data issues within an organisation and externally with suppliers and customers. Such high demands require quite some attention for “data education” from primary schools up to higher education. This is true for all disciplines since data expertise has for example mathematical, life science or linguistics aspects. Data experts covering such competences are the ones that will make the difference in any organisation.

The Netherlands is well positioned with excellent data science curricula in its universities and polytechnical schools. The Amsterdam School of Data Science is a cooperation of such educational and research institutes⁴. Another example is the initiative of the University of Amsterdam to offer a European Educational Data Science Framework with model curricula based on a list of relevant competences⁵. This structured list is also helpful for organisations in their internal assessment of data science competences. It provides options to identify gaps in required competences and to define training or recruitment priorities⁶.

⁴ schoolofdatascience.amsterdam

⁵ edison-project.eu

⁶ datasciencepro.eu

Developmental process

A "Coalition of Doers"

The concept of an Open Data Market will become reality in a developmental process with the initiators who have to courage to go this path. This is similar to the vision of the European Commission on the European Open Science Cloud, as Commissioner Carlos Moedas stated that we must come to a "coalition of doers". Stakeholders in the Amsterdam region started initiatives to create the Open Data Market, and other actors with vision and courage are invited to contribute to defining the essential design components and to get involved with their funding in the implementation steps.

Data storage providers

The Amsterdam metropolitan region includes quite some DataHubs / data storage providers. These are commercial providers, as well in the public sector and in academia. Mutual interaction is important to understand each one's market niche and so promote a better market profiling with clarity to customers and data processing services. In this respect the Dutch national initiative of Commit2Data (C2D) Big Data Hubs is interesting as a coalition aiming at establishing a required infrastructure⁷. It aims at securing safe data transactions between companies with respect to for example industrial processes, chain processes, clear legal arrangements, auditable and enforced agreements. The vision is summarised in figure 3.

⁷ dutchdigitaldelta.nl/commit2data/big-data-hubs

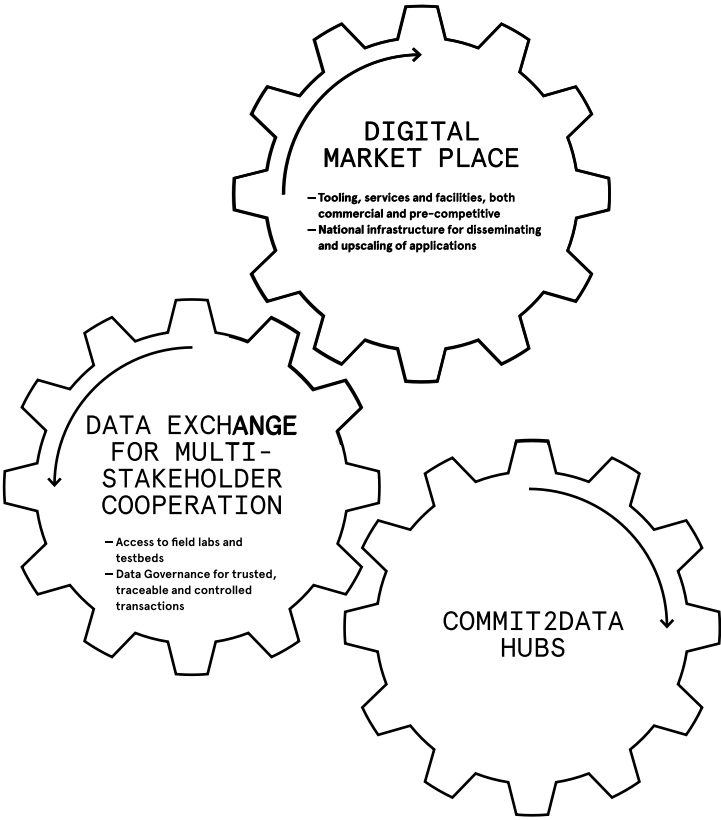
FIGURE 3
Big Data Hub Strategy for
a safe Data Market

Big data Hubs: instruments for valorisation and dissemination

Regional Big Data Hubs as connectors between C2D projects, existing fieldlabs & facilities. Thriving on regional economic clusters and ecosystems

- Focal points for collaboration of knowledge data and ideas, based on complementarity
- Creating critical mass
- Offering trusted data sharing facilities, secured data-governance and state-of-the-art tooling
- Firmly connected to:
 - (regional) knowledge institutions
 - small, medium, large enterprises
 - existing fieldlabs and infrastructure
- Supported by local economic development boards, CoC's
- Links to business acceleration support activities
- In line with the Big Data Value Centre and i-Spaces from the Big Data Value Association

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5.3 Data market for new services

Running pilot projects in the Amsterdam region related to establishing an Open Data Market are focused on public, scientific and private sectors, and at different scales including cooperation at the international level. The views until now are resulting in a better picture of an Open Data Market and the roles and functions of a facilitating AMDEX. These are summarised below (according the system of Open Distributed Processing⁸).

⁸ See for example: en.wikipedia.org/wiki/RM-ODP

– Value proposition

Objectives, AMDEX policy and scope.
(Why, for what, and for what purpose?)

– Data transactions

Which data? Scenarios, challenges and restrictions for data sharing at different scales.
(What is it about?)

– Computational design

Functional decomposition of the Open Date Market system and AMDEX, and mutual interfaces of components.
(How will each component operate?)

– Technology

Required hardware en software for the components.
(What is required to get it working?)

– Application/implementation

Establishing the components in a common infrastructure.
(How will the separate components cooperate, what is crucial for market functioning?)

In order to get the plans moving fast, it is conditional that interested participating parties in the developmental phase will demonstrate their commitment and leading role with their own investments. Additional funding may serve as seed money, but should not be conditional for progress. This approach will demonstrate a community driven energy and strong public image.

Recommendations

Chapter 5

Promote an Open Data Market

- Create an Open/transparent Data Market allowing data owners to share their data under their conditions with selected other parties, while data sharing and transactions are supported by common facilities and rules.
- Promote initiatives to offer services based on new data products in the Open Data Market.
- Organise publicity and marketing, also to attract additional funding.

Position an Amsterdam Data Exchange (AMDEX)

- Develop and establish the Amsterdam Data Exchange (AMDEX) to facilitate an Open Data Market: infrastructure and arrangements for data processing and data transfer between parties based on agreed conditions.
- Focus AMDEX on offering technical infrastructure, rules for trust, and matching of parties.
- Position AMDEX as an additional contribution to the European Open Science Cloud.

Agree on a multi annual developmental programme

- Start a developmental process with initiators throughout Europe and beyond that have the courage to shape the Open Data Market and are willing to invest in implementation steps.
- Secure governmental support at different levels from communities, regions, and up to nations.
- Organise periodic meetings between regions and sectors in order to synchronise initiatives, but also to secure a functioning labour market including education, career perspectives, and re-training.

Selected initiatives in the Amsterdam metropolitan region

Appendix

The initiatives below show selected contributions to an Open Data Market and to the role of the Amsterdam Data Exchange facilitating, local, European and international data sharing and transactions.

EOSCpilot

Several Dutch organisations participate in the European Open Science Cloud pilot project

Website

eosc-pilot.eu

surf.nl/en/about-surf/subsidiaries/surfsara

Commit2Data

The Commit2Data Big Data Hubs provide a pre-competitive environment for scientists, SME and larger companies to cooperate on real use cases.

Website

dutchdigitaldelta.nl/commit2data/big-data-hubs

Data Logistics 4 Logistics Data

DL4LD is an innovation project of the Dutch national technical institute TNO and the University of Amsterdam on sharing logistic data at a large scale.

Website

dl4ld.net

Equinix

Business hubs for hundreds of companies with a range of network services.

Website

equinix.com/locations/netherlands-colocation/amsterdam-data-centers

Amsterdam Innovation Arena Smart City Pilot

Project aiming at developing a smart stadium as an pilot example of a smart city, including a trusted digital marketplace.

Website

amsterdaminnovationarena.com

City Data

The data portal City Data of Amsterdam city showcases important parts of the huge city related data.

Website

data.amsterdam.nl

Knowledge mile

The Amsterdam Creative Industries Network created a transformation of one of the Amsterdam long streets into the smartest city street, known as the Knowledge Mile.

Website

dutchdigitaldelta.nl/succesverhalen/knowledge-mile-de-slimste-sstraat-van-amsterdam

EGI

EGI is a federated European e-Infrastructure providing advanced computing and data services for research. It brings together hundreds of data and compute centres in Europe and beyond.

Website

egi.eu

Urban Mobility Lab: Unravelling transport flows in Amsterdam

Urban Mobility Lab analyses multi-modal traffic flows. By collecting and combining data from all different mobility systems and actors, the complex relations between transport systems, activity patterns, demographic and economic processes are analysed for sustainable transport solutions.

Website

dittlab.tudelft.nl:8080/UML/triple-event.jsp

dittlab.tudelft.nl/index.php/urban-mobility-lab

CHIEF E-mobility

Intelligent data-driven optimisation of an electric car charging infrastructure.

Website

hva.nl/urban-technology/subsites/nl/kc-techniek/projecten/projecten-algemeen/ido-laad.html?origin=SjMzh29%2BT2SSTII-wlg69%2Fw

COLOPHON

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Report preparation by Wouter Los (Los Consultancy), supported by an advisory group with representatives from stakeholders in the Amsterdam metropolitan region.

Amsterdam, January 2018

The logo for 'tada' is displayed in white lowercase letters on a black rectangular background.

**DATA
DISCLOSED**

www.tada.city