

# *Executive summary*

## Study *Linked Estonia*

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This document is a brief summary of a longer and more comprehensive study. For better understanding of the information provided in the brief summary we recommend to read the final report of the study.

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# *Executive summary*

Estonia lacks a comprehensive and contextual study on the possibilities of using linked data that would take into account the Estonian needs and form a basis for developing the policy related to linked data. The findings of this study are directly contributing to the development of the country's ICT policy: preparation of implementation plans of upcoming digital agendas, preparation of financing rounds of structural funds and development of interoperability framework documents.

The objective of this study is to provide an input to the implementation plans aimed at achieving the objectives of the Digital Agenda 2020 in the field of the development and use of linked data and to prepare changes in the Estonian legal system and policy measures necessary for the efficient implementation of activities related to the use of linked data.

In the study we have outlined an approach for wider commissioning of linked data technologies in Estonia, highlighting the deficiencies that restrict efficient development and use of linked data. It includes recommendations for the re-organisation of public, private and voluntary sector databases, websites and other information resources as well as lists government's policy measures to support these activities.

## *Use of linked data*

Linked data technologies are used to link isolated data, enabling to create new services and knowledge, and to promote innovation. Examples of possibilities outlined in the studies include the governance transparency and efficiency, innovation and 21st century infrastructure. For governments, linked data technologies enable to develop smarter and more efficient public sector services and applications. Therefore, the taking of linked data technologies into wider use should be promoted.

The objectives of and results in use of linked data include improved communication between the state and its citizens, „invisible“ services that people are legitimately entitled to and that they must receive regardless of whether they purchase these services or not; faster analysis of data; enabling of monitoring for providers of vital services; reduction of public sector expenditure; increase of the quality of life of the population and decrease of the costs in the healthcare sector. The issue of linked data and related technologies should include in an updated and specified form in the interoperability framework of the state information system and related documents. It should also be taken into account that linked data constitutes a typical innovation process in which cost-effective implementation of new technology requires prior sizeable investment in the development of functioning infrastructure, prior publication of linked data, training of qualified developers, etc.

In a qualitative study, respondents emphasised the need for opening data and using semantic technologies in purpose of introducing and adopting linked data in state information systems.

With regard to linked data, Estonia should actively participate in the following initiatives: European Commission's initiatives and programs, standardisation activities, OECD project for open public sector data, series of European data forum conferences, European public sector information platform ePSI, open government partnership program, etc.

It is necessary to launch pilot projects that demonstrate the benefits of linked data and that can be used as examples in training. For taking into use of Estonian internal linked data, pilot projects should be planned in a way that they take into account Estonia's uniqueness (e.g., existence of X-Road and RIHA, the administrative system of the state information system), would not overlap major international research projects without significant need, create the possibility for third persons for creating linked data applications, create useful proof of concept for the end user or the public, would give stakeholders new experience and be sustainable. After proof of concept the next major program would be to develop core linked data based on key data to which the rest of data can be linked, if necessary.

For raising the capacity in the field of linked data, it is necessary to start in parallel with launching courses and training programs in the field of linked data, initiating pilot projects and creating technical infrastructure solutions. The first phase of training should focus on general issues (estimated duration: one day) and technical issues (estimated duration: two days). In addition, it is necessary to take part in international initiatives and to improve the regulatory environment. For raising awareness on linked data it is necessary to start by updating the information policy and its implementing plans, develop the interoperability framework further and to prepare guidelines.

The use of linked data includes agreements on the four levels of interoperability – technical, semantic, organisational and regulatory levels. Changes in the regulatory level must support other levels, and vice versa. Since linked data constitutes a typical innovation process where the cost-effective deployment of new technology requires prior sizeable investment, it is necessary to secure political support for promoting linked data and open data technologies. The incentive for such support could be indirect assessment of the level of possible benefit resulting from the publication of public sector data based on international practice.

## ***Development of interoperability architecture***

The taking into use of linked data and semantic web standards would not mean major changes in the architecture of state information system – RDF, RDFa, microdata, OWL, SA-WSDL, URI, URL, HTTP and other standards already exist in the interoperability framework of state information systems and are sufficiently mature for being taken into use. Since the implementation of linked data standards is not an objective in itself, it should be organised in connection with projects, training and other initiatives related to linked data. For developing linked data, it is reasonable to use as much as possible the opportunities provided by the existing architecture of the state information system. Since the data of state information systems are available through the X-Road, the use of the X-Road for generating linked data is entirely appropriate. At the same time it is necessary to establish design principles for linked data services for using data services of the X-Road. In addition, it is necessary to create infrastructure which enables to apply data services created for X-Road that offer open data without using the whole X-Road infrastructure.

It is necessary to develop further the Estonia's open data portal [opendata.riik.ee](http://opendata.riik.ee) and the portal of open linked data, connecting them with other data sources such as the Estonian National Geoportal, Land Board's Geoportal, Environmental Agency's portal and the database of Statistics Estonia. Since the data of many public sector organisations are not registered in the portal, a project should be launched for creating and publishing the list of open data in the Estonian public sector.

Crowdsourcing is an important instrument in shaping the civic society since it simplifies the contribution of individuals for solving major problems. For the implementation of crowdsourcing, the creation of a multi-functional crowdsourcing platform (including linked individuals) is of critical importance that will simplify the inclusion of persons in various initiatives. The state can carry out pilot projects for creating crowdsourcing platforms and test applications either as general competitions or in the interest of modernisation of specific services.

For using linked data, the existing semantic resources should be developed further, harmonised and/or coordinated, especially in case of cross-sector applications. In addition to extending existing semantic resources in accordance with the existing semantic interoperability framework, the next version of the semantic interoperability framework should be modernised from the viewpoint of linked data and related technologies. In websites and web interfaces linked data should be taken into use by assigning RDFa, microdata or microformat labels to HTML documents. The specific language and vocabulary of labels will be chosen on pragmatic considerations. In public sector websites, the priority is to label contact information of the organisations' staff and events.

## *Organisational interoperability*

The technologies of linked data, semantic web and other technologies covered in this study must be leveraged in cooperation with universities through topical educational, training and research projects which would involve experts from abroad and local students. Study programs of universities should also be regularly updated in the light of the latest trends. In addition to modernising universities' study program, it is necessary to provide training targeted at solving problems involving specific larger target groups.

As shown by interviews, respondents consider the development of services as the main opportunity of the Estonian ICT sector. Confidence in innovation is not especially high and the state should take the initiative and responsibility as a priority. For involving the private sector, rules on open and linked data should be added to public procurements that would be mandatory when procuring an information system. Estonian ICT sector can increase its export capacity by producing software based on linked data and the public sector can contribute to it by requiring that linked data is consistently used in products that they order or support.

In addition, public sector administrations should increase the role of analytical applications which use data also outside their own administrative field and which provide more obvious benefit from the use of linked data. For facilitating the development of such solutions, it is reasonable when making ICT financing decisions to take into account their cross-sectorial influence. This requires that initial problem statements of information systems separately outline the possible impact of data residing outside the administrative field on the application by taking into account usage of sectorial and open data sets. The impact of linked data can be amplified by linking other measures requiring ICT investments so that they contribute to the creation and operation of open sector linked data PaaS service platform(s) (e.g., linked data platform for e-commerce solutions).

The need for the state to take the initiative and responsibility was considered a priority by the representatives of the private sector. Another aspect that is considered important is success stories that would show innovative problem solving and could be scaled to Europe. They see the role of the private sector mainly in the creation of services, removing the public sector from the role of the service provider. The influence of linked data on private sector could be compared with the positive impact of open standards. The use of open standards and participation in standardisation has contributed significant part of growth in GDP for developed industrial countries.

The voluntary sector and citizens have been fairly active worldwide in the field of linked data. For involving the Estonian voluntary sector and citizens it is necessary to raise awareness and provide training on linked data, interesting applications, relatively simple tools and available linked data. Awareness raising, training and creation of linked data should be carried out in the framework of fulfilment of public sector duties and initiatives provided in previous sections, for instance by earmarking a certain percentage of seats in training events for the voluntary sector and citizens.

The public sector plays a leading role in the taking into use of open and linked data. It is usually the initiator, approving legal acts, recommending or enacting standards, publishing data, developing primary services, ordering pilot projects, providing training and informing other parties. Making Linked Estonia a success requires a strong leading political figure.

In the Estonian state information system, generation and publication of linked data should use a life cycle model that is in good accordance with both the TNO open data life cycle model and W3C recommendations.