



CREATE-IoT

Hyper-connected Society



European
Large-Scale Pilots
Programme

IoT European Large-Scale Pilots Programme

Key Performance Indicators

ACTU
VAGE
PROJECT

AUTOPILOT

IOF
INTERNET OF FOOD & FARM

MONICA

SYNCHRONICITY

CREATE-IoT

U4IoT

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Define Key Performance Indicators (KPIs) to ensure the longer-term evolution of the IoT, critical mass, rich portfolio of technologies, tools, to guarantee the sustainability of European IoT ecosystems and contribution to IoT infrastructures viable beyond the duration of the Large-Scale Pilots.

The Rationale

CREATE-IoT supports the IoT European Large-Scale Pilots Programme in the development of a **common methodology** and in the design of **horizontal KPIs** (H.KPIs) to measure the LSPs impact on the overall Programme.

A common methodological performance framework is instrumental to:

- **Guide the LSPs towards their specific objectives**, while:
- **Making sure that the overall Programme effectively tackles the challenges and measures the expected impacts** identified by the European Commission in Work Programme.

What are Horizontal KPIs (H.KPIs)



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Horizontal KPIs (H. KPIs) are Key Performance Indicators measuring the **contribution of the LSPs participating in the Programme** to the achievement of the strategic impacts of the Programme and underlining their **cumulative value added**.

They have been developed on the basis of an **iterative process** led by CREATE-IoT in collaboration with the LSPs. “Horizontal” therefore refers to the horizontal impacts of the Programme across all Focus Areas.

The list of validated Horizontal KPIs approved by the LSPs and CREATE-IoT taskforce dedicated to this activity is linked to the current IoT European Large-Scale Pilots Programme’s expected impacts and is ready for measurement.

Programme Expected Impact Areas

1

Validation of technological choices, sustainability and replicability, of architectures, standards, interoperability properties, of key characteristics such as security and privacy;

2

Exploration and validation of new industry and business processes and innovative business models validated in the context of the Pilots;

3

User acceptance validation addressing privacy, security, vulnerability, liability, identification of user needs, concerns and expectations of the IoT solutions;

4

Significant and measurable contribution to standards or pre-normative activities in the Pilots' areas of action via the implementation of open platforms;

Programme Expected Impact Areas

5

Improvement of citizens' quality of life, in the public and private spheres, in terms of autonomy, convenience and comfort, participatory approaches, health and lifestyle, and access to services;

6

Creation of opportunities for entrepreneurs by promoting new market openings, providing access to valuable datasets and direct interactions with users, expanding local businesses to European scale, etc;

7

Development of secure and sustainable European IoT ecosystems and contribution to IoT infrastructures viable beyond the duration of the Pilot.

Validated Horizontal KPIs – IoT Technology and Standards (Domain I)



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KPI I- 1

IoT Standard Impacts: Number of IoT Standards Contributions and Description of relevant Contributions

KPI I-2

IoT Platform / Device Interoperability Impacts: Description of relevant Achievements

KPI I-3

Number of IoT Open Platforms supported by LSP

KPI I-4

Number of Open Data Sets used / provided by the LSPs

KPI I-5

New Market-ready Solutions: Number of Market-ready IoT Solutions developed by LSP



KPI II-1

Innovative business models:
Number of validated and
sustainable business models

KPI II-2

Achievements in replicability and
sustainability of IoT services by LSP
(specific LSPs indicators)

KPI II-3

Social impacts: LSPs' achievements
on users perceived value,
improvement of quality of life and
social welfare
(specific LSPs indicators)

Validated Horizontal KPIs – Ecosystem Openness and Value Chain Involvement (Domain III)



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KPI III-1

Stakeholders involved by LSP by
Category for each Focus Area Value
Chain
(number and % coverage)

KPI III-2

SMEs Inclusion: Number of SMEs
involved by LSP
(open calls)

KPI III-3

Demonstrating IoT: Number of Pilot
Sites open to Visitors

Validated Horizontal KPIs – User Acceptance and Accessibility (Domain IV)



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KPI IV-1

Trust in Privacy and Data Protection Measures
for Piloted Services
(Qualitative Indicator)

KPI IV-2

Level of IoT Trial
Users Satisfaction
(Qualitative Indicator)

Domain I

IoT Technology and standards validation

Up-scaling, replicability and sustainability

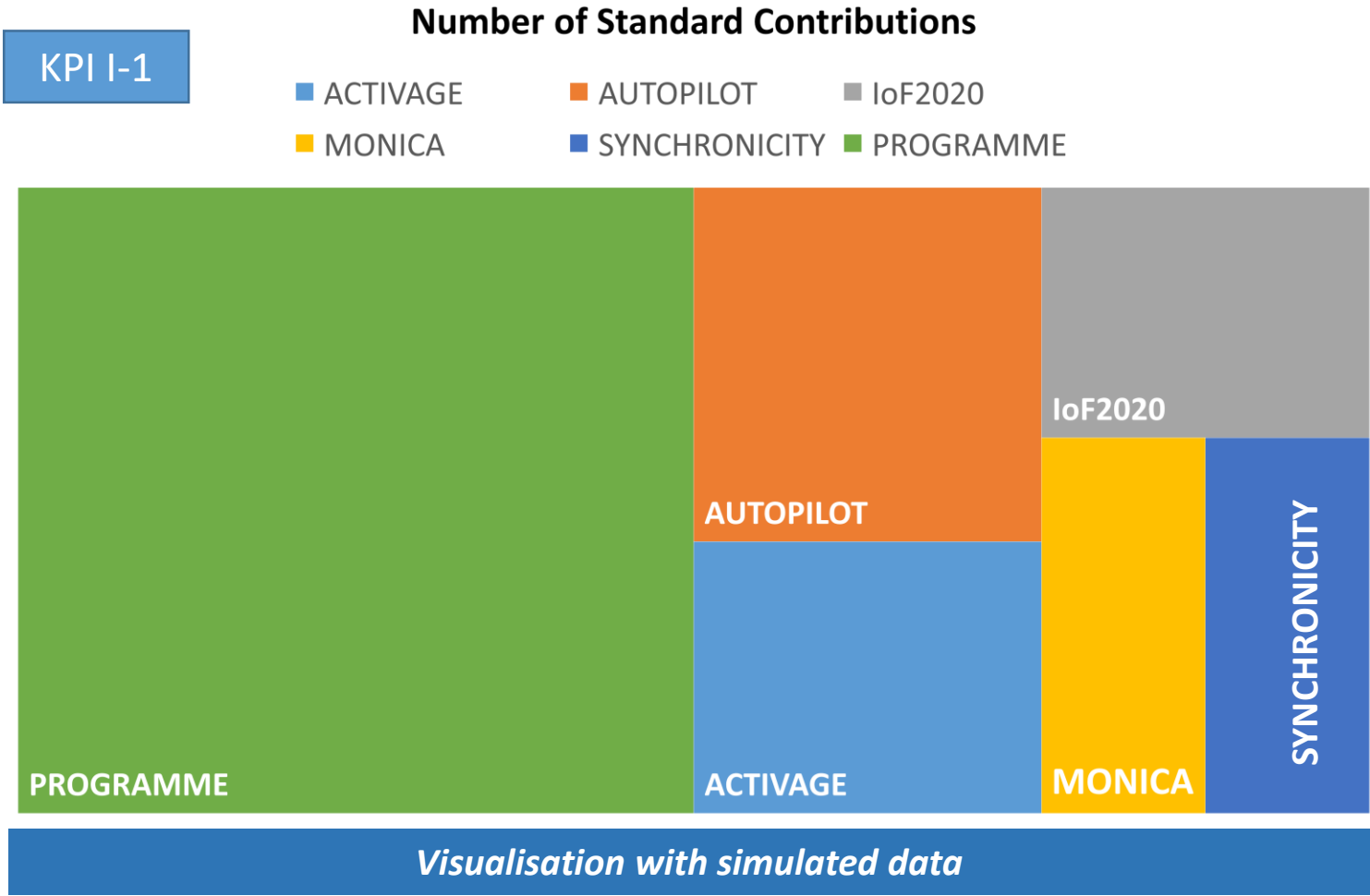
Domain I – KPIs on Impacts on IoT Standards and Open Platforms



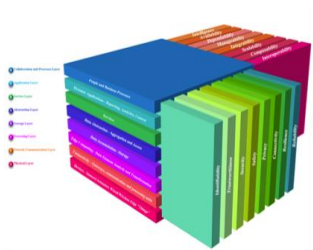
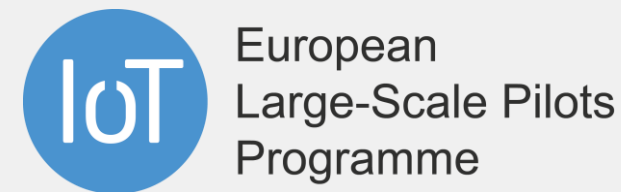
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KPI Name	KPI Definition	Proposed Metrics	Method of calculation and validation	Impact Areas by KPI
Contributions to IoT standards	IoT standards impacts	Number of relevant standard contributions by each LSP	Number not relevant: collect examples and validate in AG02	Significant contribution to IoT standards. Impact Areas: 1, 4
	IoT platform / device interoperability impacts	Improvement of IoT interoperability implementations through standards by each LSP	Number not relevant: collect examples and validate in AG02	Implementation of IoT platform / device interoperability through standards. Impact Areas: 1,4
Open platforms	IoT open platforms supported by LSP	Ratio open/proprietary platforms by LSP	<ul style="list-style-type: none"> Collect number from LSP Take highest number as = 100% and normalize all others on a scale 1 to 100% Present results on spider diagram 	Implementation of open platforms contributing to EU IoT ecosystems. Impact Area: 4
Open data sets	Open data sets used/ provided by the LSPs	Number of open data sets in use by Pilot / total project	<ul style="list-style-type: none"> Collect number from LSP Take highest number as = 100% and normalize all others on a scale 1 to 100% Present results on spider diagram 	Development of sustainable European IoT ecosystem through the provision of open data sets. Impact Area: 7

The EU IoT LSP Programme Significant Contribution to the Development of IoT Standardization



The EU IoT LSP Programme Significant Contribution to the Development of IoT Platform / Device Interoperability



A 3D-Reference Architecture Model for all LSPs.



Contributions of all LSPs to SAREF to support a European Standard Ecosystem.

KPI I-2

IoT Platform/Device Interoperability Impacts



Contribution/involvement of oneM2M, AIOTI, ETSI, Smart M2M, and others in AUTOPILOT use cases and activities.



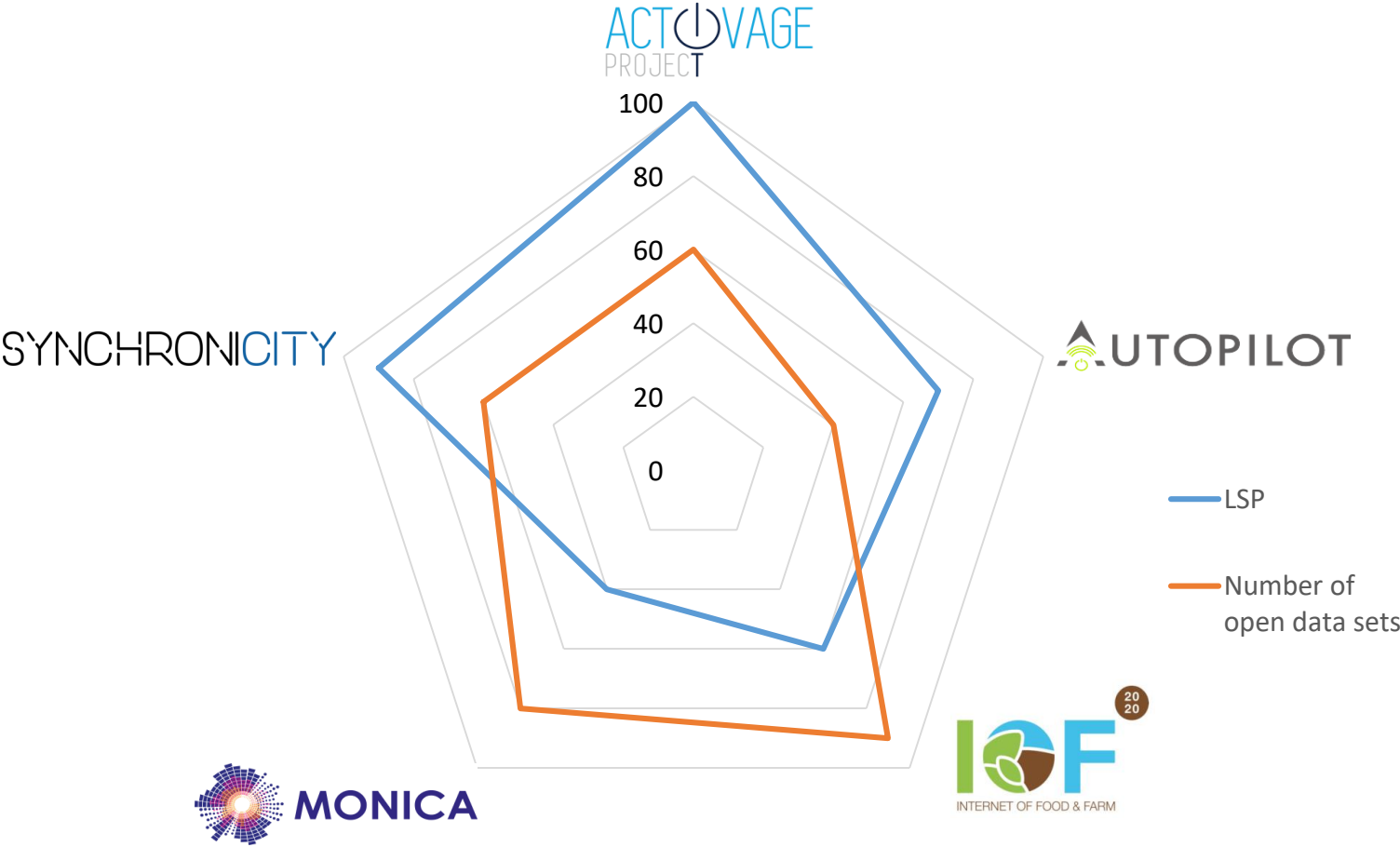
Contribution to wireless standards that was missing so far.



Contributions to leading ITU-T Groups.

The Development of IoT Open Platforms and Open Data Sets is a Key Achievement of the IoT LSPs

KPI I-3
KPI I-4



Visualisation with simulated data

Domain I – KPI I-5 on Development of Market-ready IoT Solutions



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KPI Name	Definition	Proposed Metrics	Method of calculation and validation	Targeted impacts by KPI
Number of market-ready IoT solutions	The number of products or services developed by the LSP ready for commercial launch	Absolute number of products/services for each LSP	Collect number for each LSP	Creation of new IoT business opportunities through market-ready solutions. Impact Area: 6

LSP	ACTIVAGE	AUTOPILOT	IoF	MONICA	SYNCHRONICITY
N. Pilots, trials	9	6	5	6	10
N. Market-ready IoT Solutions	9	6	5	6	10

Assumption: minimum 1 market-ready solution for each trial
Numbers to be updated based on actual KPI measurements

The IoT LSPs have collectively developed a Significant Number of Innovative Market-ready Solutions in their Respective Focus Areas

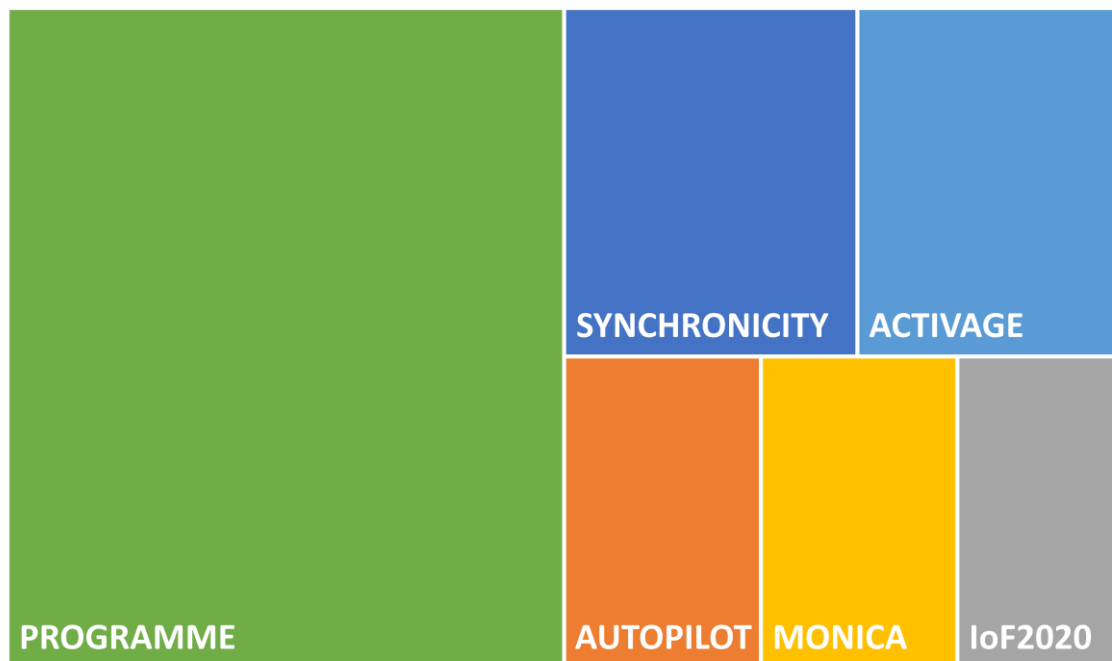


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KPI I-5

Number of Market-Ready IoT Solutions

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■ MONICA ■ SYNCHRONICITY ■ PROGRAMME



Visualisation based on assumption: 1 market-ready solution for each trial



Smartwatch-based Solution to support Healthcare, Independent Living and Community Engagement



HD Maps for Automated Driving Vehicles



SW Plug-In to read data from different sources



Video analytics to monitor crowd size, density and flow



Autonomous Air Quality Management Solutions (AAQM)



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Domain II

Business Opportunities and Social Impacts

Domain II – KPIs on Business Opportunities and Social Impacts



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KPI Name	Definition	Proposed Metrics	Method of calculation and validation	Targeted impacts by KPI
Innovative IoT-based business models	Number of validated and sustainable business models	Absolute number of business models by LSP	Collect number from each LSP	Exploration and validation of new industry and business processes and innovative business models validated in the context of the Pilots. Impact Area: 2
Business opportunities by stakeholder segment	Achievements in replicability and sustainability of IoT services by LSP	Specific indicators by LSP	Collect measurement from each LSP-specific KPIs	
Social Impact	LSPs' achievements on perceived value, improvement of quality of life and social welfare	Specific indicators by LSP	Collect measurement from each LSP-specific KPIs	Improvement of citizens' quality of life, in the public and private spheres, in terms of autonomy, convenience and comfort, participatory approaches, health and lifestyle, and access to services. Impact Area: 5

The IoT LSPs have developed a Number of Innovative and Sustainable IoT-based Business Models in their Respective Focus Areas

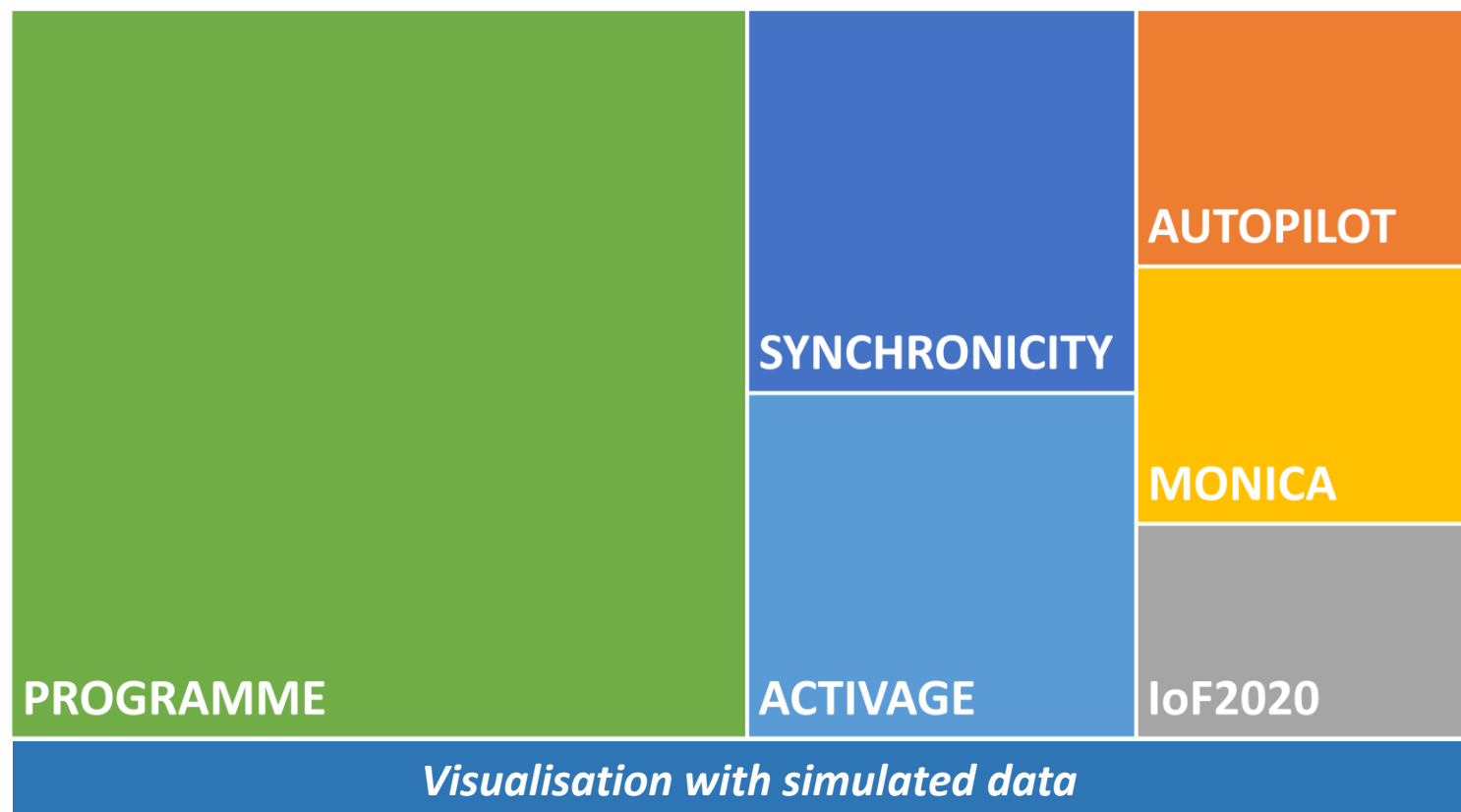


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KPI II-1

Number of Innovative IoT Business Models

■ ACTIVAGE ■ AUTOPILOT ■ IoF2020 ■ MONICA ■ SYNCHRONICITY ■ PROGRAMME



The IoT LSPs are improving the Sustainability and Replicability of IoT Services and Business Models



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KPI II-2



- 1 Business and cost benefits indicator
- 2 Number of demand creation players validating ACTIVAGE proposition



- 1 Collaboration Strategy: alliances and partnerships with other companies or consortia



- 1 Efficiency improvements in agrifood processes
- 2 Environmental impacts through resource reduction and lower CO2 emissions



- 1 Contribution to open, interoperable Smart cities platforms
- 2 Value chain actors involved



- 1 Number of services implemented during the project lifecycle
- 2 Number of replicated services during the project lifecycle
- 3 Number of new follower cities

Note: all indicators are selected from the KPI list developed by LPS – selection validated in KPI group discussions

IoT Innovation pioneered by LSPs improves Social Welfare and Quality of Life in Multiple Domains



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KPI II-3

ACTIVAGE
PROJECT

- 1 Improved quality of life for users
- 2 Improved quality of life for informal caregivers
- 3 Improved quality of life at work for professional caregivers

AUTOPILOT

- 1 Improved road safety
- 2 Improved personal mobility and sustainable mobility

IOF
INTERNET OF FOOD & FARM

- 1 Ease of work
- 2 Impacts on Public Health
- 3 Improvement of Food Quality

MONICA

- 1 Quality of life improvements for noise reduction (musicians, neighbours, other professionals)

SYNCHRONICITY

- 1 Perceived value by the citizens/end users
- 2 Perceived value by the local government and decision makers involved

Note: all indicators are selected from the KPI list developed by LPS – selection validated in KPI group discussions

ACTIVAGE
PROJECT

AUTOPILOT

IOF
INTERNET OF FOOD & FARM

MONICA

SYNCHRONICITY

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Domain III

Ecosystem Openness, Development and Value Chain Actors' Involvement

Horizontal KPIs – Ecosystem Openness, Development and Value Chain Actors' Involvement



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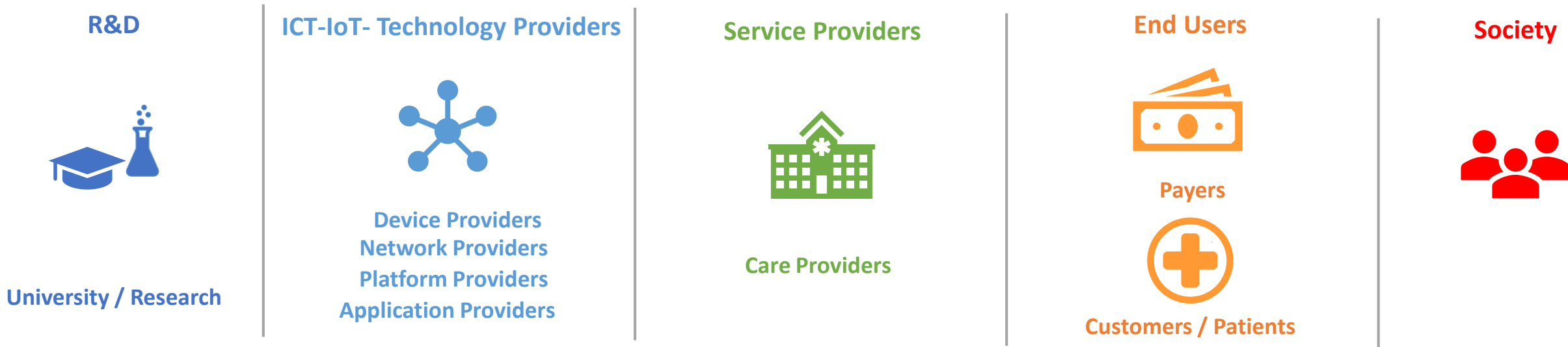
KPI Name	Definition	Proposed Metrics	Method of calculation and validation	Targeted impacts by KPI
Impacts on IoT Ecosystem	Stakeholders involved by LSP by category for each Focus Area ecosystem	Number of ecosystem partners/third parties involved by LSP and level of participation in the project of the stakeholder categories active in the ecosystem (all categories represented = 100%)	Collect input from each LSP	Promoting the ecosystem development by involving all stakeholders typologies in the value chains. Impact Area: 7
SMEs inclusion	Number of SMEs involved by LSP	N. of SMEs involved by Pilot / total per LSP / and as % of total partners	Collect input from each LSP	Promoting the ecosystem inclusiveness by demonstrating the viability of SMEs inclusion. Impact Areas: 7, 6
Demonstrating IoT	Number of Pilot sites open to visitors	N. of Pilot sites with implemented IoT solution open to visitors	Collect input from each LSP	Promoting the ecosystem development by demonstrating IoT technology solutions to stakeholders. Impact Areas: 7, 6

The IoT EU LSP Programme Impact on the IoT Ecosystem

Active and Healthy Ageing



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KPI III-1

ACTIVAGE
PROJECT

ACTIVAGE brings together 48 partners from 9 European countries with the objectives to build the first European IoT ecosystem across 9 Deployment Sites (DS) in seven European countries. It engages the whole spectrum of the active and healthy ageing ecosystem responding to real needs of caregivers, service providers and public authorities.

The IoT EU LSP Programme Impact on the IoT Ecosystem

Active and Healthy Ageing



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KPI III-1

Role in the ecosystem	Stakeholder category	Ecosystem coverage	
		N.	% of categories
R&D	University/ Research	8	14%
ICT/IoT - Technology Providers	Device Providers	6	10%
	Network Providers	1	2%
	Platform Providers	8	14%
	Application Providers	9	15%
Service Providers	Care Providers	9	15%
End Users	Payers	7	13%
	Customers/ Patients	9	15%
Society	Civil Society	1	2%
Total		58	100%

ACTIVAGE Open Calls



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1st Call: 31 Jul 2018 - 31 Oct 2018
2nd Call: 22 Mar 2019 - 21 Jun 2019



Total Budget Allocated for Open Calls
(Call 1 and 2): **€ 1,200,000**



Registered Participants (Call 1):
+500 participants
10 winners

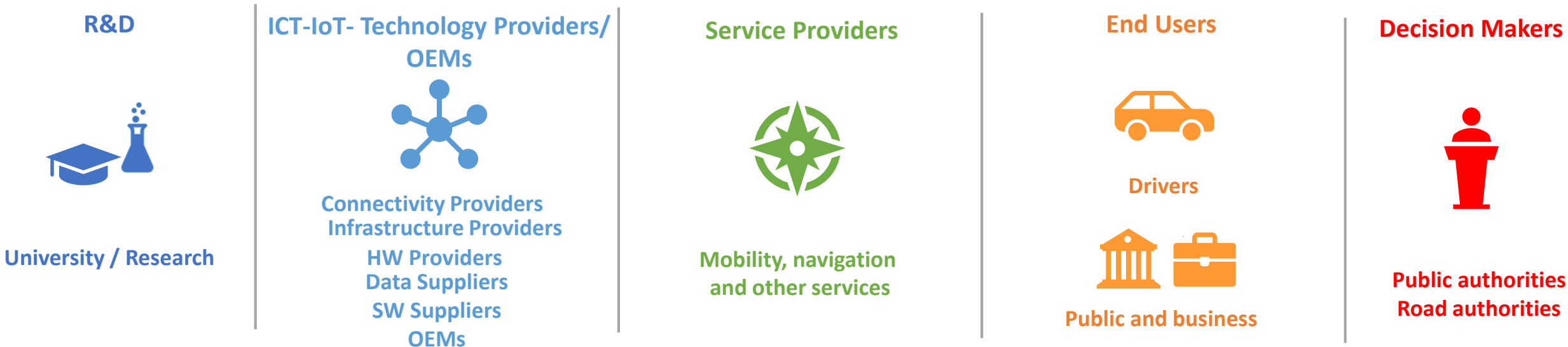
Challenges	N of Proposals per Challenge	N of Winners per Challenge
Monitoring and self-management of chronic disease	11	1
IoT enabled heart arrhythmias monitoring	6	1
Cognitive stimulation	7	1
Physical activity/coaching, motivation	13	2
Daily activity monitoring of senior people in multioccupancy scenarios	9	1
Analytics intelligence	10	1
User authentication solution	2	2
Open Challenge	6	1

The IoT EU LSPs Programme Impact on the IoT Ecosystem

Connected Vehicles



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KPI III-1

AUTOPILOT develops a range of driving services to be tested in four different driving modes and six different Pilot sites. The project mobilizes 45 partners in 4 different sectors: development of autonomous driving vehicles, development of IoT and networks, collection of data to evaluate the systems and end-users organisations.



The IoT EU LSPs Programme Impact on the IoT Ecosystem

Connected Vehicles



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KPI III-1

Role in the ecosystem	Stakeholder category	Ecosystem coverage	
		N.	% of categories
R&D	University/ Research	14	33%
ICT/IoT - Technology Providers & OEMs	Suppliers of Data (e.g. maps), Connectivity Providers, Infrastructure Providers, Hardware Providers (components, sensors, batteries), Software Suppliers (OS, user interfaces,...), OEMs	17	40%
Service Providers	Mobility services, navigation services, others (car rental, parking, entertainment, etc.)	5	12%
End Users	Private Owners, Public Users (fleet owners, public transport, etc.)	2	5%
Decision Makers	Public authorities (cities, regions, etc.), road authorities	4	10%
Total		42	100%

The IoT EU LSP Programme Impact on the IoT Ecosystem

Internet of Food and Farms



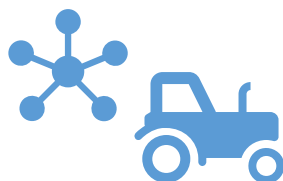
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R&D



University / Research

ICT-IoT- Technology
Providers/OEMs



OEMs
Machinery and Equipment
Manufacturers
ICT- and IoT- devices
manufacturers

Service Providers



Software developers
Advisors
Feed or Agrochemicals
Suppliers
Rentals

End Users



Farmers
Retailers
Consumers

Associations



Organisations in the
agri-food industry

Investors



Investment Programmes
Business Incubators

KPI III-1



IoF2020 comprises 120+ partners from 22 countries and is dedicated to accelerating the update of IoT technologies in the European farming and food chains and ultimately strengthening their competitiveness and sustainability. The projects builds on a strong and coherent ecosystem spanning from major R&D players, IoT technology & service providers and OEMs and bringing in end-users and their representative organizations.

The IoT EU LSP Programme Impact on the IoT Ecosystem

Internet of Food and Farms



European
Large-Scale Pilots
Programme

KPI III-1

Role in the Ecosystem	Stakeholder Category		Ecosystem Coverage	
			N.	% of Categories
R&D	University/ Research		29	22%
ICT- IoT- Technology Providers & OEMs	Manufacturers of machinery and equipment, OEMs	Large enterprise	7	5%
		SMEs	9	7%
	ICT and IoT devices manufacturers	Large enterprise	4	3%
		SMEs	12	9%
Service Providers	Software developers, advisors, feed or agrochemicals suppliers, rentals	Large enterprise	4	3%
		SMEs	33	25%
End Users	Farmers, Retailers, Consumers		14	11%
Associations	Organisations in agri-food industry		14	11%
Investors	Investment programmes, business incubators		5	4%
Total			131	100%



Timeline: 5 Jun 2018 - 30 Sep 2018



Total Budget Allocated for the Open
Call: € 6,000,000



Registered Participants:

- **235 participants**
- **14 winners**

Challenges	N of Proposals per Challenge	N of Winners per Challenge
IoT in new Regions	26	3
Post Farm or Other Sector	10	0
Both Challenges	63	11

The IoT EU LSP Programme Impact on the IoT Ecosystem

Wearables in the Entertainment and Security Market



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Programme

R&D



University / Research

ICT-IoT- Technology
Providers/OEMs



Connectivity Providers
Infrastructure Providers
Hardware Providers
Software Suppliers
OEMs

Service Providers



Security, Acoustic,
Innovation and other
Services, (Entertainment,
etc.)

End Users &
Decision Makers



Public and Private Users
Public Authorities

KPI III-1



The MONICA project comprises 29 partners from 9 countries, a large-scale demonstration of how cities can use IoT technologies to meet sound, noise, crowd and security challenges at big, open-air cultural and sporting events, which attract and affect many people. Several applications are deployed at large events in six European cities, involving thousands of application users.

The IoT EU LSP Programme Impact on the IoT Ecosystem

Wearables in the Entertainment and Security Market



European
Large-Scale Pilots
Programme

KPI III-1

Role in the Ecosystem	Stakeholder Category	Ecosystem Coverage	
		N.	% of Categories
R&D	University/ Research	7	24%
ICT/IoT - Technology Providers & OEMs	Connectivity Providers, Infrastructure Providers, Hardware Providers (wearables, drones, cams, sensors, meters,..), Software Suppliers (OS, user interfaces,...), OEMs	5	17%
Service Providers	Security, acoustic, innovation and others services, (entertainment, etc.)	9	31%
End Users and Decision Makers	Public and Private Users (municipalities, event organizers, etc.), Public authorities (cities, etc.)	8	28%
Total		29	100%

The IoT EU LSP Programme Impact on the IoT Ecosystem

Smart Cities



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R&D



University / Research

ICT-IoT- Technology Providers



Connectivity Providers
Infrastructure Providers
Device Providers
Software / App Providers
IT Service Providers

Service Providers



Public Safety and
Emergency Services
Transport Providers
Tourism Agencies
Utilities

End Users



Citizens
City Governments
Regional Bodies
Local / Regional Social Actors

Regulatory Bodies



Road Infrastructure,
Railway and Utilities
Regulators, etc.

KPI III-1

The SynchroniCity consortium brings together 39 partners with worldwide outreach. Spanning the whole smart cities ecosystem, the project aims to deliver a Digital Single Market for IoT-enabled urban services in Europe and beyond - in 8 European cities and worldwide - connecting partners from 13 countries over 3 continents.

SYNCHRONICITY

SYNCHRONICITY Open Call



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Timeline: 1 Jun 2018 – 30 Sep 2018



Total Budget Allocated for the Open
Call: € 3,000,000



Registered Participants:

- **133 participants**
- **16 winners**

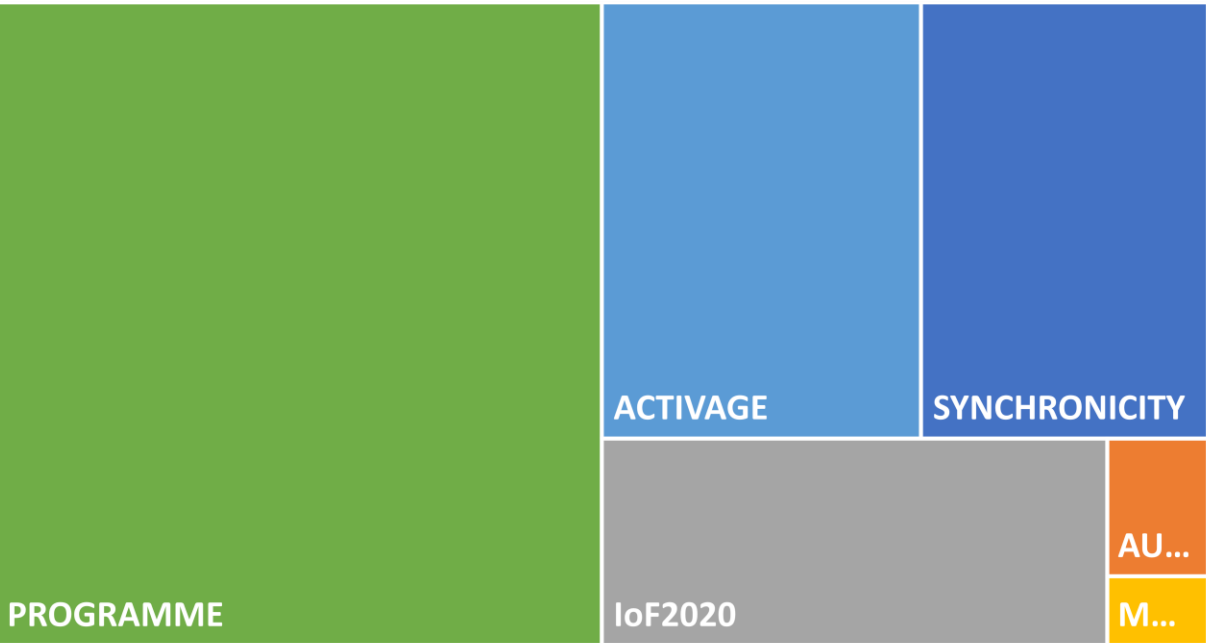
Challenges	N of Proposals per Challenge	N of Winners per Challenge
Enabling and Improving mobility as a service	21	3
Encouraging non-motorized active transport	14	3
Climate Change adaption	12	2
Reducing air and noise pollution	26	4
Increasing citizen engagement in decision making	20	1
Open challenge	40	3

The IoT LSP Programme has involved a Significant Number of SMEs and runs Pilots open to Visitors

KPI III-2

Participation of SMEs (number)

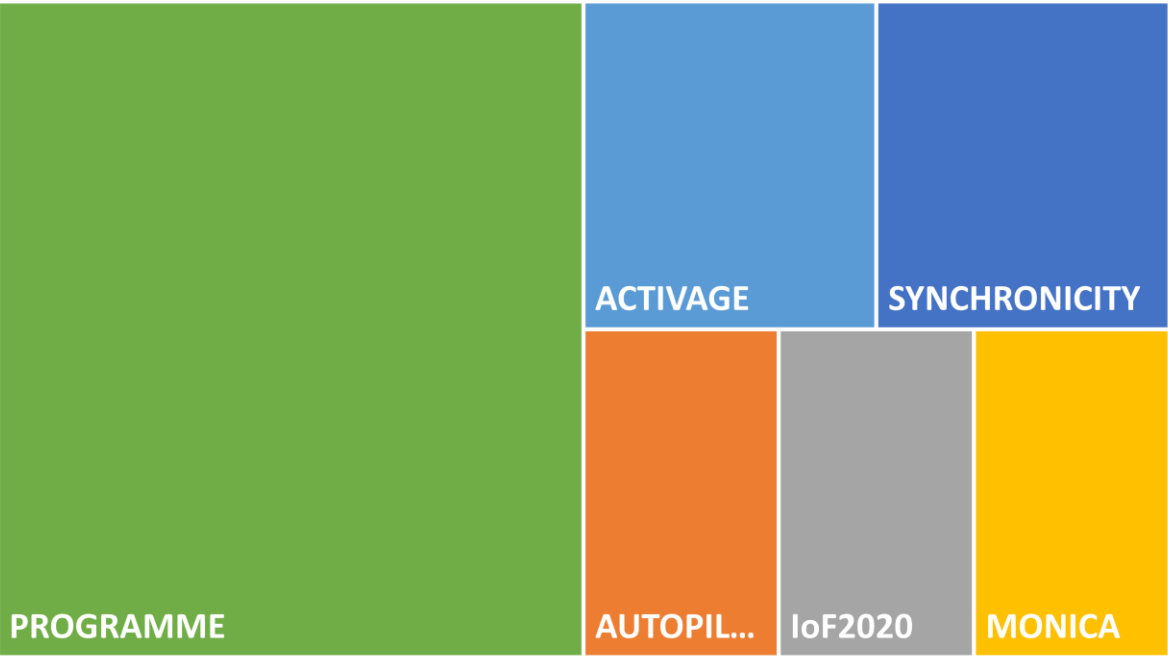
- ACTIVAGE
- AUTOPILOT
- IoF2020
- MONICA
- SYNCHRONICITY
- PROGRAMME



KPI III-3

Number of Trials open to visitors

- ACTIVAGE
- AUTOPILOT
- IoF2020
- MONICA
- SYNCHRONICITY
- PROGRAMME



Visualisations with simulated data

Domain IV

User Acceptance and Accessibility

Domain IV – User Acceptance and Accessibility



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KPI Name	Definition	Proposed Metrics	Method of calculation and validation	Targeted impacts by KPI
User Trust	Trust in privacy and data protection measures for piloted services	Qualitative scale from Very High to Very Low (0-100%)	Each LSP to provide a qualitative assessment about level of trust in privacy and data protection measures for IoT services achieved through the different trials (Projects' indicators to be transformed into qualitative scale)	User acceptance validation addressing privacy, security, vulnerability, liability, identification of user needs, concerns and expectations of the IoT solutions. Impact Area: 3
User Satisfaction	Level of IoT trial users' satisfaction	Likert scale for user satisfaction	Data collected by LSPs for each trial – need to provide an average by LSP	

H. KPIs: User Acceptance and Accessibility



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KPI IV-1 KPI IV-2

ACTIVAGE
PROJECT

- 1 Level of satisfaction by end-users
- 2 Trust in privacy and data protection measures for piloted services

UTOPILOT

- 1 Number of end users testing the IoT solution
- 2 Trust in privacy and data protection measures for piloted services

IOF²⁰²⁰

- 1 Level of IoT users satisfaction
- 2 Trust in privacy and data protection measures for piloted services

MONICA

- 1 Level of users satisfaction
- 2 Usability of real time event information
- 3 Trust in privacy and data protection measures for piloted services

SYNCHRONICITY

- 1 Participatory governance – local communities involvement in services design
- 2 Trust in privacy and data protection measures for piloted services

Note: all indicators are selected from the KPI list developed by LPS – selection validated in KPI group discussions



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ACTOVAGE
PROJECT

Breaking barriers for a sustainability
Active and Healthy Ageing through
IoT technologies.



AUTOPILOT

Unlocking the potential of IoT to
take autonomous driving to the
next level.



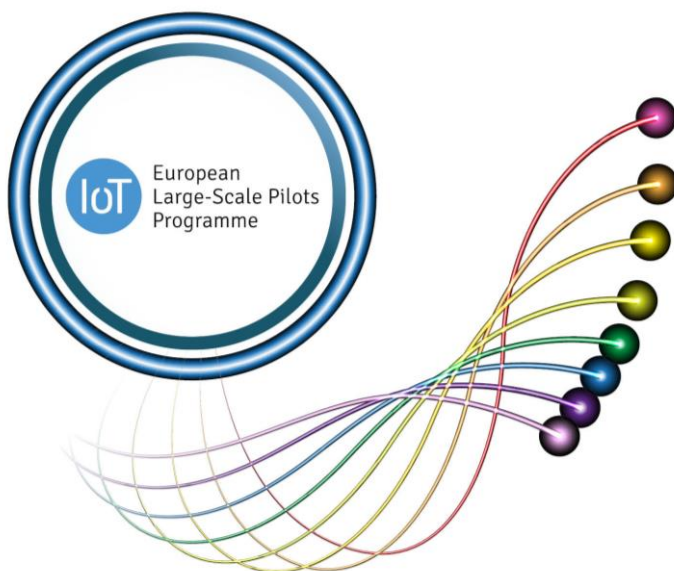
Strengthen competitiveness of
farming and food chains in Europe.



Sound and security solutions for
large open-air events in the smart
city.

SYNCHRONICITY

Single digital city market of Europe.



CREATE-IoT

Stimulate collaboration between
IoT initiatives. Development and
growth of IoT ecosystems based on
open technologies and platforms.

Promote best practices and foster links between
communities of IoT users and providers, link to
large-scale pilots in member states and/or building
on regional investments in excellence centres,
innovation hubs, transfer centres or business
incubators in the IoT domain to leverage national
and European investments to ensure efficient and
innovative IoT take-up in Europe.

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CREATE-IoT

www.european-iot-pilots.eu

www.create-iot.eu



@IOTEULSP



@IoT_euLSP



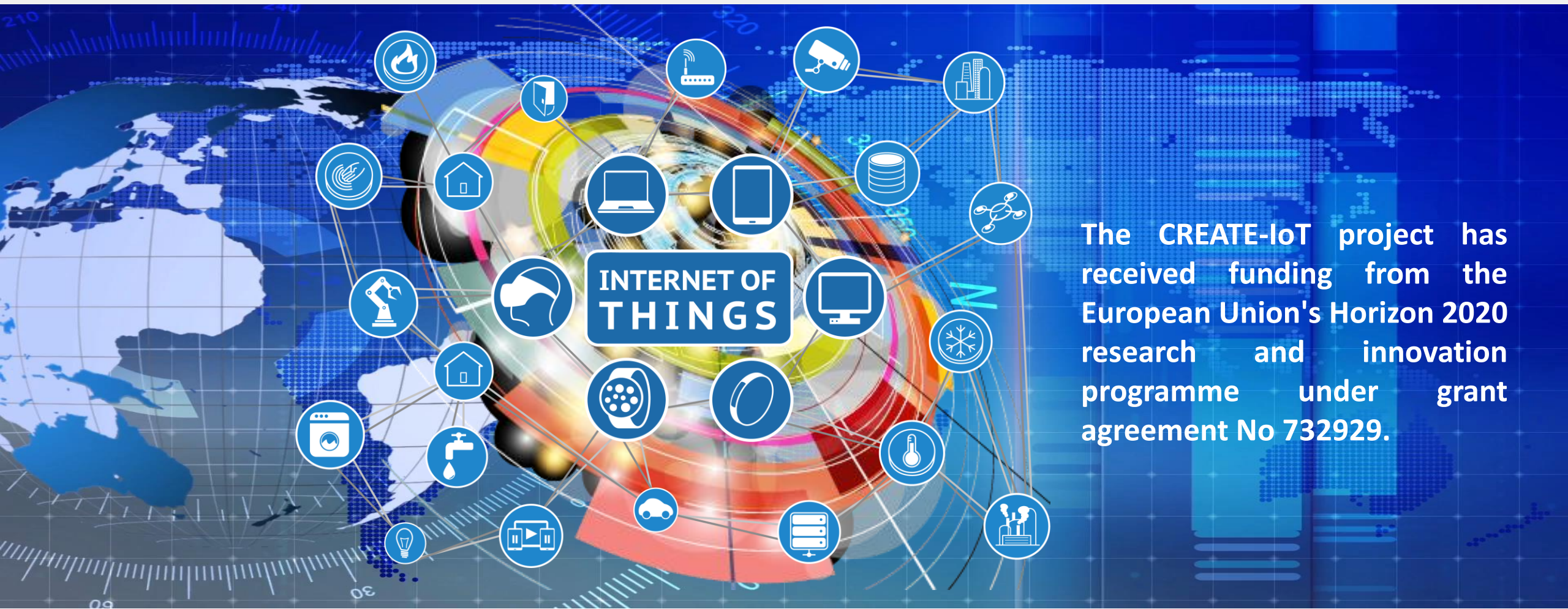
@CREATE-IoT



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The CREATE-IoT project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 732929.

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AUTOPILOT

IOF
INTERNET OF FOOD & FARM

MONICA

SYNCHRONICITY

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