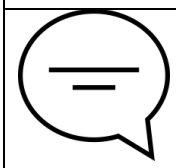
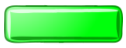
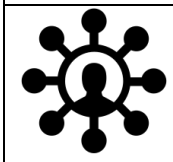
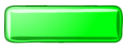
Roadmap for API Economy

Description and state of the art	
Definition	Trend, based on engineering and software development advances. The API Economy refers to the trend of turning a business or organization into a platform by using Application Programming Interfaces (APIs) to integrate and connect people, places, systems, data, things and algorithms, create new user experiences, share data and information, authenticate people and things, enable transactions and algorithms, leverage third-party algorithms, and create new product/services and business models, thus positively affecting the organization's profitability[246]. An API is a set of subroutine definitions, protocols, and tools for building software and applications by abstracting the underlying implementation and only exposing objects or actions the developers need in order to reduce their cognitive load[247]. Essentially, an API is a customer interface for technology products that allows software components to communicate[248].
 Addressed societal /business or public sector need	Societal need: Faster and transparent access to PS services
Existing solutions /applications /services	• ECIM[249] Smart Mobility API • STORK project[250] • WatchUK, CitaDel, Public Contracts http://public-contracts.nexacenter.org/, Open Coesione[251] (to monitor how EU money is spent) http://www.opencoesione.gov.it/ , Visual OPML[252] (to make available employment data through innovative interfaces) • CitySDK APIs (Amsterdam)[253] • The European Cloud Marketspace for Intelligent Mobility (ECIM) offer APIs for EU wide mobility apps
Main actors	• Fraunhofer-Gesellschaft zur Förderung der Angewandten Forschung e.V. • European Crowdfunfind Network • Technische Universiteit Eindhoven • Ethniko Kentro Erevnas Kai Technologikis Anaptyxis

regarding R&D of this technology	• Europe Unlimited S.A. • Fundacion Centro de Tecnologias De Interaccion Visual y Comunicaciones Vicomtech • Institut Jozef Stefan • Universidad Politecnica de Madrid • University of Southampton • IBM • Vordel (now part of Axway)
 Current research activities	**EU R&D projects and programmes** NEAT and some applications of APIs: CANGOPAL, MusicBricks **Other national or international R&D projects and programmes** DARIAH-DE (BMBF), KobRA (BMBF)
 Impact assessment	**Public sector modernization:** • Degree of Resources (Capital, Personnel, Infrastructure) Utilization • Efficiency / Productivity • Sustainability • Cross-organization Cooperation • Quality of Services Provided • Image Modernization • Transparency • Creation of Trust & Confidence **Public Sector as an Innovation Driver:** • Entrepreneurship • Innovation • ICT Infrastructure • e-Security
Necessary technological modifications	
 Potential use cases	There are quite a lot of potential uses of APIs where public sector releases data to be used by other applications, for example: Emergency situations handled by agencies need to coordinate with other agencies for housing, emergency services, food supplies, etc. Different types of emergencies need different types of support and the ability to put together solutions quickly and integrate with local private sector suppliers quickly can benefit from an API approach. Private sector developers can access government APIs to provide value to citizens and potentially earn some revenue. Businesses may want to access traffic data to find opportunities for marketing (e.g. to people stuck in traffic). Infrastructure planning and zoning are also potential consumers of this data. Population and census data can be made available via APIs for outside developers to access and use in their Apps in creative ways.

	On the homepage of programmableweb.com there are e.g. 712 API's listed in the area of "government". Several of them will help to present public sector information to citizens and businesses, e.g. World Government Data, GeoGratis (geospatial data), opengov.es (data from the Spanish government)[254]	
Technological challenges	• Programming knowledge required. • Poor or badly written APIs. • Maintenance required. • Potential of system crash when testing APIs. • Steep learning curve to knowing how to program APIs • No standardised documentation	
Necessary activities (in or for the public sector)		
Development of a specific training necessary	**Open task**	Creating new APIs does take some work and developers need to know about the data and programming. However, it's much faster than traditional application development, and requires no rewriting or recoding of source applications.
Advanced or adapted ICT infrastructure needed	**Open task**	The large amount of data put at the disposal of third parties implies placing that data within big data systems for data analytics processes to analyse the data in real time or near real time.
Change of (public sector internal) processes necessary	**Open task**	As derived from the potential use cases described, there is a need for partnerships with private sector, so, in many cases, it is necessary to change internal processes. Besides, and because of API efficiency, government employees can shift from transaction processing and other clerical tasks to other type of activities, which also demands changes.
Promotion / information of stakeholders necessary	**Open task**	According to a Deloitte analysis[255] on API economy from a public sector perspective, the full realization of this "API economy" will require government to assemble a community of partners, including those from the open source, to create a thriving ecosystem. Additionally, it is desirable that public sector APIs are collected in a public directory to promote them and encourage its use.

Need to deal with cyber security issues	**Open task**	Cyber risk considerations should be at the heart of the API economy. APIs expose data, services, and transactions, creating assets to be shared and reused. The downside is the expansion of critical channels that need to be protected—channels that may provide direct access to sensitive IP that may not otherwise be at risk. Deloitte, in their report about API Economy – From systems to business services[256], poses some leading concerns: • Control: who is allowed to access an API, what they are allowed to do with it, and how they are allowed to do it. Managing this concern translates into API-level authentication and access management, controlling who can see, manage, and call underlying services • More tactical concerns focus on the protocol, message structure, and underlying payload, protecting against seemingly valid requests from injected malicious code into underlying core systems. • Routing, throttling, and load balancing have cyber considerations as well—denials of service (where a server is flooded with empty requests to cripple its capability to conduct normal operations). • Privacy and security concerns arise whenever public sector entities share data, especially citizen data.
New or modified legislative framework or regulations necessary	**Open task**	An important issue in the API Economy is data ownership and liability, regardless of whether the APIs are open or protected.
Development of a common standard necessary	**Open task**	Public sector needs to start making APIs a required component of the projects they undertake, including the use of open and established standards. Standards are there, but it is important to ensure that they are leveraged to ease the data exchange between the different IT systems.

		According to Liip[257]: Standards like Swagger and RAML can help when implementing API documentation. With regard to the protocol, for server-to-server communication REST APIs based on XML are the standard, while REST via JSON is becoming increasingly popular especially for server-to-browser communication. For authentication, OAuth is the most popular option for user based authentication, while JSON Web Tokens are more or less the go to option when implementing server-to-client authentication. For single sign on SAML should be considered as the go to option.
 Need for a more economical solution	**Open task**	API Economy in public sector has some associated costs (development costs, maintenance costs, API documentation and support provision to users of the API). But, in the long run, APIs enable fast and transparent access to public sector services, which saves time and money.
Dealing with challenges		
 Ethical issues		No ethical issues identified
 Societal issues		No ethical issues identified
 Health issues		No ethical issues identified
 Public acceptance		There are some facts that are accelerating API adoption in the public sector and the high acceptance levels. Citizens' desire for more data and agility in their public processes, demands for improved customer service, budget pressures to deliver more services with less funding. Those leading the way in the API Economy are

		the ones that start by identifying high-value use cases that facilitate smoother interactions between citizens, businesses and government agencies.