

# BIG DATA VALUE cPPP

Monitoring Report 2019-2020

Version 1.0. September 2021

## ABOUT THIS VERSION

This report is combined with 4 additional annexes (annex 1 directly embedded in this document) providing many additional details.

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- European Commission DG CNECT G1: Annex 3 and some KPIs in part 3 of annex 1 (contribution to programme-level KPIs)

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***Disclaimer:** This document has been prepared by the Big Data Value Association (BDVA) and it reflects the views only of its authors.*

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<sup>1</sup> Full list of members <https://www.bdva.eu/members>

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# 1. INTRODUCTION: THE BIG DATA VALUE CPPP

The **European contractual Public Private Partnership on Big Data Value (BDV cPPP)** was signed on 13 October 2014 and marked the commitment of the European Commission, industry and partners from research to **build a data-driven economy across Europe**, mastering the generation of value from Big Data and creating a significant competitive advantage for European industry, thus boosting economic growth and jobs<sup>2</sup>. The **Big Data Value Association (BDVA)** was the private counterpart to the European Commission in implementing the BDV cPPP.

The BDV cPPP started in 2015 and was operationalised with the launch of the Leadership in Enabling and Industrial Technologies (LEIT) work programme 2016/2017 of Horizon 2020 (H2020) **with the first cPPP projects (Call 1) starting on January 2017**<sup>3</sup>.

The Big Data Value PPP played a central role in the **implementation of the revised DSM strategy**<sup>4</sup>, contributing to multiple pillars including “Digitizing European Industry”, “Digital Skills”, “Building the European Data Economy” and “Developing a European Data Infrastructure”. The Big Data Value PPP and the BDVA have also played a very central role in the **European AI Strategy** and **European Data Strategies** launched by the European Commission in 2018 and further developed in the following years.

The vision, overall goals, main technical and non-technical priorities, and a research and innovation roadmap for the European Public Private Partnership (PPP) on Big Data Value are defined in the **Big Data Value Strategic Research and Innovation Agenda (BDV SRIA)**<sup>5</sup>.

The BDV SRIA defines an implementation strategy involving four main mechanisms:

- **i-Spaces** are cross-organisations cross-sector interdisciplinary Innovation Spaces to anchor targeted research and innovation projects. They offer secure accelerator-style environments for experiments for private data and open data, bringing technology and application development together. I-Spaces act as incubators for new businesses and the development of skills, competence and best practices.
- **Lighthouse projects** are large-scale data-driven innovation and demonstration projects that aim to create superior visibility, awareness and impact.
- **Technical projects** tackle specific Big Data technical priorities.
- **Cooperation & coordination projects** foster cooperation for efficient information exchange and coordination of activities, and address non-technical challenges such as skills, ethical issues, etc.

The BDV cPPP SRIA defines the roadmap and methodology describing 3 different phases:

- **Phase I:** Establish Innovation Ecosystem (H2020 WP 2016–2017 calls)
- **Phase II:** Disruptive Big Data Value (H2020 WP 2018-2019 calls)
- **Phase III:** Long-term Ecosystem Enablers (H2020 WP 2019–2020 calls)

The BDV SRIA has been regularly updated incorporating the multi-annual roadmap of the BDV cPPP. BDV SRIA v4 (delivered at the end of 2017) provides direct input to the LEIT WP 2018-2020 as defined in its updated phase II and III.

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2 BDV Contractual agreement and BDV CPPP SRIA

3 2 projects of the 15 granted projects of the 2016 call started at the very end of 2016

4 <https://ec.europa.eu/digital-single-market/en/news/digital-single-market-mid-term-review>

5 BDVA SRIA v4.0: [http://bdva.eu/sites/default/files/BDVA\\_SRIA\\_v4\\_Ed1.1.pdf](http://bdva.eu/sites/default/files/BDVA_SRIA_v4_Ed1.1.pdf)

**BDVA**<sup>6</sup> is an industry-driven and fully self-financed international non-for-profit organisation under Belgian law. BDVA has over 230 members all over Europe with a well-balanced composition of large and small and medium-sized industries (over 30% of SMEs), as well as research and user organisations. BDVA members come together to collaborate in a common mission: developing the **European Big Data Value Ecosystem** that will **enable the data-driven digital transformation** in Europe delivering maximum **economic and societal benefit** and **achieving and sustaining Europe's leadership on Big Data Value creation and Artificial Intelligence**.

To achieve this mission BDVA members have developed the following activities in the following areas:

- **Develop Data Innovation Recommendations:** Providing guidelines and recommendations on data innovation to the industry, researchers, markets and policy makers.<sup>[1][SEP]</sup>
- **Develop Ecosystem:** Developing and strengthening the European Big Data Value Ecosystem.
- **Guiding Standards:** Driving Big Data standardisation and interoperability priorities and influencing standardisation bodies and industrial alliances.
- **Know-How and Skills:** Improving the adoption of Big Data through the exchange of knowledge, skills and best practices.

In 2020 and taking into account the end of the 2014-2020 Multi Annual Financial Framework and the advent of the post 2020 European Commission's programmes (i.e. Horizon Europe<sup>7</sup> and Digital Europe<sup>8</sup>), BDVA members decided to strengthen the Association by giving it a new mandate, a new name and by expanding its scope and breadth of activities. The legal name of BDVA (Big Data Value Association) changed to Data, AI and Robotics aisbl (although the BDVA name continues used in public communications as the short name or brand).

The BDV cPPP has been implemented through 71 projects. The first tranche of cPPP projects started on January 2017 (15 projects from the Call 1, 2016), a second tranche of projects following in 2018 (17 projects from Call 2, 2017) followed by subsequent calls: 14 projects from the calls 2018, including the calls ICT-11-a (combined HPC-Data projects), 15 projects from the calls 2019 and 10 projects from the calls 2020). They all were active during the reporting period except 3 projects from the calls ICT-51 that started in 2021

The **BDV cPPP projects** cover **Big Data technology, including Artificial Intelligence methods, and application research and innovation, privacy preserving technologies, data platforms, data incubators, pilots addressing technology convergence HPC-Big Data-AI-IoT, extreme-scale data analytics, new data-driven business models, data ecosystem support, data skills, regulatory and IPR requirements and societal aspects**. The value generated by Big Data technologies empowers **Artificial Intelligence** to foster linking, cross-cutting and vertical dimensions of value creation at the technical, business and societal levels **across many different sectors**

The cross-technological nature of the data value chains, flowing across different technologies (IoT, Cloud, 5G, Cybersecurity, infrastructures, HPC, ...) has triggered and accelerated during the whole life of the partnership the **development of stronger collaborations** between the BDV cPPP/BDVA and other technological (cross-sectorial) sectorial communities including partnerships, data and AI communities and standardisation bodies.

The remarkable results presented in the Monitoring Report 2018 are extended to the period 2019-20 with value-created in investments, jobs and skills, innovations created and support to SMEs. The European

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<sup>6</sup> <https://www.bdva.eu/>

<sup>7</sup> [https://ec.europa.eu/info/horizon-europe\\_en](https://ec.europa.eu/info/horizon-europe_en)

<sup>8</sup> <https://ec.europa.eu/digital-single-market/en/europe-investing-digital-digital-europe-programme>

Federation of Big Data Innovation Hubs (EUHubs4Data) was launched at the end of 2020 federating many of the outcomes and results from previous year investments and with strong focus on supporting SMEs and linking the European and local ecosystem. EUHubs4Data promises being of the long-term enablers for the European Data Economy as initially planned.

The launch of the Coordinated Plan led BDVA/DAIRO and euRobotics to sign a formal commitment to collaborate in March 2019, taking the form of a Joint Vision Paper<sup>9</sup> and then brought to kicking off the drafting of the first version of the joint Strategic Research, Innovation and Deployment Agenda (SRIDA)<sup>10</sup> in June 2019. The second version of the SRIDA which resulted from these discussions was released in September 2019. This updated version (SRIDA "Second Consultation Release") included the outcome of the stakeholder engagement efforts carried out during the summer. Key stakeholder associations (such as AIOTI, NESSI, CLAIRE, ELLIS, Humane AI, AENEAS, ECS, 5G IA, EurAI, EuroHPC, Artemis, AI4EU project and others) were directly and heavily involved in its development. this notion of collaboration by making the link between EU research communities, EU projects and EU policies. The third update of the SRIDA<sup>11</sup> was released in September 2020.

BDVA has also continue being part of the EuroHPC JU and in 2020, BDVA/DAIRO has also been closely involved in the negotiations of the new regulation of the EuroHPC Joint Undertaking under the 2021-2027 Multi-Annual Financial Framework. Furthermore, the association has been one of the main promoters of the TransContinuum Initiative, launched in December 2020, together with ETP4HPC, ECSO, 5G IA, EU-MATHS-IN, CLAIRE, HiPEAC and AIOTI.

The Covid-19 global pandemic crisis that has paralysed the world since Q1 2020, affecting economies and societies all over the globe, has impacted the implementation of the partnership, mainly moving all activities online, affecting macro-economic numbers, bringing uncertainty to businesses and affecting the economies of many companies. The partnership has had a very good response to the situation organising many online activities to bring the community together, and supporting the knowledge sharing at all moments.

The **European Big Data Value Forum** (EBDVF) (which first edition took place in November 2017 in Versailles), and in 2018 EBDVF is consolidated as the flagship event of the community associated to the Presidencies of the EU (Austria in 2018, Finland in 2019<sup>12</sup>, and online-Berlin for 2020). The **BDV Summit** 2019 was organised in Riga (Latvia) in June 2019, and edition 2020, originally planned to take place in Porto (Portugal) was transformed in a series of online events.

## 2. MAIN ACTIVITIES AND ACHIEVEMENTS DURING 2019-20

The main achievements of the Big Data Value cPPP during 2019-20 can be summarised as follows:

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<sup>9</sup> Joint Vision Paper for an Artificial Intelligence Public Private Partnership (AI PPP), March 2019, <http://www.bdva.eu/sites/default/files/VISION%20AI-PPP%20euRobotics-BDVA-Final.pdf>

<sup>10</sup> <http://www.bdva.eu/sites/default/files/AI%20PPP%20SRIDA-Consultation%20Version-June%202019%20-%20Online%20version.pdf>

<sup>11</sup> <https://ai-data-robotics-partnership.eu/wp-content/uploads/2020/09/AI-Data-Robotics-Partnership-SRIDA-V3.0-1.pdf>

<sup>12</sup> Associated event to the Presidency in Helsinki 2019

- With 627,1 M€ of mobilised private investments in 2019-20 the **BDV cPPP reports a total of 2,26 B€** since the launch of the cPPP achieving the target of the contractual PPP (2 B€) with a **leverage factor of 6,1** (contractual target of 4).
- **71 projects** have been addressed for the Monitoring Report 2019-20. They all were active during the reporting period except 3 projects from the calls ICT-51 that started in 2021. These includes **all the running and selected Big Data cPPP projects** during years 2019 and 2020 (**15 projects** from the Call 1, 2016, **17 projects** from Call 2, 2017, **14 projects** from the calls 2018, including the calls ICT-11-a (combined HPC-Data projects), **15 projects** from the calls 2019 and **10 projects** from the calls 2020). **25 new projects were selected for funding during 2019-2020. Participation of SMEs is over 20%.**
- The BDV cPPP has organised more than **4375 training activities involving over 150.000 participants**. Projects have contributed with 375 training activities during 2019-2020 involving 6.421 participants. BDVA members have reported additional 4000 training activities with over 139.000 participants. Projects and members have developed 180 interdisciplinary programs arising from the cPPP with around 1685 participants.
- **A total of 188 job profiles were identified during the period 2019-2020 (114 job profiles** were identified or established in 2019, and **74 new job profiles** have reportedly been created in 2020.
- Data skills activities including the update of the **BDV cPPP Educational Hub** for European MSc programmes in Data Science and Data Analytics and the continuation of **the pilot on skills recognition** programme.
- Organisation of **708 events** outreaching over **114.110 people** during 2019-2020
- **328 Innovations of exploitable value** are reported as delivered in 2019 and 2020. or delivered earlier but further developed during that period. **89 of them (27%) are labelled as innovations of significant value**. The number of unique innovations delivered in 2019-20 is 274: 81 during 2019 and 193 during 2020. 54 were reported as delivered in 2018 and just Improved during the reporting period. The BDV project continued reflecting many of these innovations in the **Big Data Value Marketplace**<sup>13</sup> and the Big Data Value **Landscape**<sup>14</sup>.
- **70% of the BDV cPPP projects contributing to job creation by 2024**, with an estimation in accumulated numbers of thousands. **Estimated numbers go over 8 100 new jobs created by 2024 linked to project activities** and many more considering indirect effects.
- **10 patents** (and 49 more planned for +2021), over **170 publications** (and similar amount planned for +2021) and **158 products or software components** in the field of **advanced privacy and security respecting solutions** for data access, processing and analysis in 2019-2020.
- **146 new economically viable services of high societal value** developed during 2019-20 (67 in 2019 and 79 in 2020).
- **100% coverage of research priorities defined in SRIA**. with **337 new systems and technologies in developed** different sectors during 2019-2020 (141 in 2019 and 196 in 2020). The **major focus of technical contributions lies in the “Data Analytics”** priority, followed by “Data Management”. and “Data

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<sup>13</sup> <http://marketplace.big-data-value.eu/>

<sup>14</sup> <https://landscape.big-data-value.eu/>

Processing Architectures". All priorities and topics are covered substantially and with a large number of contributions,

- **1251 use cases or/and experiments** conducted during 2019-2020 many performed along the 2 years. BDVA i-Spaces have reported additional 194 experiments. From those **1202** are reported as **large scale experiments the majority involving closed (private) data**.
- **6 major sectors** (Bio Economy; Transport, Mobility and Logistics; Healthcare; Smart Manufacturing; Finance: Energy) covered with close to the market large-scale implementations, **and over 17 different sectors covered** in total.
- **1,709 Petabytes of data made available for** experimentation during 2019-20.
- Evidence of **contribution to the environmental KPIs**, with some pilots showing up to **80% in energy reduction** and improvements concerning **CO<sub>2</sub> emissions reaching up to 37%** of emission reductions in general. Some projects have reported up to 32% reduction in waste.
- During 2019-20 Master and PhD students in numbers of **786 equivalent FTEs** (503 Master and 283 PhD) have been involved in PPP projects.
- **SME turnover evolution** increase of 206,92% with respect to 2014. The increase from 2018-2019 was of the 23,62 % and there was a decrease of -3,41% in between 2019 and 2020. There is a very positive trend in employment evolution with an average increase in employment for the SMEs part of the PPP is of 300% respect to 2014, with an increase of 8,92% from 2018 to 2019 and a decrease of 10,23% from 2019-2020. Decrease in turnover and employment on 2020 could reflect the effect of the Covid-19 global pandemic.
- Organisation of the **BDV-PPP Summit in Riga (Latvia)**<sup>15</sup> in Jun 2019, the **European Big Data Value Forum (EBVDF) 2019** in Helsinki, Organisation of the **BDV PPP Summit 2020 (online)**<sup>16</sup> and **EBVDF 2020 (online-Berlin)**.
- **BDVA i-Spaces labelling**<sup>17</sup> 2019 and 2020, with 5 labelled i-Spaces in 2019 and **13 labelled i-Spaces** 2020. And the launch of the Federation of i-Spaces in September of 2020 boosted by the EUHubs4Data project.
- **BDVA continues contributing to the EuroHPC Joint Undertaking**<sup>18</sup> as one of its private members, bringing synergies between Big Data, AI and HPC and the industry as user viewpoint.
- **BDVA**, together with euRobotics, CLAIRE, ELLIS and EurAI are in the process of setting up a new partnership on AI, Data and Robotics, with 1 joint position paper, 3 versions of the SRIDA, and a partnership proposal developed during this reported period.

## 2.1 Implementation of the calls for proposals evaluated in 2019-20

The calls evaluated in 2019-20 included 5 topics: 3 topics evaluated in 2019 (ICT-11, ICT-13 and DT-ICT-11) and 2 topics in 2020 (ICT-51 and DT-ICT-05).

<sup>15</sup> <https://www.big-data-value.eu/ppp-summit-2019/>

<sup>16</sup> <https://www.big-data-value.eu/bdvppp-summit-2020/> (The event, initially planned to take place in Porto was cancelled and substituted by a series of webinars over time bringing all projects and members together.

<sup>17</sup> All Information about the i-Spaces labelling can be found on the the BDVA website. General information: <http://bdva.eu/i-Spaces>. Labelling process: Information about labelled i-Spaces 2018: <http://www.bdva.eu/node/1172>

<sup>18</sup> <https://eurohpc-ju.europa.eu/>

**25 proposals were selected for funding** (success rate of 14,7%) with a total EC contribution of **179,5 Million euros (118,9 M€ for the calls evaluated in 2019 and 60,6 M€ for the calls evaluated in 2020)** and an estimated private contribution of **29,7 M€**.

From the total contribution of the EC to the calls 2019-20 (**179,5 Million €**), 43,5 % goes to private for-profit organisations, 18,1 % to High Education Institutions, 26,4 % to research institutions, 1,3 % to public bodies, and 10,7% to others. **18,95 %** of the original EU allocated budget in total goes to SMEs (34 M€). Funding allocated for FSTP or Cascade funding to third parties is not included in these calculations (so % for SMEs is higher).

In terms of participant types, 49,2% are private for-profit organisations, 19,3% Research organisations, 16,1% Higher or secondary education, 2,1% public bodies, and 13,3% others. SMEs represent the 22,9% of all participants.

The ratio of **BDVA member participation** in projects funded under the 5 topics evaluated in 2019-20 was about **34,4%** with an allocation of **36,4% of the budget**. Annex 3 (Results from calls for proposals) provides further details and explanations on these results.

**Portfolio analysis:**

Table 1 shows the mapping of the BDV SRIA mechanisms to the funded projects for the whole cPPP (H2020 LEIT WP 2016-17<sup>19</sup>, WP 2018<sup>20</sup>, and WP 2019-20), and introduces for first time in this report the name of all the funded projects linked to the BDV cPPP. It includes also the ICT-11-a-2018 projects (HPC and Big Data enabled Large-scale Test-beds and Application) identified as “associated” projects to the BDV cPPP contributing strongly to the BDV cPPP SRIA implementation. A total of **71 projects have been funded and are directly contributing to the BDV cPPP SRIA** implementation covering a wide range of technologies and of industrial application areas (from Finance to Retail and from Healthcare to Utilities). Table 1 provides an analysis of the project portfolio per type of mechanisms defined by the SRIA and per call. It shows the type of projects which have been funded over the years and supports the analysis provided in 3.1 concerning the achievement of the goals of the PPP.

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<sup>19</sup> Table 1 does not include the sister project from ICT-35-2016 (Enabling responsible ICT-related research and innovation - KPLEX project) was added to the cPPP portfolio  
<sup>20</sup> Only calls for proposals resolved during 2018

SRIA Mechanism	WP Topic	Calls 2016	Calls 2017	Calls 2018	Calls 2019	Calls 2020
i-Spaces	ICT-14- 2016-2017	<p><b>EW-Shop:</b> Supporting Event and Weather-based Data Analytics and Marketing along the Shopper Journey</p> <p><b>AEGIS:</b> Advanced Big Data Value Chain for Public Safety and Personal Security</p> <p><b>QROWD:</b> Because Big Data Integration is Humanly Possible</p> <p><b>FashionBrain:</b> Understanding Europe's Fashion Data Universe</p> <p><b>euBusinessGraph:</b> Enabling the European Business Graph for Innovative Data Products and Services</p> <p><b>SLIPO:</b> Enabling the European Business Graph for Innovative Data Products and Services</p> <p><b>BigDataOcean:</b> Exploiting Ocean's of Data for Maritime Applications</p> <p><b>Data Pitch:</b> Accelerating data to market (INCUBATOR)</p>	<p><b>BODYPASS:</b> API-ecosystem for cross sectoral exchange of 3D personal data</p> <p><b>Fandango:</b> FAke News discovery and propagation from big Data ANalysis and artificial intelligence Operations</p> <p><b>ICARUS:</b> Aviation-driven Data Value Chain for Diversified Global and Local Operations</p> <p><b>TheyBuyForYou:</b> Enabling procurement data value chains for economic development, demand management, competitive markets and vendor intelligence</p> <p><b>Lynx:</b> Building the Legal Knowledge Graph for Smart Compliance Services in Multilingual Europe</p> <p><b>Cross-CPP:</b> Ecosystem for Services based on integrated Cross-sectorial Data Streams from multiple Cyber Physical Products and Open Data Sources</p> <p><b>EDI:</b> European Data Incubator (INCUBATOR)</p>	N/A	N/A	

SRIA Mechanism	WP Topic	Calls 2016	Calls 2017	Calls 2018	Calls 2019	Calls 2020
	DT-ICT-05-2020	N/A	N/A	N/A	N/A	<p><b>EUHubs4Data:</b> European Federation of Data Driven Innovation Hubs</p> <p><b>I4Trust:</b> Incubator of Trusted B2B Data Sharing ecosystems of collaborating SMEs linked to Digital Innovation Hubs</p> <p><b>REACH:</b> EuRopEAn incubator for trusted and secure data value CHains</p> <p><b>MediaFutures:</b> Data-driven innovation hub for the media value chain</p>

<p style="text-align: center;">Lighthouse projects</p>	<p>ICT-15- 2016-2017 ICT-11-a 2018 (Associated projects)</p>	<p><b>DataBio:</b> Data-Driven Bioeconomy</p> <p><b>TT:</b> Transforming Transport</p>	<p><b>BOOST 4.0:</b> Big Data Value Spaces for Competitiveness of European Connected Smart Factories 4.0</p> <p><b>BigMedilytics:</b> Big Data for Medical Analytics</p>	<p><i>Joint HPC-BigData projects part of the HPC portfolio but Implementing the BDV cPPP SRIA:</i></p> <p><b>Deep-Health:</b> Deep Learning and HPC to Boost Bio-medical applications for Health</p> <p><b>LEXIS:</b> Large-scale Execution for Industry and Society</p> <p><b>CYBELE:</b> Fostering precision agriculture and livestock farming through secure access to large-scale HPC-enabled.</p> <p><b>EVOLVE:</b> HPC and Cloud-enhanced Testbed for Extracting Value from Diverse</p>	<p>N/A</p>	
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SRIA Mechanism	WP Topic	Calls 2016	Calls 2017	Calls 2018	Calls 2019	Calls 2020
				Data at Large Scale		
	H2020-ICT-2018-3 (ICT-11b)	N/A	N/A	N/A	<p><b>IoTwin:</b> Distributed Digital Twins for industrial SMEs: a big-data platform</p> <p><b>Infinitech:</b> Tailored IoT &amp; BigData Sandboxes and Testbeds for Smart, Autonomous and Personalized Services in the European Finance and Insurance Services Ecosystem</p>	

SRIA Mechanism	WP Topic	Calls 2016	Calls 2017	Calls 2018	Calls 2019	Calls 2020
	DT-ICT-11-2019	N/A	N/A	N/A	<p><b>PLATOON:</b> Digital PLAtform and analytic TOOLS for eNergy</p> <p><b>BD4OPEM:</b> Big Data for OPen innovation Energy Marketplace</p> <p><b>SYNERGY:</b> Big Energy Data Value Creation within SYNergetic enERGY-as-a-service Applications through trusted multi-party data sharing over an AI big data analytics marketplace</p> <p><b>BD4NRG:</b> Big Data for Next Generation Energy</p>	
Cooperation and Coordination projects	ICT-17a-2016	<b>BDVe:</b> Big Data Value ecosystem	N/A	N/A	N/A	
	ICT-17b-2016	<b>e-Sides:</b> Ethical and Societal Implications of Data Sciences	N/A	N/A	N/A	

SRIA Mechanism	WP Topic	Calls 2016	Calls 2017	Calls 2018	Calls 2019	Calls 2020
	ICT-17c	N/A	N/A	<b>Data Market Services:</b> Supporting the European data market providing free support services to data-centric SMEs and start-ups	N/A	
Technical projects	ICT-16-2017 ICT-12-2018	N/A	<p><b>BigDataGrapes:</b> Big Data to Enable Global Disruption of the Grapevine-powered Industries.</p> <p><b>BigDataStack:</b> High-performance data-centric stack for big data applications and operations</p> <p><b>CLASS:</b> Edge and Cloud Computation: A Highly Distributed Software Architecture for Big Data Analytics</p> <p><b>E2Data:</b> European Extreme Performing Big Data Stacks</p> <p><b>I-BiDaaS:</b> Industrial-Driven Big Data as a SelfService Solution</p>	<p><b>CloudButton:</b> Serverless Data Analytics Platform</p> <p><b>ELASTIC:</b> A Software Architecture for ExtremeScale Big-Data Analytics in Fog Computing Ecosystems</p> <p><b>EXAMODE:</b> EXtreme-scale Analytics via Multimodal Ontology</p>	N/A	

SRIA Mechanism	WP Topic	Calls 2016	Calls 2017	Calls 2018	Calls 2019	Calls 2020
			<p><b>Track and Know:</b> Big Data for Mobility Tracking Knowledge Extraction in Urban Areas</p> <p><b>TYPHON:</b> Polyglot and Hybrid Persistence Architectures for Big Data Analytics</p>	<p>Discovery &amp; Enhancement</p> <p><b>ExtremeEarth:</b> From Copernicus Big Data to Extreme Earth Analytics</p> <p><b>INFORE:</b> Interactive Extreme-Scale Analytics and Forecasting</p> <p><b>SmartDataLake:</b> Sustainable Data Lakes for Extreme-Scale Analytics</p>		
	<p>ICT-18-2016</p> <p>ICT-13 b - 2018</p>	<p><b>SODA:</b> Scalable Oblivious Data Analytics</p> <p><b>MH-MD:</b> My Health - My Data</p> <p><b>SPECIAL:</b> Scalable Policy-aware linked data architecture for privacy, transparency and compliance</p>	N/A	<p><b>Safe-SEED:</b> Safe Data Enabled Economic Development</p> <p><b>MUSKETEER:</b> Machine learning to augment shared knowledge in federated</p>	N/A	N/A

SRIA Mechanism	WP Topic	Calls 2016	Calls 2017	Calls 2018	Calls 2019	Calls 2020
				privacypreserving scenarios  <b>MOSAICrOWN:</b> Multi-Owner data Sharing for Analytics and Integration respecting Confidentiality and Owner control		
	ICT-17b-2017	N/A	<b>DataBench:</b> Evidence Based Big Data Benchmarking to Improve Business Performance	N/A	N/A	N/A
	ICT-51-2020	N/A	N/A	N/A	N/A	<b>DAPHNE:</b> Integrated Data Analysis Pipelines for Large-Scale Data Management, HPC, and Machine Learning  <b>EVEREST:</b> dEsign enVironmEnt foR Extreme-Scale big data analytics on heterogeneous platforms  <b>MARVEL:</b> Multimodal Extreme Scale Data Analytics for Smart Cities Environments

SRIA Mechanism	WP Topic	Calls 2016	Calls 2017	Calls 2018	Calls 2019	Calls 2020
						<p><b>MORE:</b> Management of Real-time Energy Data</p> <p><b>SELMA:</b> Stream Learning for Multilingual Knowledge Transfer</p> <p><b>Vessel AI:</b> Enabling maritime digitalisation by extreme-scale analytics, AI and digital twins.</p>
Data platforms	ICT-13-2019	N/A	N/A	N/A	<p><b>SmashHIT:</b> Smart dispatcher for secure and controlled sharing of distributed personal and industrial data</p> <p><b>KRAKEN:</b> Brokerage and Market Platform for personal data</p> <p><b>PIMCITY:</b> building the next generation personal data platforms</p> <p><b>TRUSTS:</b> Trusted Secure Data Sharing Spaces</p>	N/A

SRIA Mechanism	WP Topic	Calls 2016	Calls 2017	Calls 2018	Calls 2019	Calls 2020
					<p><b>i3-MARKET:</b> Intelligent, Interoperable, Integrative and deployable open source MARKETplace with trusted and secure software tools for incentivising the industry data economy</p> <p><b>DataVaults:</b> Persistent Personal Data Vaults Empowering a Secure and Privacy Preserving Data Storage, Analysis, Sharing and Monetisation Platform</p> <p><b>The FSM:</b> the Food Safety Market: an SME-powered Industrial data platform to boost competitiveness of European Food Certification</p>	

SRIA Mechanism	WP Topic	Calls 2016	Calls 2017	Calls 2018	Calls 2019	Calls 2020
					<p><b>OpertusMundi:</b> A Single Digital Market for Industrial Geospatial Data Assets</p> <p><b>DataPorts:</b> A Data Platform for the Cognitive Ports of the Future</p>	

Table 1: Overall project portfolio and mapping with BDV cPPP SRIA instrument

It is worth mentioning here that the Mechanism "Data Platform" presented in the table has been included in the latest version of the SRIA (version 4<sup>21</sup>) because considered useful to achieve the PPP objectives but it is not an official H2020 instrument. As such, it is not explicitly mentioned in the calls.

For what concerns to the SRIA coverage (KPI II.10), measured as "% of research priorities covered compared to overall scope of research priorities defined in SRIA" projects have delivered contributions during 2019 and 2020 covering already 100% of all the SRIA technical priorities. The major focus of technical contributions lies in the "**Data Analytics**" priority, followed by "Data Management". and "Data Processing Architectures". All priorities and topics are covered substantially and with a large number of contributions. "**Data Protection**" shows a clear Increase during the years 2019 and 2020 due mainly to the contribution of the ICT-13 projects or Data Platforms. "**Data Management**" has also been Influenced by the ICT-13 with an solid Increase In contributions during 2019 and 2020. "**Data Processing Architectures**" doubles Its number of expected contributions In 2021+ thanks to the contribution of the recently started projects part of the ICT-51 topic. "**Data Analytics**", the priority with the highest number of contributions, keeps quite a steady line along the years, also showing Increase for the 2021+ contributions. For the "**Data Visualisation and user Interaction**" 2019 is the year where more contributions have been received.

Specific details per technical priority can be found in Annex 2 to this report.

## 2.2 Mobilisation of stakeholders, outreach, success stories

**2019 and 2020** have been two **years of remarkable progress and advancements** for the Big Data Value cPPP and the BDVA.

In its third and fourth year of operations (with running projects), the PPP can show a great quantity and variety of success stories from projects and the Association. Main success stories from projects relate to:

- **Impact created in specific sectors** (e.g. the project Infinitech has developed and demonstrated more than 12 Proof of Concepts in Financial Institutions and FinTechs in areas like wealth management, asset management, anti-money laundering, customer-centric products, fraud detection),
- "**Close to the market**" **technology and solutions** delivered (e.g. Safe-Deed developed tools for data-driven business model innovation and integrated into an existing commercial platform for business model innovation),
- **Performance** (e.g. IoTwins developed a platform that will help manufacturing companies to implement their productive processes along the Cloud-Edge-IoT chain with very little efforts in terms of time and money)
- **Resources generated** (e.g. the ExaMode multimodal dataset includes over 30'000 images and associated text to target four use cases: colon cancer, uterine cervix cancer, lung cancer and celiac disease),
- **Successful experiments and outcomes** (e.g. EUH4D has launched the first open call for experiments with 89 eligible applicants)
- **Incubation of new data-driven businesses** (e.g. Data Market Services accelerator has given support to 100 data-driven startups),
- **Research excellence** (publications and paper awards),
- **Impact in Standardisation**, and,
- **Strong foundations put in place for future activities.**

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<sup>21</sup> [https://bdva.eu/sites/default/files/BDVA\\_SRIA\\_v4\\_Ed1.1.pdf](https://bdva.eu/sites/default/files/BDVA_SRIA_v4_Ed1.1.pdf)

**The European data Incubators/accelerators have given support and new opportunities to 205 start-ups and entrepreneurs** helping them to grow their business in the new Data Economy offering skills development, access to resources, data, infrastructure, ecosystem and additional private funding. **Data Market Services** funded 50 SMEs and start-ups in 2019 and 50 in 2020, **Data Pitch** 29 in 2019 (year of the end of the project) and **EDI**, with 40 funded SMEs and start-ups in 2019 and 36 in 2020. This has generated significant impact in revenues, jobs created and competitiveness. The newly funded **EUH4D** project plans to run 3 rounds of open calls to attract SMEs, start-ups and group of web entrepreneurs to use the services of the project's federation, providing technical and financial support to 42 experiments. Also, the **Reach** incubator is planning to fund 100 start-ups, with 30 reaching the experimentation stage.

It is important to highlight the **positive effect that participation in a larger programme** brings to individual projects. Almost 93% of the projects reported value created for their Research and Innovation projects by being part of the BDV cPPP e.g. facilitating collaboration and exchanges in between projects, such as complementary functionalities (e.g. Boost 4.0 and EUHubs4Data), re-use of projects outcomes (functionality, solutions or ontologies, data sharing <sup>22</sup> and specific know-how sharing. Additionally, the PPP is seeing to be effective in providing new channels for knowledge sharing, coordinating communication and dissemination activities, providing new opportunities for Start-ups and providing a common framework and vocabulary to develop effective end-to-end ecosystems.

A summary and examples of success stories from the projects and the BDVA members can be found in Annex 4 section 4.

It is also quite remarkable the overall impact in communication and engagement of the PPP overall with estimated numbers of people outreached in dissemination activities around **10,4 million people** in 2019 and 2020 with the objective of raising awareness about their different activities, to engage new stakeholders, and communicating results:

- Over 114 000 participants have been outreached through events, conferences, etc. although with a clear decrease in numbers through the year 2020, most likely due to the COVID-19 pandemic
- On the contrary, over 40 000 have been engaged in online activities such as webinars, online training, etc.
- Over 5 Million people have been outreached via mass media, online or physical format, and,
- Over 1,1 Million people have been outreached via other ways of communication and dissemination.

Additionally, the **BDV cPPP** has **organised 378 training activities** involving **over 6 000 participants** during 2019 and 2020. The **range and diversity of actors and stakeholders** outreached is very broad, in alignment with the overall objectives of the PPP.

Over the years, BDVA has established several collaborations with relevant organisations and initiatives at the European and international level. Particularly, during 2019-2020 BDVA has consolidated well-established relationships with the following organisations: EIT Digital, euRobotics, the European Cyber Security Organisation (ECSO), the Alliance for Internet of Things Innovation (AIOTI), Sustainable Process Industry through Resource and Energy Efficiency (SPIRE), the European Factories of the Future Research Association (EFFRA), European Digital SMEs Alliance and the DataSci Awards. New collaborations have been established during 2019 and 2020 with NESSI, ETSI, CEN-CENELEC, The European Organisation for Security (EOS) and Gaia-X. BDVA also initiated collaborations with many other organisations and initiatives, mainly in the context of the new Partnership on AI, Data and Robotics. These include AI Research organisations such as CLAIRE, EurAI and ELLIS (and especially for the development of the SRIDA and Partnership Proposal) and also 5G IA, INATBA, and the 3 Industry Associations of the ECSEL Joint

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<sup>22</sup> Discussions going on in between projects working in same sector

Undertaking (ARTEMIS, AENEAS and EPoSS). BDVA has also established an official liaison with ISO/IEC JTC1/SC42 and with CEN-CENELECT JTC21

BDVA **officially joined the EuroHPC Joint Undertaking** as a private member (together with ETP4HPC) in 2018 with the objective of shaping and strengthening European innovation on HPC/Big Data/AI related technologies and services by taking innovation joint efforts based on industrial needs. During 2019-2020 BDVA has participated in many different activities to consolidate its participation in the JU.

BDVA, euRobotics, CLAIRE, ELLIS and EurAI have joint forces to develop a **new partnership in AI-Data-Robotics**, leveraging investments, knowledge synergies and outputs from the different associations towards next framework programme.

In addition to this, the Association (**BDVA**) in close collaboration with the BDVe project has also contributed with the organisation Activity Groups meetings with the BDVA community, projects, and guests, organised and contributed multiple workshops and events, to highlight the organisation of the **BDV-PPP Summit in Riga** (Latvia)<sup>23</sup> in Jun 2019, the **European Big Data Value Forum (EBVDF) 2019** in Helsinki, the **BDV PPP Summit 2020 (online)**<sup>24</sup> and **EBDFV 2020 (online-Berlin)**.

## 2.3 Governance

The main governance structure of the BDV cPPP (

Figure 1), was prepared and delivered at the beginning of the cPPP to provide the framework for collaboration and alignment among all members of the cPPP (EC, funded projects, the Associations and its members).

The **Cooperation Charter**<sup>25</sup> was created and regularly updated by the Association as one of the key governance mechanisms to facilitate cooperation among the BDV cPPP actions and the BDVA and updated every year accordingly.

The BDVe project<sup>26</sup> (CSA of the BDV cPPP) has supported the implementation of the PPP projects Governance structure by establishing the BDV cPPP **Steering Committee** (SC) and the **Technical Committee** (TC). The Steering Committee (SC) provides executive-level steering and advice to ensure effective and efficient coordination and communication between the BDV cPPP actions. The Technical Committee (TC) facilitates knowledge exchange and cooperation on the technical aspects, methodology and implementation of the BDV cPPP programme. A non-formal Communication Committee was also established to support cooperation in Marketing and Communications.

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23 <https://www.big-data-value.eu/ppp-summit-2019/>

24 <https://www.big-data-value.eu/bdvppp-summit-2020/> (The event, initially planned to take place in Porto was cancelled and substituted by a series of webinars over time bringing all projects and members together.

25 The Cooperation Charter was produced by the BDVA during 2016 and it has been integrated in the CAs or GAs of the Call 1 and 2 actions, thereby formalizing the actions' commitment to supporting the cooperation among the BDV ecosystem. Latest version: [http://www.bdva.eu/sites/default/files/BDV%20PPP%20COOPERATION%20CHARTER%20January%202019\\_approved.pdf](http://www.bdva.eu/sites/default/files/BDV%20PPP%20COOPERATION%20CHARTER%20January%202019_approved.pdf)

26 Reported as part of BDVe project D3.17

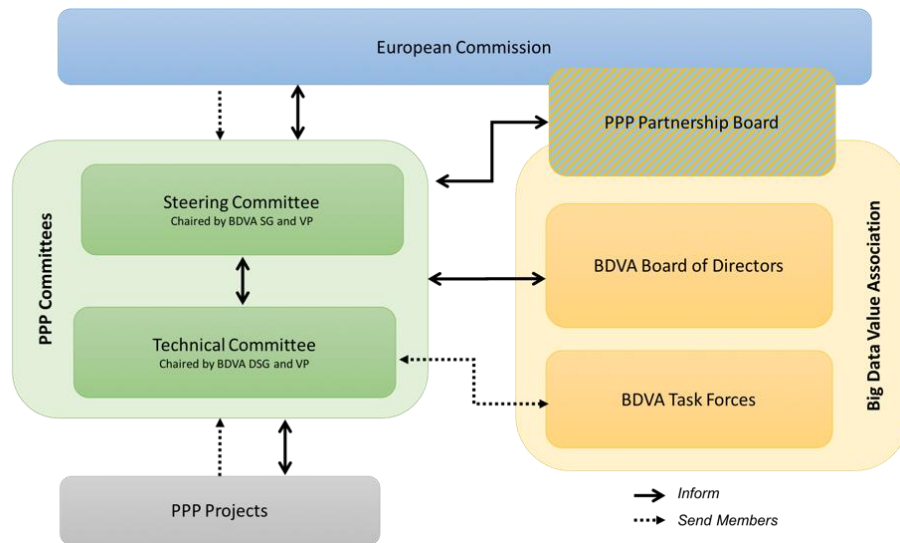


Figure 1: BDV cPPP Governance structure

The **Board of Directors**<sup>27</sup> (BoD) of BDVA is selected by the General Assembly of the Association (2-year mandate) and is in charge to achieve the Objectives of the Association. It follows the resolutions, instructions and recommendations adopted by the General Assembly. During 2019-2020 the Association Board organised 22 official meetings. The BDVA General Assembly (GA), conformed by all the BDVA members, approves the general policy of the Association. During the year 2019-20 the GA was officially convened 5 times (5 official meetings). The BDVA Task Forces<sup>28</sup> (TFs) are the main centres of BDVA activities and are regulated by its bylaws and established or dismissed by the BoD.

The **Partnership Board** (PB) is the monitoring body of the cPPP formed by selected directors of the Board of the BDVA, and representatives of the European Commission. The PB meets approximately 1-2 times per year and complements this with regular bi-weekly exchanges of information. The European Commission is represented by DG Connect Directorate G (Unit G1 in particular). Following the elections of the BoD on November 2018, 10 Association directors were appointed during 2019 to renew the PB PSM and continued until end of 2020. Appointment is based on expression of interest and assessment on the balance in composition.

<sup>27</sup> List of BoD members: <http://www.bdva.eu/board-members>

<sup>28</sup> <http://www.bdva.eu/task-force-overview>

## 3 MONITORING OF THE OVERALL PROGRESS SINCE THE LAUNCH OF THE CPPP

### 3.1 Achievement of the goals of the cPPP

According to the Big Data Value PPP SRIA v4<sup>29</sup> the programme will develop the European data ecosystem in distinct phases of development, each with a primary theme. The three phases are:

- Phase I: Establish the ecosystem (governance, i-Space, education, enablers) and demonstrate the value of existing technology in high-impact sectors (Lighthouses, technical projects) (Work Programme WP 16–17).
- Phase II: Pioneer disruptive new forms of Big Data Value solutions (Lighthouses, technical projects) in high-impact domains of importance for EU industry, addressing emerging challenges of the data economy (WP 18–19).
- Phase III: Develop long-term ecosystem enablers to maximise sustainability for economic and societal benefit (WP 19–20).

The cPPP goals achieved are analysed based on the defined roadmap. Projects reporting results in 2019-2020 have contributed to several phases. The assessment combines input from previous reports and the new information collected in 2019-20 considering objectives of all phases.

**Phase I: Establish Innovation Ecosystem (WP 2016-17)**, focused on laying the foundations needed to establish a sustainable European data innovation ecosystem. In particular (Table 2):

Expected cPPP activities and outcomes for WP2016-17 according to BDV cPPP SRIA / Multi-Annual roadmap	Achievements
Establish a European network of i-Spaces for cross-sectorial and cross-lingual data integration, experimentation and incubation (ICT14 – 2016–17)	<ul style="list-style-type: none"> <li>• 15 projects running in 2018 including 2 European Data Incubators. (Reported in MR2018)</li> <li>• 10 labelled BDVA i-Spaces providing data experimentation and data incubation capabilities for SMEs. (Reported in MR2018)</li> <li>• Over 15 sectors covered (reported in MR2018). 17 covered by end of 2020.</li> <li>• Growing number of experiments over the years by the projects and i-Spaces including large scale experiments involving closed (private) data</li> <li>• Large amount of data made available for experimentation</li> </ul>
Demonstrate Big Data Value solutions via large-scale pilot projects in domains of strategic importance for EU industry, using existing technologies or very near-to-market technologies (ICT15 – 2016–17)	<ul style="list-style-type: none"> <li>• 4 lighthouse projects running in 2018. Additional 4 HPC-Big data enabled lighthouse projects associated projects) started in 2019 (reported in MR2018).</li> <li>• 4 major domains of strategic importance covered: Bio Economy; Transport, Logistics and mobility; Healthcare; and Manufacturing. (Reported in MR2018)</li> </ul>
Tackle the main technology challenges of the data economy by improving the	<ul style="list-style-type: none"> <li>• 100% of SRIA technical priorities covered in 2018 (trend continues in 2019 and 2020)</li> </ul>

<sup>29</sup> And Multi-Annual roadmap version 2017

<p>technology, methods, standards and processes for Big Data Value (ICT16 – 2017).</p>	<ul style="list-style-type: none"> <li>• 7 technical projects running in 2018 and 6 additional projects funded (started in 2019). Additional projects started in 2020 and 2021.</li> <li>• The number of innovations of exploitable value starts being very significant in 2018 and growing in 2019-2020 including technologies, platforms, services, products, methods, systems, components or/and modules, frameworks/architectures, processes, tools/toolkits, spin-offs, datasets, ontologies, patents, and knowledge.</li> <li>• Many new systems and technologies developed different sectors during already by 2018 with a growing trend.</li> <li>• BDV cPPP reference model (2017).</li> </ul>
<p>Advance the state of the art in privacy-preserving Big Data technologies and explore the societal and ethical implications of this (ICT18 – 2016).</p>	<ul style="list-style-type: none"> <li>• 4 projects running in 2018 (1 focused on societal and ethical implications). 3 additional projects started in 2019 to scale solutions. The 9 data platform projects starting in the second half of 2019 are already tackling data protection.</li> <li>• Number of patents, publications and products or software components in the field of advanced privacy and security respecting solutions for data access, processing and analysis has a growing trend since 2018.</li> <li>• BDVA TF5 (Societal and Ethical aspects of Data, among other things) and BDVA T6.SG4 (Data Protection)</li> </ul>
<p>Establish key ecosystem enablers including programme support and coordination structures for industry skills and benchmarking (ICT17 – 2016-17).</p>	<ul style="list-style-type: none"> <li>• BDV Marketplace, BDV Landscape, the Education Hub and the skills recognition programme</li> <li>• Very large number of training activities organised over the years by projects, members, and i-Spaces.</li> <li>• Centres of Excellence in Big Data</li> <li>• EBDVF and BDV cPPP Meet-up (Data week since 2021)</li> <li>• DataBench project.</li> </ul>

Table 2: Summary achievements of the goals of the BDVA cPPP: Phase I of the roadmap

**Phase II: Pioneer disruptive new forms of Big Data Value solutions** (Lighthouses, technical projects) in high-impact domains of importance for EU industry, addressing emerging challenges of the data economy (WP 18–19). According to the SRIA this second phase is meant to build on the foundations established in Phase I and will have a primary **focus on Research and Innovation (R&I)** activities to deliver the next generation of Big Data Value solutions. Table 3 shows an overview on how the projects funded under WP2018-19, BDVA and its members contributed to achieve this phase, combining outputs of the MR2018 and the MR2019-20 :

<p>Expected cPPP activities and outcomes for WP2018-19 according to BDV cPPP SRIA / Multi-Annual roadmap</p>	<p>Achievements</p>
<p>Supporting the emergence of the data economy with a particular focus on accelerating the progress of SMEs, start-ups and entrepreneurs, as well as best practices and standardisation.</p>	<ul style="list-style-type: none"> <li>• 10 labelled BDVA i-Spaces providing data experimentation and data incubation capabilities for SMEs.</li> <li>• 2 European Data incubators (EDI and DataPitch) with 47 Start-ups incubated during 2018 and Data Market Services project started in 2019 (support to SMEs and Standards).</li> <li>• 3 next-generation Data incubators projects (I4Trust, MediaFutures, REACH) and the Federation of Big Data Innovation Hubs (EUHubs4Data) started in 2020 with strong focus on supporting SMEs and Startups. (DT-ICT-05)</li> <li>• BDVA organises workshops to bring SMEs closer to Standards</li> </ul>

<p>Pioneering disruptive new forms of Big Data Value solutions with the Cloud and HPC or the IoT via large-scale pilot projects in emerging domains of importance for EU industry using advanced platforms, tools and test-beds.</p>	<ul style="list-style-type: none"> <li>• 4 ICT-11-a-2018 projects (HPC and Big Data enabled Large-scale Testbeds and Applications) funded in 2018 and started in 2019 (associated projects to the PPP). All projects contributing to the SRIA implementation and bringing BDVA closer to EuroHPC activities.</li> <li>• 2 additional projects started in 2019 for IoT-Big Data (ICT-11-b-2018) (Infinitech and IoTwins).</li> <li>• ICT-51 projects starting in 2020 and 2021 (6 projects) combining BigData and AI with HPC and cloud (extreme data analytics)</li> <li>• BDVA organises workshops with the projects and the outcomes are contributing to the EuroHPC JU discussions.</li> </ul>
<p>Tackling the next generation of Big Data research and innovation challenges for extreme-scale analytics.</p>	<ul style="list-style-type: none"> <li>• 6 technical projects selected in 2018 (started in 2018) with focus on extreme-scale analytics.</li> <li>• 6 additional projects (ICT-51) started in 2020 and 2021 focused on this topic.</li> <li>• The major focus of technical contributions lies in the “Data Analytics” priority, followed by “Data Management”. and “Data Processing Architectures” by the end of 2020.</li> </ul>
<p>Addressing ecosystem roadblocks and inhibitors to the take up of Big Data Value platforms for data ecosystem viability, including platforms for personal and industrial data.</p>	<ul style="list-style-type: none"> <li>• 3 projects started in 2019 to advance the state of the art in the scalability and computational efficiency of methods for securing desired levels of privacy of personal data and/or confidentiality of commercial data (ICT-13-b)</li> <li>• 9 projects started in the second half of 2019 (ICT-13a) setting up and operating platforms for secure and controlled sharing of “closed data” (proprietary and/or personal data).</li> <li>• 4 projects are funded under DT-ICT-11 to support the establishment of Big Data Value platforms in the Energy sector.</li> <li>• BDVA community releases 2 papers on “Data Sharing Spaces” defining a roadmap for Data Spaces in Europe.</li> </ul>
<p>Providing programme support (continuing), facilitating networking and cooperation among ecosystem actors and projects, and promoting community building between BDV, Cloud, HPC and IoT activities.</p>	<ul style="list-style-type: none"> <li>• BDVA has built strong collaborations with ETP4HPC (for HPC), AIOTI (for IoT), EFFRA and euRobotics</li> <li>• BDVA continues as private member of the EuroHPC Joint Undertaking also in its phase 2.</li> <li>• BDVe project supports collaborations.</li> <li>• BDVA has set up liaisons and MoU with Standardisation bodies.</li> <li>• BDVA has started close collaboration with Gaia-X, IDSA, and FIWARE and other organisations.</li> <li>• BDVA is a main promoter and contributor to the AI, Data and Robotics Partnership.</li> </ul>

Table 3: Summary achievements of the goals of the BDVA cPPP: Phase II of the roadmap

**Phase III: Develop long-term ecosystem enablers to maximise sustainability for economic and societal benefit (WP 19–20).** According to the SRIA While the sustainability of the ecosystem has been considered from the start of the PPP, the third phase will have a specific focus on activities that can ensure long-term self-sustainability. Table 4 provides an overview on how the calls WP2019-20, BDVA and its members have contributed to the achievement of this phase, even considering many of the projects just started in 2020 or after:

Expected cPPP activities and outcomes for WP2019-20 according to BDV cPPP SRIA / Multi-Annual roadmap	Achievements
Sowing the seeds for long-term ecosystems enablers to ensure self-sustainability beyond 2020.	<ul style="list-style-type: none"> <li>The Federation of Big Data Innovation Hubs is launched in 2020 as one of the most promising long-term ecosystems enablers.</li> <li>BDVA collaborates with multiple partnership and associations: set up foundations for the HE partnership on AI, Data and Robotics; continues involvement as private member in the EuroHPC JU.</li> <li>9 Data Platform projects are launched, building foundations for the future Digital Europe Programme (DEP) in Data Spaces</li> </ul>
Creating innovation projects within a federation of i-Spaces (European Digital Innovation Hubs for Big Data) to validate and incubate innovative Big Data Value solutions and business models.	<ul style="list-style-type: none"> <li>The Federation of Big Data Innovation Hubs (EUHubs4data) and 3 additional next generation data incubators (I4Trust, MediaFutures, REACH) and many SMEs and innovators are expected to be engaged in experiments until the end of 2023</li> </ul>
Ensuring continued support for technology outputs of PPP (Lighthouses, R&I, CSA), including non-technical aspects (training) beyond 2020.	<ul style="list-style-type: none"> <li>Multiples workshops, activities and events organised by BDVA, BDVe project and EUHubs4Data to continue giving visibility to the project results and facilitation of knowledge sharing.</li> <li>Launched of the 6 ICT-51 projects on extreme-scale analytics</li> <li>Building collaborations with market-oriented organisations (e.g GaiaX) to link Research and Innovation with Market activities</li> </ul>
Establishing a Foundation for European Innovation Spaces with a charter to continue collaborative innovation activity beyond 2020, in line with the concept of European Digital Innovation Hub for Big Data	<ul style="list-style-type: none"> <li>Launch of the European Federation of Big Data Innovation Hubs (EUHubs4Data) in 2020</li> </ul>
Liaising with private funding (including Venture Capital) to accelerate entry into the market and socio-economic impacts, including the provision of ancillary services to develop investment-ready proposals and support scaling for BDV PPP start-ups and SMEs to reach the market.	<ul style="list-style-type: none"> <li>4 incubators (including the Federation) launched during 2020 offering supporting services to innovators including access to private funding.</li> </ul>
Tackling the necessary strategy and planning for the BDV Ecosystem until 2030, including the identification of new stakeholders, emerging usage domains, technology, business, and policy road-mapping activity.	<ul style="list-style-type: none"> <li>Contribution to 3 versions of the AI, Data and Robotics partnership in HE</li> <li>Contributing to the EuroHPC RIAG</li> <li>Delivery of strategic and position papers during the reporting period</li> <li>Involving BDV cPPP projects in roadmapping activities</li> <li>New collaborations built such as the Transcontinuum (8 associations), Gaia-X, etc</li> </ul>

Table 4: Summary achievements of the goals of the BDVA cPPP: Phase III of the roadmap

### 3.2 Progress achieved on KPIs (2019 and 2020)<sup>30</sup>

#### 3.2.1 Mobilised Private Investments (I.1)

Through this KPI we attempt to understand and capture/show the level of industrial engagement within the BDV cPPP. This KPI includes both direct and indirect leverage as described in Figure 2.

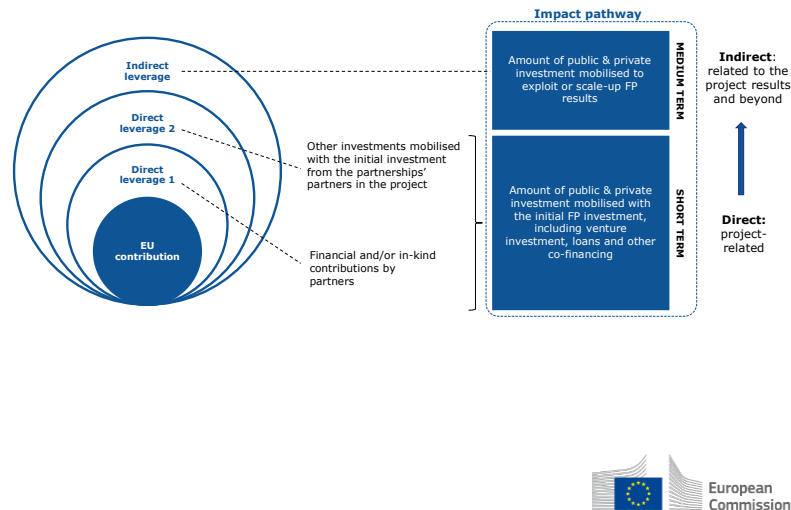


Figure 2: Methodology and KPI structure proposed by EC in 2018 for the cPPPs

To calculate both the private investment mobilised in R&D activities and the private expenditure mobilised in projects, **a questionnaire was sent out to 554 companies** representing all **for-profit organisations** participating in Big Data Value cPPP including organisation in projects active during 2019-20 (including not only project partners but also third parties engaged through cascade funding) and all for-profit organisations members of BDVA. None of the 205 start-ups Involved through the data Incubators provided Input. As their Input is not significant for this KPI, only direct project partners in projects and BDVA members (**349 companies in total**) are considered for the statistics related to response rate.

In total **86 for-profit organisations provided input** to this KPIs (overall response rate of 24,6%).

Table 5 shows the overall results of private investments for 2019-20.

Description	2019-20 (Meuros)	Response rate (%)
EC: EU contribution received for projects under the cPPP	144,88	Calculated over 100%. Estimation based on running projects 2019-20

<sup>30</sup> Details in methodology, response rates, and detailed outcomes and analysis can be found in annex 2.

<b>Direct leverage (A = A1 + A2)</b>	<b>25,07</b>	
A1: Direct contributions from the industry to the cPPP projects, as predetermined in the projects (co-funding)	19,50	Calculated over 100%. Estimation based on running projects 2019-20
A2: Additional investment or resources spent by your company for the execution of cPPP projects, beyond the direct contributions under A1 (these are typically due to shortfalls in fixed overheads for a project, infrastructure costs not covered by direct funding, consumables and maintenance costs, equipment costs, additional personnel costs, other costs)	5,57	6%
<b>Indirect leverage (B = B1 + B2)</b>	<b>601,94</b>	
B1: Additional investment or resources spent as a follow-up to the activities and results related to cPPP projects (e.g. to exploit or scale-up results) and that are not supporting directly the execution of these projects. This can include additional funding mobilised thanks to the cPPP projects such as venture capital, other public funding, etc.	21,77	6%
B2: Additional investments or resources spent that support the objectives of the cPPP and that have been triggered/encouraged by the existence of the cPPP, but that are not following up activities or results of the cPPP projects as such (hence, not counted in A1, A2 and B1).	580,17	12%
<b>Total leverage (A+B)</b>	<b>627,01</b>	

Table 5: Investment results 2019-20

Details of the methodology used to calculate these numbers as well as the specific questionnaires used to collect the information can be found in Annex 2 to this report.

Table 6 shows the evolution of reported numbers in private investments over time.

KPI	Description	Unit	2015	2016	2017	2018	2019-2020	2021+	Total
B2	Estimate the amount of R&D expenses that are related to the Big Data PPP but are not related to EC funded projects. (This excludes any expenses that are funded by the EC by definition!)	MEUR	245,80	289,10	388,67	370,33	541,41	-	1.835,31
B2	Estimate the amount of R&D expenses resulting from follow-up investments of projects funded by the EC that are topic-wise related to the Big Data PPP however initiated outside the Big Data PPP (in FP7 or in H2020). (This excludes any expenses that are funded by the EC by definition!)	MEUR	35,10	49,40	83,55	70,40	38,77	-	277,22
B1	Estimate the amount of R&D expenses resulting from follow-up investments of Big Data PPP projects (This excludes any expenses that are funded by the EC by definition!)	MEUR	N/A	N/A	1,09	7,57	21,77	42,93	73,36
A2	Additional investments in execution of PPP projects (in BDVPPP projects). (This excludes any expenses that are funded by the EC by definition!)	MEUR	N/A	N/A	3,46	9,52	5,57		18,55
A1 (estimated)	Annual private contribution (estimated for reporting period 2019-20)	MEUR			5,48	9,64	19,50	19,18	53,80

Table 6: Evolution of private investments on BDV cPPP over time<sup>31</sup>

Aggregated to the numbers reported in 2015 (280,9 M€), 2016 (338,5 M€), 2017 (482,25 M€), 2018 (467,47M€) and the remaining co-funded committed in cPPP projects, and some estimations on follow-up investments provided the amount of mobilised private investments since the launch of the cPPP is **2.258,2 M€ (2,26 B€)**. Considering the amount of EU funded allocated to the cPPP overall (380,8 M€) the BDV cPPP ends with a **leverage factor of 5,93** higher than the leverage factor of 4 committed contractually.

### 3.2.2 Job creation, new skills and job profiles (I.2, II.8)

**70% of the BDV cPPP projects that answered the questionnaire indicated their project will contribute to job creation by the end of 2023**, with an estimation in accumulated numbers of thousands. **Estimated numbers go over 8 158 new jobs created until the start of 2024, linked to project activities** and many more considering indirect effects.

BDV cPPP projects contribute to job creation in Europe by 1) **increasing market share and benefit big data economy actors**; 2) developing **new job profiles** that generate new jobs; 3) **increasing the actual number of IT jobs in Europe**, in fields such as data science, software engineering and machine learning and, to a less extent, non-IT jobs (financial, communication, insurance, marketing and business) 4) **developing new opportunities for entrepreneurs and startups** in the new Data Economy; 5) generating job opportunities by **increasing data sharing**; 6) creating new **jobs** already **during the life time of the project**; 6) forecasting new

<sup>31</sup> Input to PPP project investment was 0 before 2017 as project had not started. Number 12,4 MEuros is calculated based on real input extrapolated based on percentage of responses and expected annual private investment explained earlier.

<sup>31</sup> Considering the response rate we can assume this number is much higher, but as in previous years we only report on aggregated numbers based on real individual inputs with no extrapolation. As the methodology used this year to calculate this KPIs is the same that the one used in previous

jobs created as a **follow up of project results**; and 7) **creating jobs in sectors such as: IT, energy, healthcare, journalism, finance, insurance, biomedicine** etc.

On the other hand, **41% of the BDVA members which participated in the questionnaire stated that their participation in the BDVA/BDV cPPP has already contributed** directly or indirectly **to job creation**, either directly because of the hiring of new experts to develop H2020 projects, start-ups created...), and/or new profiles hired to develop operations. The total number of new jobs created was 3255 for the years 2019 and 2020.

Projects reported **188 job profiles were created or identified in 2019-2020**, and almost 1000 new job profiles are expected to be created from 2021 until the end of the projects, in liaison with the project activities. Projects directly contributing to new job profiles are BigMedilytics, MORE, DataMarketServices, SYNERGY, Boost 4.0, DataPorts, EUHubs4Data, IoTwins, EDI, TT, Lynx, QROWD. 34% of the projects running in 2019-2020 reported contribution to the creation of new job profiles. Some examples include Data scientists with special expertise in health sector (BigMedilytics), in the energy sector (Synergy), in the logistics sector (TT and DataPorts) and Legal AI Scientists for the legal sector (Lynx). Details are provided in Annex 2 to this report.

**67,5%** of the projects which answered the questionnaire reported **contribution to the generation of new skills** by end of the project. In addition to the skills linked to the new job profiles new skills are expected to be developed in cross sectorial domains (e.g new skills in machine learning, data analysis, data management for which the projects Kraken, DataBench and Synergy have contributed) and in specific sectors (e.g in the health sector the project BigMedilytics is fostering skills in machine learning techniques for processing Electronic Health Records or Examode project is enhancing the digital skills of the histopathology healthcare workers). The BDV cPPP incubators (DataPitch, EDI and Data Market Services) helped developing skills of start-ups in both technical and non-technical skills needed to develop business in the Data Economy.

Among the **BDVA members**, **50%** of organisations have reported contribution to the **creation of new job profiles** and **54% contribute to the creation of new skills linked to the Big Data Value**. Finally, projects that have replied to the questionnaire have indicated that 45% (2019) and 67,5% (2020) as well as 63% of the BDVA members have reported contributions to the **Skills Agenda for Europe**.

The **BDV cPPP** has **organised almost around 4.375 training activities** involving **over 150.000 participants** during 2019 and 2020<sup>32</sup>. Projects have contributed to this with **375 training activities during 2019 and 2020** involving over **6.000 participants**. **BDVA members reported 4.023 training activities involving over 139.000 participants**. Projects have developed **62 interdisciplinary programs** during 2019-2020 outreaching **1800** participants.

During 2019-2020 Master and PhD students in numbers of **786 equivalent FTEs** (503 Master and 283 PhD) have been involved in PPP projects therefore collaborating with industrial players in developing industry-driven solutions and deploying experimentation testing scenarios.

Contributing to the professional, user and public awareness raising the BDV cPPP projects that have answered the questionnaire has organised **708 events** outreaching around **114 000 participants** during 2019-2020, with a clear fall in numbers of events organised during the 2020 COVID-19 pandemic.

Details for any of the KPIs reported in this section can be found in Annex 2 (section 3) and Annex 4.

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<sup>32</sup> The numbers might be higher due to the fact that no all cPPP projects or BDVA members have answered the questionnaires.

### 3.2.3 Impact of the BDV cPPP on SMEs (I.3, II.18)

Results of the Monitoring Report 2019-20 show that a wide range of SMEs in Europe benefit from the Big Data Value cPPP, considering **size** (19% medium-size companies, 47% are small companies and 35% are micro companies<sup>33</sup>), **age** (19% of the SMEs are 0 to 4 years old, 21% of the SMEs are 5 to 10 years old and 60% of the SMEs are 10 years old or older) and wide **geographical distribution**. The SMEs play a variety of roles in the data value chain<sup>34</sup>. SMEs participating in cPPP projects clearly show a trend of increase in turnover and increase in number of employees. It is also important to mention that not all the SMEs involved in BDV cPPP projects are technology companies but Data users or providers, and the overall results and trend clearly indicate an **ongoing growth of turnover along the whole value chain**.

**Total turnover** reported for SMEs in 2019-20 is is **268,1 M€ in 2019** and **259 M€ in 2020**<sup>35</sup>. In terms of **turnover evolution** there is an **increase in aggregated data of 217% in 2019 with respect to 2014** (beginning of H2020) and 206% increase in 2020 with respect to 2014. Looking at the annual increase, there was a 23,6% increase in 2019 with respect to 2018, and a 3,41% decrease in 2020 with respect to 2019. reflecting the effect of Covid-19 in companies (in particular medium-sized companies). Young SMEs (5 and 10-year-old) show in average the biggest growth in turnover in relation to 2014.

In terms of **employment evolution**, the trend is positive in all companies' part of the PPP with an average in Increase in employment for the SMEs part of the PPP is of 300% with respect to 2014. Year 2020 shows a decrease in employment with respect to 2019 (effect of Covid-19 ?). We can also observe that the major increases take place in 2017, year of the implementation of the PPP.

Detailed results based on age and size of the company are provided in Annex 2.

As results of the call for proposals from **2019-20** with a result of **88 SMEs** participating in projects selected for funding in 2019-20 **22,9% of the partners are SMEs** that are taking **18,95% of the total budget** of the call). These values are not considering the FTSP cascade funding.

Annex 3 provides details of the results.

### 3.2.4 Innovations emerging from projects (I.4, II.7, II.17)

Innovations arising from the BDV cPPP include:

- **Specific project developments that have a marketable value**, including Big Data **products, processes, instruments, methods, systems and technologies** offering value to a wide variety of economical and industrial sectors (I.4).
- **Services of high societal value** developed by projects (II.7) (including solutions contributing to the environmental challenges II.6, II.19, II.20, II.21).
- **Spin-offs** arising from projects and **start-ups** incubated by the programme activities (I.2 and I.3).
- **Patents** and **solutions** enabling **advanced privacy and security respecting solutions** for data access, processing and analysis (II.4).
- **Contribution to Standards** (III.3) (Individually as projects and coordinated activities at a programme level).

<sup>33</sup> Criteria for classification following EC rules: [http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition\\_en](http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_en)

<sup>34</sup> This information has not been specifically gathered through a questionnaire, but it is known because of the role of the companies in the projects. In future exercise it could be useful to request this information also.

<sup>35</sup> Aggregated total of the companies

- **Innovations result of cooperation in between projects** or programme-coordinated activities (e.g. advances in data sharing, innovative skill programmes, re-use of technical solutions across different sectors, etc).
- Transformation of sectors of high economical value (led by the cPPP lighthouse projects, but also triggered by project cooperation): **New business models** and **scaling innovations** (advances in TRLs, cross-border solutions and bringing technology closer to the market accelerating adoption).

It is therefore necessary to have a full overview of the contribution to many different KPIs to understand the innovation value of the cPPP.

**328 Innovations of exploitable value, 27% of significant Impact**, are reported as **delivered in 2019 and 2020** or delivered earlier but further developed during that period. The number of unique innovations (not reported as delivered in 2018 or earlier) is **274** (81 during 2019 and 193 during 2020) and 54 were reported as delivered in 2018 and just Improved during the reporting period. **86%** of the innovations reported during this period have the potential to generate **economic impact** and **30%** have a potential to generate **societal impact**. Considering the type of innovation, **62,2%** are labelled as **incremental innovation**, **15% as disruptive innovation**, **12,5% architectural innovation**, and **0,7% radical innovation**.

Exploitable Innovations include **technologies** (including platforms) (55%), **systems** (33%), **services** (15%), **products** (14%), **methods** (8%), **systems** (8%), 5% is **software**, components or/and **modules** (4%), **frameworks and architectures** (2%) and **others**, including **processes, tools and toolkits, spin-offs, datasets, ontologies, patents, and knowledge** (9%).

Innovations can be exploitable in a single sector or in multiple sectors. **23% of the innovations are fully cross-sectorial**. Many are exploitable in several sectors. When looking at the sectors, **27%** of the Innovations are delivered for the **Financial sector**: mainly Influenced by the Infinitech project that has reported quite a large number of exploitable assets during 2020, and start-ups funded by the EDI Incubator; **12%** provide solutions to the **Transport, mobility and logistics sector** mainly delivered TT, DataPorts, QROWD and EDI projects; **10%** relate to **health and healthcare** delivered by BigMedilytics, BodyPass, DeepHealth, Examode, and EDI but also but others such cloudbutton, DataPitch, DMS and Musketeer; **9%** to **industry and manufacturing** thanks to the lighthouse projects Boost4.0, IoTwins and some Innovations linked to the DataPitch Incubator; **4%** of the innovations relate to **Public services and Smart Cities**; **4%** to the **ICT market**; **3%** to the **energy sector**; **3%** to **commerce**; **2%** are linked to **Marketing activities**; **1%** to the **bio-economy**; **5%** to **others** (including media, business services, and retail mainly)

In relation to the maturity levels and TRLs, 2% of the innovations delivered are TRL 3, 10% are TRL 4, 16% is TRL5 or TRL 6, 15% is TRL 7, 4% is TRL 8 and 1% TRL 9. Over 50% of the listed Innovations delivered or enhanced In 2019-20 did not Indicate any TRL level (not applicable as 45% of the innovations don't relate to know technologies), but indicated a maturity level of the innovation. Not reflected in the percentages above most of them can be considered TRL 4-6 (so low-medium maturity level) and some (when indicated marketable ready) TRL 9% (high maturity model). Although not reflected in the percentages above, this is reflected in the overall visualisation presented in Figure 3

Figure 3 provides the full overview of the innovations delivered by the BDV cPPP during the year 2019-20 combining level of significance, type of innovation (incremental, disruptive, architectural, and radical) and the TRLs (or maturity levels). Innovations of **significant impact** are equally distributed among Incremental, disruptive and architectural. and around a third of them have high TRLs or maturity levels: **9% of the Innovations delivered combine Impact and close-to-market characteristics at the same time**.

- The largest number of Innovations are classified as Incremental, with medium Impact and low-medium TRLs (43% of the total).

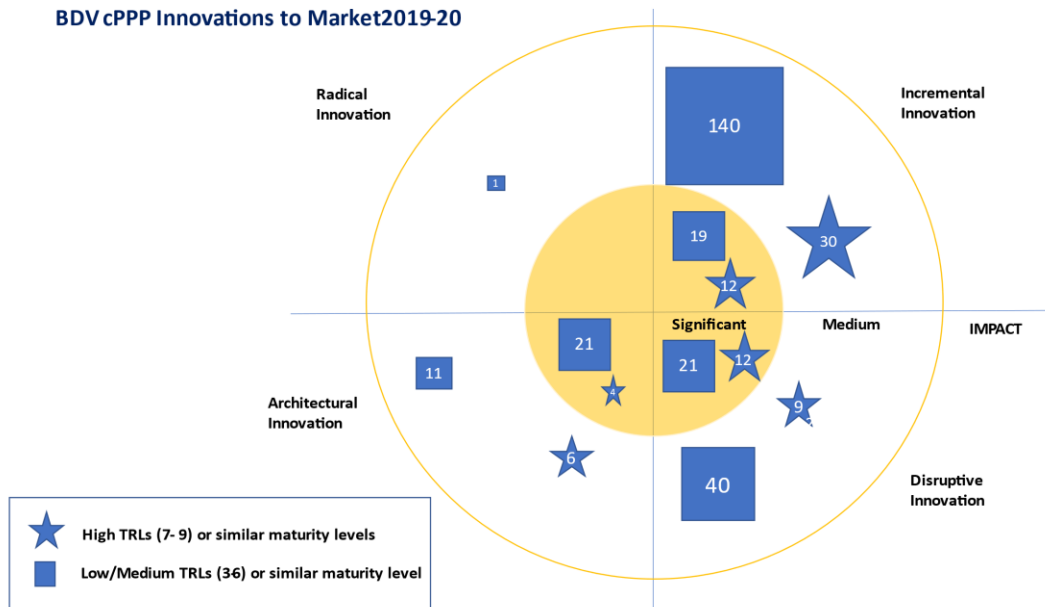


Figure 3: BDV cPPP innovations to market 2019-20

Figure 4 provides an overview of the expected evolution towards +2021. Following the general trend, it is important to highlight the expectations to deliver quite many disruptive Innovations of significant Impact In the upcoming years.

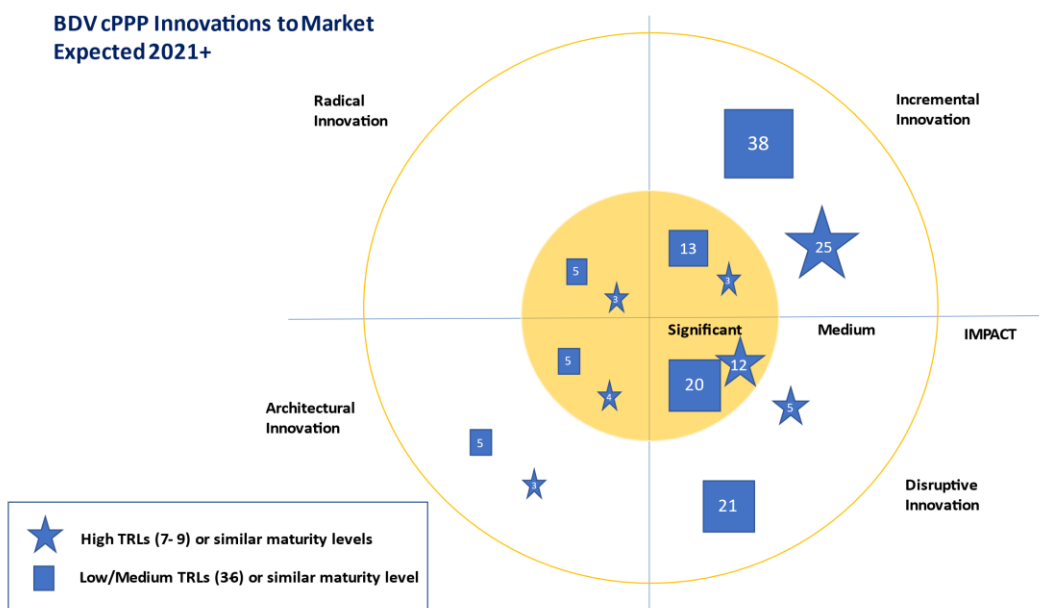


Figure 4: BDV cPPP innovations expected to be delivered in +2021

The full list of innovation of exploitable value (fully categorised) can be found in Annex 2 section 5.

**146 new economically viable services of high societal value** were developed during 2019-2020 as result of the projects that replied to the questionnaire (40 projects). 13 projects for 2019 (32,5% of respondents) and 15 projects for 2020 (37,5% of respondents) contributed to this KPI. Additionally, projects have forecasted (2021-2024) additional **64** new economically viable services of high societal value as result of their projects in the upcoming 4 years (2021-2024).

Projects have reported **337 new systems and technologies** developed during 2019-2020. Many of them are reported already as part of the KPI “Significant innovations to Market”. Systems and technologies developed are not limited to one sector and in fact most of the new systems and technologies can be utilised in different sectors/markets and by that stimulating the use of Big Data technologies in many areas.

Finally, many the solutions and innovations arising from the Big Data PPP were promoted in the BDV cPPP Marketplace<sup>36</sup> developed by the BDVe CSA project to spread the knowledge about the outcomes of the cPPP.

### 3.2.5 Support major sectors and major domains by Big Data technologies and applications (II.13)

The BDV cPPP lighthouse projects<sup>37</sup> active in 2019-2020 focused on the Bio economy (Agriculture, Fisheries, and Forestry) (**DataBio project**), Transport, mobility and logistics (**Transforming Transport project**), Health and Healthcare (**BigMedilytics project**) and Manufacturing (**BOOST4.0**), with a total of **4 major sectors supported** by Lighthouse projects and therefore widely supported with multiple use cases, scenarios and solutions.

Considering the whole project portfolio, the number of sectors supported is larger than **17**, with a solid distribution of use cases, experiments, solutions, and outreach activities among different sectors.

The BDV CPPP Marketplace as a supporting tool will help to further promote the marketable and exploitable results of the cPPP Projects to create a higher impact of the cPPP and contribute to its sustainability.

**10% of the projects are fully cross-sectorial** (their outcomes can be used in any sector or application domain) and **77,5% of the projects are working in more than 1 sector or application domain** (this explain why the total is superior to 100% in Table 7). In particular the BDV cPPP projects address a great variety of sectors<sup>38</sup> as shown in Table 7.

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37 Large-scale data-driven innovation and demonstration projects that aim at creating superior visibility, awareness and impact in specific relevant economic sectors

38 Grouped with a good level of alignment to the NACE registry These categories are part of the information in the BDV CPPP Marketplace that will be used for promoting all exploitable solutions coming out of the cPPP Projects (if needed new categories can be added)

Sector/application domain	Projects addressing this sector/application domain (% over active projects in 2019-2020)	Innovations to market (delivered in 2019-20, % over the total)
Cross-sectorial	10%	23%
Public services	25%	4%
Smart Cities	32,5%	4%
Transport and logistics	47,5%	12%
Mobility	40%	12%
Retail	30%	-
Business Services	35%	-
Environment	27,5%	-
Health and healthcare	47,5%	10%
Manufacturing	35%	9%
Media	30%	2%
Finance	42,5%	27%
Telecommunication	20%	-
Energy	37,5%	3%
Bio-Economy	15%	1%
Water and natural resources	17,5%	
Earth Observation	27,5%	
Others	20%	

Table 7: Support major sectors and domains

**Others** (20% of the projects) includes sectors such as insurance, public safety, personal security, public tenders, e-commerce, marketing, fashion industry, citizen engagement, ICT/Cloud services, social networks, procurement, legal domain, etc.

Some general conclusions can be reached (even when missing Information of over 40% of the projects) also looking at **Table 8** (so evolution over time from 2017):

- Cross-sectorial nature of around 15-25% of all Innovations of exploitable value delivered stimulating the use of Big Data technologies in many sectors of activity.
- Coverage of multiple sectors In the programme, not only with specific pilots addressing that vertical but delivering also sector specific assets
- The Impact of the lighthouse projects or large/close-to-market sectoral demonstrators over time, with solid coverage of those sectors.

Sectors (coverage of innovations per sector per reporting period)	2017	2018	2019-20	2021+
Cross-sectorial	15,4%	16,0%	23,2%	26,5%
Transport, mobility, logistics	84,6%	74,5%	11,9%	3,1%
Industry (manufacturing, production, automotive,...)		18,9%	8,8%	17,3%
Bio-economy		14,2%	1,2%	
Health and healthcare		7,5%	10,1%	3,7%
Finance			27,4%	2,5%
Energy			3,4%	35,8%
ICT		8,5%	4,3%	3,7%
Marketing		12,3%	2,4%	9,3%
geospatial		6,6%		
Public services and Smart Cities		19,8%	4,0%	5,6%
Telco		13,2%		
Commerce	23,1%	4,7%	3,0%	
Others		2,8%	5,2%	1,9%

**Table 8:** Innovations to market – sector: Percentage over the total per reporting period. Evolution.

In addition to the projects, BDVA's Task Force <sup>739</sup> (application) bring together European stakeholders to identify and act on the needs (technology, skills, etc.) of different industrial sectors as well as the areas of interest applicable to different industrial sectors such as language technologies, HPC, etc. During 2019-2020 twelve different application domains were represented in BDVA, organised in different subgroups.

In particular:

- TF7.SG2 Telecom
- TF7.SG3 Healthcare
- TF7.SG4 Media
- TF7.SG5 Earth Observation & Geospatial
- TF7.SG6 Smart Manufacturing Industry
- TF7.SG7 Mobility and logistics
- TF7.SG8 Smart Governance and Smart Cities
- TF7.SG9 Agriculture
- TF7.SG10 Finance
- TF7.SG11 Automotive
- TF7.SG12 Energy
- TF7.SG13 Security

<sup>39</sup> <http://bdva.eu/task-force-7>

### 3.2.6 Experimentation (II.11, II.12, II.14)

Projects reported **1251 use cases or/and experiments** conducted during 2019-2020 with a contribution from 40 different projects (many experiments performed along the 2 years). This is an increase of **over 500%** with respect to 2018 (224 experiments). List of all use cases and experiments and additional information can be found in Annex 2. (II.12). BDVA i-Spaces have reported additional **194** experiments with 3 i-Spaces contributing to this KPI. Details can also be found in Annex 2.

As part of the experiments performed **1078** are considered **large scale experiments** (aggregated number of experiments conducted by all projects in 2019-2020), of which the majority involve closed (private) data (with the project Exa-mode reporting more than 1000 experiments). Large-scale experiments either involve many users with high TRLs, or/and are developed in large geographical areas, in many cases involving a large number of users and actors or/and involve a combination of data volume, complexity, and velocity, a large number of data sources or integrate complex datasets flowing across borders. **BDVA i-Spaces** also contributed to this KPI reporting in total **24 large scale experiments** performed during 2019-2020, **14 of them involving private data**.

In relation to the amount of data made available for experimentation, reported information from projects and i-Spaces (members of BDVA) show that the amount of data made available by the BDV cPPP for experimentation in 2019-20 is **0,001669 Exabytes** (1,604 Petabytes). A total of 0,001564 Exabytes (**1,669 Petabytes**) has been reported by the projects<sup>40</sup>. It is important to notice that some of the projects are not only providing internal access to diverse data sets from different sources, but also are **improving and creating new valuable datasets** (e.g., of ExtremeEarth project). BDVA i-Spaces contributed to this KPI reporting additional **0,04 Petabytes** of data for experimentation.

Additional details for each of the projects and i-Spaces can be found in Annex 2.

### 3.2.7 SRIA update and implementation (II.9, II.10)

For what concerns SRIA coverage (KPI II.10), measured as “% of research priorities covered compared to overall scope of research priorities defined in SRIA” projects have delivered contributions during 2019 and 2020 covering **100%** of all the SRIA technical priorities.

Based on the data reported by the BDV CPPP projects, Table 9 shows the consolidated and aggregated results over time showing only the main priorities and associated topics. The table depicts the number of technical contributions and big data technologies per SRIA technical priority and challenge, both as totals (first column) and per different phases / years of the PPP. In the rest of the columns, not only including the results of the year 2019, 2020 and ongoing and planned for 2021+, but results from the launched of the PPP (2017 and 2018 results correspond to the reports of those 2 years). As part of SRIA Version 4.0, four

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<sup>40</sup> 13 projects provided data for this KPI (Aegis, BigDataOcean, DataBio, euBusinessGraph, EW-Shopp, TT, QROWD, BigDataStack, BigMedilytics, Boost 4.0, CLASS, EDI, TheBuyForYou )

new technical challenges were introduced and are included in the table. As a result, the 2017 column does not report coverage of these challenges, as they were not part of the previous SRIA.

Technical priorities and challenges	Number of contributions/technologies					
	TOTAL	Delivered in 2017	Delivered in 2018	Delivered in 2019	Delivered in 2020	Ongoing in 2021 and planned 2021+
<b>Priority "Data Management"</b>	<b>547</b>	<b>44</b>	<b>122</b>	<b>66</b>	<b>145</b>	<b>170</b>
Semantic Annotation of unstructured and semi- structured data	107	9	31	13	31	23
Semantic interoperability	67	11	13	6	20	17
Data quality	65	7	15	12	15	16
Data Management lifecycle and data governance	71	9	11	6	20	25
Integration of data and business processes	90	3	44	9	21	13
Data-as-a service	93	4	4	11	24	50
Distributed trust infrastructures for data management	53	1	4	9	14	25
Other (specify)	1	0	0	0	0	1
<b>Priority: "Data Processing Architectures"</b>	<b>510</b>	<b>9</b>	<b>126</b>	<b>58</b>	<b>117</b>	<b>200</b>
Heterogeneity	104	4	33	12	21	34
Scalability	114	4	28	11	23	48
Processing of data-in-motion and data-at-rest	76	0	19	8	18	31
Decentralization	72	0	12	11	20	29
Performance	80	1	18	7	19	35
Novel architectures for enabling new types of big data workloads -- new in SRIA4.0	40		13	4	9	14
Introduction of new hardware capabilities -- new in SRIA4.0	22		1	5	7	9
Other (specify)	2	0	2	0	0	0
<b>Priority: "Data Analytics"</b>	<b>697</b>	<b>11</b>	<b>183</b>	<b>120</b>	<b>177</b>	<b>206</b>
Semantic and knowledge-based analysis	88	5	21	17	22	23
Content validation	36	2	6	7	18	3
Analytics frameworks & processing	135	4	25	19	31	56
Advanced business analytics and intelligence	105	0	53	19	19	14
Predictive and prescriptive analytics	140	0	53	28	28	31
High Performance Data Analytics (HPDA) -- new in SRIA 4.0	46		13	13	9	11
Data analytics and Artificial Intelligence -- new in SRIA 4.0	143		12	17	48	66
Other (specify)	4	0	0	0	2	2
<b>Priority: "Data Protection"</b>	<b>196</b>	<b>15</b>	<b>33</b>	<b>16</b>	<b>47</b>	<b>85</b>
Generic and easy to use data protection approaches	73	0	9	10	21	33
Robust Data privacy ((incl. multi-party computation)	67	1	21	4	12	29
Risk based approaches	16	0	3	2	5	6
Other (specify)	40	14	0	0	9	17
<b>Priority: "Data Visualisation and User Interaction"</b>	<b>247</b>	<b>5</b>	<b>56</b>	<b>72</b>	<b>53</b>	<b>61</b>
Visual data discovery	61	3	10	14	16	18
Interactive visual analytics of multiple scale data	59	0	10	22	17	10
Collaborative, intuitive and interactive visual interfaces	79	2	31	18	8	20
Interactive visual data exploration and querying in a multi-device context	45	0	5	18	12	10
Other (specify)	3	0	0	0	0	3
<b>Other (specify)</b>	<b>21</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>21</b>

Table 9. Coverage of SRIA Technical Priorities and Challenges (Number of Contributions/Technologies)

Section 8 of Annex 2 to this report provides a detailed analysis of the SRIA implementation.

During 2019-2020 there was no updates of the BDA cPPP SRIA as the programme was ending. Efforts have been put to contribute to the AI, Data and Robotics PPP SRIDA, to the EuroHPC JU roadmap documents, and whitepapers produced by the association.

### 3.2.8 Technical Projects (II.4, II.15, II.16)

The BDV cPPP contributes to **enabling advanced privacy and security respecting solutions for data access, processing and analysis** (II.4). For 2019-2020, **341 contributions** were reported (10 patents<sup>41</sup>, 173 publications and 158 OSS/SW/Products). Table 10 **Error! Reference source not found.** shows the consolidated and aggregated results for the three specific sub-KPIs evolution over the years and projects (based on the 40 running projects that replied to the 2019-2020 questionnaire) for 2021-2024.

II.4 a) Number of patents filed that enable advanced privacy and security respecting solutions for data access, processing and analysis			II.4 b) Number of publications that describe advanced privacy and security respecting solutions for data access, processing and analysis			II.4 c) Number of OSS contributions / SW / Products that enable advanced privacy and security respecting solutions for data access, processing and analysis		
Year 2018	Years 2019-2020	2021-2024 (forecasted)	Year 2018	Years 2019-2020	2021-2024+ (forecasted)	Year 2018	Years 2019-2020	2021-2024 (forecasted)
2	10	49	61	173	189	24	158	115

Table 10: Sub-KPIs for KPI II.4 “Enable advanced privacy and security respecting solutions for data access, processing and analysis”.

In relation to the assessment of quality, diversity, and value of data assets (KPI II.15) **42.5% of the 40 projects** that participated to the questionnaire confirmed they are **assessing quality, diversity and value of data assets**. Details per project can be found in section 9 of Annex 2. These results show the intense usage of metrics to measure quality, diversity and value of data assets in projects and some projects have developed specific metrics and methods to ensure quality, diversity and value in the data (e.g. Safe-Deed has developed a Data Valuation Component (DVC), which performs the valuation of a data set from several perspectives: data quality, data exploitability, aggregate value).

In relation to the speed of **data throughput** 47,5% of the projects reported they expect the project to improve data throughput. Some projects such as INFORE has measured improvements over 70%. Others such as Safe-Deed observed improvements in throughput by a factor of more than 4 and simultaneously a 5-fold reduction of pre-processing effort, albeit at the cost of higher latency.

Details can be found in section 9 of Annex 2.

### 3.2.9 Macro-Economic KPIs (II.1, II.2, II.3, II.5)

The monitoring of the macro-economic KPIs (KPI II.1, II.2, II.3 and II.5) is based on input from the European Data Market (EDM) study<sup>42</sup> as they are presented in the most recent report<sup>43</sup> by IDC (data March 2020, publication July 2020). The IDC report provided estimates for 2020 which are now unreliable because of the COVID-19 pandemic impacts on the economy. The new set of data with updated 2020 and 2021 estimates will be produced in the fall of 2021 under a new release of the study (European Data Market Study 2021–2023). If feasible this data will be Included in an updated release of the Monitoring report.

<sup>41</sup> Filled patents

<sup>42</sup> SMART 2016/0063 – Study “Update of the European Data Market Monitoring Tool”, IDC and Lisbon Council

<sup>43</sup> [The European data market monitoring tool - Publications Office of the EU \(europa.eu\)](https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&plugin=1), Final Study Report (Deliverable D2.9), IDC and the Lisbon Council, July 2020

KPI II.1 assesses development of the market share of the European Union in the global Big Data Market. As an indicator, we will compare the total revenues of EU Data Companies with other economies, i.e. the US, Japan, and Brazil, as they are used as a benchmark in the IDC report<sup>44</sup>. This share has remained substantially stable since then, with a slight decrease to 27.02% in 2019. However, the EU data companies' revenues grew faster than those from Japan and Brazil second only to the US companies' growth. This is remarkable considering the dominance of global US platforms in the data market. In absolute terms, the amount of the total revenues of US Data Companies in 2019 was more than twice the revenues of EU28 Data Companies in the same year (€185 bn vs. €84 bn).

**60% of the cPPP projects active in 2019-2020<sup>45</sup>** reported contribution to increase revenue share of EU companies. Projects contribute either by:

- Accelerating adoption of new technologies,
- Development of new products and system infrastructures
- Supporting EU data driven companies to build innovative solutions that can be scaled internationally,
- Giving cross-sectorial industries access to the great spectrum of sensor data coming from high volume products from various industrial sectors
- Enabling industries to exploit their big data efficiently and therefore increase their market share and services provided to their customers.

Data companies are the suppliers of digital data-related products and services. According to the most recent report<sup>46</sup> **the number of Data Companies (KPI II.2)** increased to 290,000 by 2019, compared to 283,390 in 2018, with a growth rate of 2.3%. It should be noticed that almost half of them are based in the UK. BDVA i-Spaces and Data Incubators (ICT 14-b projects, so DataPitch and EDI) are in particular designed to contribute to this KPI as they support start-ups and entrepreneurs from early ideas to technical and business development till go-to-market.<sup>47</sup> **85% of the BDV cPPP projects active in 2019-2020<sup>48</sup> reported contribution from their project to increase the number of European Companies** offering data technology and applications. Projects contribute in different ways such as:

- Helping additional companies serving as platforms for healthcare IT solutions (BigMedilytics)
- Creating tools that will stimulate the creation of new companies and start-ups based on the technologies of the project,
- Creating new companies as results of the project (e.g. BigDataOcean),
- Supporting EU data driven companies,
- Building innovative solutions to solve data related challenges,
- Offering data-skills courses to start-up employees
- Supporting companies in complying with the GDPR, assuring security and privacy and/or,
- Lowering the threshold to create new business in a particular sector.

In addition, 27% of the BDVA members reported their organisation run or support a programme that is specifically targeted at supporting start-ups or entrepreneurs in the Big Data area.

The revenues of Data Companies in the European Union (KPI II.3), according to the IDC report<sup>49</sup>, reached 84 €B in 2019 compared to 77 €B in the year before, with a growth of 8.1%.

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44 The EDM monitoring tool, ibidem D.2.9 Final study report, chapter 2.5, pages 41-47

45 Based on number of respondents.

46 The EDM monitoring tool, ibidem D.2.9 Final study report, chapter 2.3, pages 33-34

47 Further information can be found in section 2.1 of this report.

48 Based on number of respondents.

49 The EDM monitoring tool, ibidem, chapter 2.3 pages 36-37

The value of revenues by SMEs in 2019 amounts to €59.6 €B (71.4% of the total revenues), an absolute growth of 4 €B on the year before. The growth rate of revenues increases in proportion to company size, with the revenues of large companies over 500 employees growing at 13.4% in 2019 over 2018.

**67,5% of the cPPP projects** active in 2019-2020<sup>50</sup> reported contribution (or plan to contribute) to the revenue generated by European Data Companies. Project contribution to this KPIs is mainly by:

- Opening up sectors to data-intensive companies,
- Offering direct support and getting funding for data start-ups,
- Making data processing easier and cheaper for companies,
- Creating new opportunities through privacy-preserving analytics solutions,
- Through the commercialisation of new services with marketable value,
- Creating opportunities for common exploitation based on joint Big Data technology pipelines, and/or,
- Developing simplicity in some business ecosystems.

The baseline for Data Professionals in the EU27+UK in 2013 (KPI II.5) amounts to 5,77 million. The number of Data Professionals increased to a total of 7.6 million by 2019, resulting in a total absolute growth of 1,836 thousand professionals since 2013 with a compound annual growth rate (CAGR) of +4.7% over this period. Approximately 394 thousand positions were added in 2019 corresponding to 5.5% growth on the year before.<sup>51</sup>

- 80% of the cPPP projects active in 2019-2020<sup>52</sup> reported contribution from their project to increase the number of Data Workers in Europe. Projects contribute to this KPI in different ways:
- New organisations created as result of the project hiring new data professionals;
- Supporting emerging start-ups to grow;
- Developing more data-driven services that will require new data-workers;
- Unlocking value of data services introducing privacy preserving technologies;
- Creating of new job profiles;
- Supporting the adoption of data solutions in different sectors; and/or,
- Supporting education and training.

Details of contribution from the different projects to the macro-economic can be found in Section 10 of Annex 2.

Table 11 KPI II.1 Market Share of the European suppliers of the global Big Data Market

Key Performance Indicator (KPI)			
Revenue share of EU companies against total of revenue of EU, US, Japan, Brazil			
Target: > than 2013 value 27.67%			
Value €M	2013 (Baseline)	2018	2019
EU27+UK	47,801	77,297	83,545
US	97,237	163,993	184,873

50 Based on number of respondents.

51 The EDM monitoring tool, ibidem, chapter 2.2 pages 29-32

52 Based on number of respondents.

BR	4,703	7,373	7,905
Japan	23,021	29,799	32,929
<b>Total</b>	163,067	260,112	289,969
<b>EU27+UK %</b>	27.67%	27.76%	27.02%

Source: [The European data market monitoring tool - Publications Office of the EU \(europa.eu\)](#), Final Study Report (Deliverable D2.9), IDC and the Lisbon Council, July 2020  
**Details and contributions from projects in Annex 2.**

Table 12 KPI II.2 Number of Data Companies

Key Performance Indicator (KPI) Increased number of European Companies offering data-related technologies, products, and services Target: Net Increase > 0 compared to 2013 baseline				
Number	2013 (Baseline)	2018	2019	Delta on 2013 Baseline
EU27+UK	239,845	283,390	290,000	
Increase Y/Y value		11,690	6,610	50,155
Increase Y/Y %		4.1%	2.3%	3.2%

Source: [The European data market monitoring tool - Publications Office of the EU \(europa.eu\)](#), Final Study Report (Deliverable D2.9), IDC and the Lisbon Council, July 2020  
**Details and contributions from projects in Annex 2.**

Table 13 KPI II.3 Revenues generated by Data Companies

Key Performance Indicator (KPI) Increased revenues generated by data companies Target: Net Increase > 0 compared to 2013 baseline				
Value €M	2013 (Baseline)	2018	2019	Delta on 2013 Baseline
EU27+UK	47,801	77,297	83,545	
Increase Y/Y value		8,452	6,248	35,744
Increase Y/Y %		12.3%	8.1%	9.8%

Source: [The European data market monitoring tool - Publications Office of the EU \(europa.eu\)](#), Final Study Report (Deliverable D2.9), IDC and the Lisbon Council, July 2020  
**Details and contributions from projects in Annex 2.**

Table 14 KPI II.5 Employment

Key Performance Indicator (KPI)				
Increased number of European Data Professionals				
Target: Net Increase > 200,000 at the end of H2020				
Number (units)	2013 (Baseline)	2018	2019	Delta on 2013 Baseline
EU27+UK	5,771,863	7,214,503	7,608,299	
Increase Y/Y value		548,394	393,796	1,836,436
Increase Y/Y %		8.2%	5.5%	4.7%

Source: [The European data market monitoring tool - Publications Office of the EU \(europa.eu\)](#), Final Study Report (Deliverable D2.9), IDC and the Lisbon Council, July 2020

**Details and contributions from projects in Annex 2.**

### 3.2.10 Contributions to environmental challenges (II.6, II.19, II.20, II.21)

5 projects (DataBench, TT, IoTwins, Everest and Daphne) reported they are monitoring Energy Efficiency in their projects. For example, by using specific KPIs (TT project) or by considering energy consumption (Everest) for every operation workload (Daphne).

**17,5% of the projects** running in 2019-2020 and that participated to the questionnaire, have reported they contribute to the **reduction of energy** use and **27,5% contributed to the reduction of CO<sub>2</sub> (II.19)**. Quantitative results are provided by some projects such as the Transforming Transport (TT) project that reports improvements concerning CO<sub>2</sub> and other emissions such as NO<sub>x</sub> and PM, savings reach up to 37%. Moreover, in the BDV PPP there are 4 projects belonging to the DT-ICT-11 topic "Big Data Solutions for Energy". Those are: BD4NRG, BD4OPEM, PLATOON, SYNERGY. Those projects are developing some services which contribute to the reduction of CO<sub>2</sub> emission and environmental challenges at large. For example, SYNERGY is contributing to 1bn tons annual CO<sub>2</sub> emissions reduction by 2050 due to renewables integration at EU level.

Also, 2 lighthouse projects running in 2019-2020 (Transforming Transport and Boost4.0) have reported contribution to the **reduction of waste (II.20)**. For example, TT project contributes to decrease waste through savings in operational activities and improved management of assets. On the other hand, BigMedilytics' pilot focuses on reducing the number of assets a hospital needs to own by optimizing workflows. Plan to completely replace the current paper-based system for tracking readings by digital solutions.

15% projects running in 2018 have reported contribution to the **reduction in the use of material resources (II.21)** e.g. DataPorts is contributing with a reduction of paperwork in ports, reduction of paperwork for port logistics and truck companies.

### 3.2.11 Standardization activities with European Standardization Bodies (III.3)

During 2017 and 2018 BDVA and the BDV cPPP set up some foundations defining priorities for the PPP in Big Data Standardisation. The implementation continued during 2019-20 as follows

**The following activities have been developed during 2019:**

The preparation of a Memorandum of Understanding between CEN-CENELEC and BDVA started in 2019 when the two associations agreed on the objective of strengthening collaboration for the establishment of trustworthy AI within the EU. Through this MoU, BDVA and CEN CENELEC committed to establishing regular forms of collaboration and formalising knowledge sharing and exchange. The aim of the agreement is to contribute to enhancing the industry and meet stakeholders needs to maintain Europe's competitiveness through digitalisation. With the new Big Data, AI and Robotics partnership bringing research and innovation activities closer to deployment and user uptake, joining forces with CEN CENELEC became even more Important for BDVA in order to drive standardisation efforts. The MoU signature took place in early 2020<sup>53</sup>.

Discussions for the development of a Memorandum of Understanding with ETSI started in summer 2019 and resulted in the signature of a MoU during the month of November of the same year. The MoU defines five key areas of mutual Interest and notably:

- exchanging information (including technical, technological and regulatory information) and experience in the field of Big Data, Artificial Intelligence and standardization, that are of mutual interest;
- inviting each other to contribute to existing dedicated groups which have been established on Big Data and/or Artificial Intelligence;
- contributing to relevant activities in the fields of Big Data, AI and standardization, which may include mutual consulting in the requirements phase of development of standards;
- informing each other of relevant events they organise (such as with regard to the publication of policy documents and initiation of public consultation procedures and other public events);
- meeting each other in order to exchange views on strategic level matters, informing on ongoing developments and cooperating on policy or technical matters of common interest to both Parties.

In April 2019, the 3<sup>rd</sup> ISO/IEC JTC 1/SC 42 committee plenary meeting voted a resolution requesting BDVA (and a short list of other organisations) to collaborate with the committee by providing input, and more specifically use cases, concerning Artificial Intelligence. The mandate of this newly established ISO committee in fact is to a) serve as the focus and proponent for JTC 1 standardisation program on Artificial Intelligence and b) provide guidance to JTC 1, IEC, and ISO committees developing Artificial Intelligence applications<sup>54</sup>. To fulfil this mandate, the committee is currently working on a publication which is due in 2020 and which considers possible AI areas requiring further standardisation efforts. The collaboration between the committee and BDVA therefore helps shaping ISO standardisation activities for the near future and nourishing the reflection concerning the needs and opportunities for standards in the AI domain. As a contributor for the committee's work and for the upcoming publication, BDVA can therefore take an active part in the current and upcoming discussion within ISO. This collaboration, together with the MoUs signed with ETSI and CEN-CENELEC and described above, shows the importance of standardisation for BDVA, in the context of Big Data and AI, and strengthens the relations of the association with key standardisation organisations and stakeholders.

It is worth highlighting here the webinar on " Standards and Innovation Data and AI standards generating value for SMEs" which was organised by the BDVA TF6.SG6 (Standards) and the BDVA TF8.SG1 (Business-SMEs) and combined an introductory part on ICT Standards and Standardisation with a deep dive for SMEs<sup>55</sup>.

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53 <https://www.bdva.eu/node/1526>

54 <https://www.iso.org/committee/6794475.html>

55 [http://www.bdva.eu/Standards\\_Innovation\\_SMEs\\_webinar](http://www.bdva.eu/Standards_Innovation_SMEs_webinar)

This webinar was originally planned to be part of the 2020 Big Data Value PPP summit's agenda but the event was cancelled due to Covid19 restrictions.

Over 30% of the projects running in 2018 reported they perform activities leading to data/Big data Standardisation and 3 projects have reported contribution to European Standardization Bodies (ESBs) activities. In particular: 20% of BDVA members reported its organisations perform activities leading to data/Big data Standardisation and 15% of BDVA members reported contribution to ESBs but they did not report specific data about the specific working items of Pre-Normative Research Files they are involved in.

### 3.3 Evolution over the years

2020 is the 6<sup>th</sup> year of activity of the BDV cPPP and the 4<sup>th</sup> year with running projects, therefore results from the projects are limited to 4 years (2017-2020).

- **Leverage investments:** There is a clear indication of annual increase in **private R&D investments in the context of the PPP** along the years (280,9 M€ in 2015, 338,5 M€ reported in 2016, 482,2 M€ reported in 2017, 467,46 M€ and 627,1 M€ reported for 2019-20 with a total the amount of reported **mobilised private investments** since the launch of the cPPP **of 2,26 B€** achieving the target of the contractual PPP (2 B€). Considering the amount of EU funded allocated to the cPPP overall (380,8 M€) the BDV cPPP ends with a **leverage factor of 5,93** higher than the leverage factor of 4 committed contractually.
- **Progress in tangible outcomes of the PPP projects:** Evolution of tangible outcomes that have a marketable value can be seen in Table 15. This includes Big Data products, processes, instruments, methods, systems, and technologies offering value to a wide variety of economical and industrial sectors, spin-offs and start-ups incubated/accelerated, patents, contribution to standards. The table shows a very positive growth over the years in most of the KPIs, explained by the increase in the number of projects, maturity of the projects, and it is also a good indication of the successful orientation of the PPP to impact creation. The PPP shows quite remarkable results in the number of innovations created and, in the experiments developed addressing many different sectors. The availability of data for experimentation does not show in 2019-20 the growing trend observed until 2018.

Key Performance Indicator (KPI)	Value in 2017	Value in 2018	Value in 2019	Value in 2020	KPI: value at the end of H2020	
Significant Innovations to market	45 innovations of exploitable value	106 innovations of exploitable value, 39 of which are significant	81 innovations of exploitable value (new reported this year). 27% labelled as significant 54 additional ones reported in 2018 but improved during this period	193 innovations of exploitable value (new reported this year). 27% labelled as significant 54 additional ones reported in 2018 but improved during this period	>0 No particular KPI defined	Achieved
New economic viable services of high societal value	1	63	67	79	>0 No particular KPI defined	Achieved
New systems and technologies	32	204	141	196	>0 No particular KPI defined	Achieved
Large scale experiments	19	64	1202		>49	Achieved
Uptake of BDV use cases and experiments	151	224 (48,3% increase)	1251		Annual increase of 30%	Achieved
Amount of data that has been made available to I-Spaces (including in particular closed data)	0,0854 Exabytes	0,10696 Exabytes	0,001709 Exabytes		> 10 ExaBytes	
Increase the speed of data throughput compared to 2014	150-200%	Over 1000%	400-500%		100	Achieved
Enable advanced privacy and security respecting solutions for data access, processing and analysis	3 patents 23 publications 7 OSS/SW/products	2 patents (7 patents planned 2019+) 61 publications 24 OSS/SW/products	10 patents 173 publications 158 OSS/SW/products		>0 No particular KPI defined	Achieved
Support major sectors and major domains by Big Data technologies and applications	10 sectors	15 sectors	17 sectors		>9	Achieved
Availability of metrics for measuring the quality, diversity and value of data assets	7 projects using metrics. 0 new metrics developed by cPPP	15 projects using metrics. 0 new metrics developed by cPPP	14 projects using metrics. Some projects have developed their metrics		>0	Achieved

Table 15: Evolution over time KPIs tangible outcomes cPPP - Innovations, systems, and data

- **Evidence of Innovations result of cooperation in between projects or programme-coordinated activities** such as re-use of projects outcomes (functionality, solutions, or ontologies), data sharing (discussions going on in between projects working in same sector) and specific know-how sharing.
- **Achievements in implementing the BDV cPPP roadmap and the coverage of the SRIA technical priorities implementation** are described in Section 3.1 and Section 2.1 of this report. Results show the cPPP is in track with no major gaps identified according to the plan.
- **Participation of SMEs in the programme has increased and kept over 20% of SME** participation in projects and over 30% in the Association. The evolution over the years of the SMEs involved in this PPP, show growth in revenues and employment in alignment with the macro-economic KPIs of the European Data Market. The effect of the Covid-19 pandemic is somehow visible in the decrease that companies reported in revenues and number of employees in between 2019 and 2020.
- There is an ongoing increase of the awareness on the importance of **skills and new job profiles identification**. Table 16 shows the growing trend in the identification of new job profiles and developing activities for skills development. The cPPP, both the projects and the Association, have done a tremendous effort in **communication and public awareness actions**. The European Big Data Value Forum has been consolidated as major event for the community and the BDV Meetup transformed in the Forum in 2019 and in the Data Week in 2021. With the starting of the Covid-19 global pandemic, the Association in strong collaboration with the BDVe project has done an extraordinary effort in organising ongoing online activities to keep the community together.

Key Performance Indicator (KPI)	Value in 2017	Value in 2018	Value in 2019	Value in 2020	KPI: value at the end of H2020	
Job profiles	0	48	114	74	>0 No particular KPI defined	Achieved
Higher establishment availability of big data value creation skills development	18 training activities involving around 1700 participants in total	85 training activities involving over 9700 participants	4375 training activities involving over 150.000 participants		>49	Achieved
	0 developed interdisciplinary programs	16 during 2018 with around 250 participants	180 interdisciplinary programs arising from the cPPP with around 1685 participants		>9	Achieved
	49 (19 Master and 30 PHD)	396 equivalent FTEs (260 Master and 136 Phd)	786 equivalent FTEs of the mentioned profiles (503 Master and 283 Phd).		N/A	
	100 events	323 events outreaching over 630 000 participants	708 events outreaching over 114.110 people.		N/A	

Table 16: Skills, training, and events

- BDVA, the **Association**, was created at the end of 2014 with 24 founding members, and has grown over the years outreaching a solid based of almost 200 members at present, with a well-balanced composition of large industries, SMEs and research organisations and geographical distribution. Task Forces and Subgroups were already set up back in 2015 and have evolved along the 3 years to adapt to the multi-annual roadmap needs and members focus. Since the launch of the PPP until the end of 2020 the Association organised 41 Activity group meetings/workshops (for task forces and cross-task forces collaborations, inviting very often projects from the cPPP), 10 international open large events, 52 Board meetings, 22 General Assembly meetings, and over 10 Partnership Board meetings, delivered 4 versions of the BDV SRIA, over 15 strategic papers (including whitepapers, multiple position papers), and has built strong collaborations with other PPPs, International and national organisations In addition to the BDV cPPP, BDVA is private member of the EuroHPC JU and has driven together with euRobotics, CLAIRE, ELLIS and EurAI the new partnership on AI, data and robotics for next Framework Programme and set-up Adra. Additionally, during 2021 the Association has started to build collaborations for the development of Data Space more connected to Digital Europe Programme and Market activities.
- The Macro-economic KPIs show evidence of growth in the sector and most of the projects provided qualitative statements and examples that give evidence of contribution of the PPP to those KPIs even if KPIs have not been achieved in all cases. The Covid-19 global pandemic has also had an effect in the trends (trends over the last few years is explained in section 3.2.9).
- **Environmental impact:** over the time the number of projects contributing to Energy saved in big data analytics has increased. There is clear demonstration of the contribution of Big Data Value to the reduction of Energy use and CO2 emissions (with pilots and experiments showing up high % of reductions). Pilots have also shown over the years the contribution to the reduction of waste and the reduction in the use of material resources.

Many projects of the PPP continue active in 2021, 2022, 2023 and even 2024, and it would be necessary to measure input until 2024 to have a full understanding of the overall impact and evolution of the programme. However, as the contractual agreement of the EC and the Association ended at the very end of H2020 (Dec 2020) this is the last official Monitoring Report of the BDV cPPP.

## 4. OUTLOOK AND LESSONS LEARNT

The BDV cPPP finished, as a contractual Partnership, in December 2020 but many of the funded projects of the programme will be active until 2023-2024, therefore the current report only offers a partial view on the overall impact of the programme. The results are at this stage outstanding in value and impact generated. The period 2019-2020 is in one hand a consolidation phase of the PPP and inflection point in between the phase II and III of the BDV cPPP: (*pioneer disruptive new forms of Big Data Value solutions* as phase II and *develop long-term ecosystem enablers to maximise sustainability for economic and societal benefit* as phase III), and on the other hand it is a transition point towards a new framework programme (Horizon Europe) where a brand new partnership is created (AI, Data and Robotics partnership), and many other partnerships launched or continued (new generation of European Partnerships). The European Strategy for AI, the European Data Strategy and in particular its implementation through the Digital Europe Programme offer a continuity path to the results of the BDV cPPP (e.g. towards the development of European Common Data Spaces, AI TEFs, EDIHs, etc).

Despite closing the BDV cPPP, BDVA continues growing and expanding and offers sustainability beyond the PPP to the community, the ecosystem created and the ongoing projects. The main programme CSA ended in December 2020 (BDVe project) but the Association gets strong support from the European Federation of Big Data Innovation Hubs (EUHubs4Data) launched in September 2020, to keep supporting projects and related activities. The Association is moving in 2021 from a bi-lateral collaboration with the European Commission (BDV cPPP) to a multi-lateral collaboration participating in several partnerships and building alliances with other private organisations. During 2019-20 BDVA has been contributing to the production of vision papers and Strategic Agenda for the new AI, Data and Robotics partnership and strongly contributing to setting-up the new partnership and has consolidated its participation in the EuroHPC JU as private member for the framework programme 2021-2027.

Events such as the European Big Data Value Forum, and the Data Week (the evolution of the BDV Summit), will continue being organised annually, as well as many other activities to bring community and projects together (workshops, activity group meetings, joint papers, etc). The European Federation of Big Data Innovation Hubs (EUHubs4Data) is one of the most promising sustainable outcomes of the BDV cPPP.

Some lessons learnt:

- **Collaboration is key:** collaboration in between different type of stakeholders (research, industry, etc), in between initiatives and collaboration in between associations and different communities is key to foster progress and innovation. Projects involved in the partnership have reported benefits in being part of a programme and collaborating with others. The interdisciplinary expertise is particularly important to address data and AI challenges. Collaboration is also crucial for the sustainability of ecosystems: The BDV ecosystem relies for its long term sustainability on the large network of collaborations that BDVA has developed over the years.
- **Standards and Interoperability are becoming more important:** Establishing common standards, common frameworks, glossaries, data models, and interoperable interfaces can facilitate data sharing,

integration, and reuse, and can promote interoperability among big data and AI technologies and applications. Standards are also a tool to facilitate compliance. Industry-driven Research and Innovation communities would benefit from strengthening cooperation with Standardisation and market-oriented communities.

- **Coordinating and Support actions (CSAs) are crucial** for success in supporting ecosystem developing, skills, business aspects, collaborations, and road mapping activities, among others. The main CSA of the BDV PPP (BDVe project) has been crucial for the success of the BDV cPPP). The PPP and the overall ecosystem would have benefited for additional investment in coordination and supporting activities.
- **Trust, data privacy and security continue being relevant topics to address.** Managing and protecting sensitive data, complying with relevant regulations and standards, and implementing robust security measures are essential to gain public trust, ensure data integrity, and mitigate potential risks associated with big data technologies. On top of privacy and security, **AI and Data ethics** are becoming a crucial element for the years to come in the Big Data Value ecosystem.
- **Skills development** continues being a crucial topic.
- **Setting up well functioning communities and ecosystems (such as the BDV cPPP) requires extraordinary efforts and investments.** In public-private settings the sustainability of those ecosystems would benefit from both the public and private support (ongoing investments) and a long lasting Public-private collaboration.
- **Misalignment** in between the official partnership duration and the projects life is an aspect to improve. The BDV cPPP has officially ended at the end of 2020 but many projects are active until the end of 2023 (and potentially 2024).

## 5. ANNEXES TO THIS REPORT:

Annexes included in this public report:

- **Annex 1:** Results on all common and specific KPIs (embedded in this document)

In separate documents (referred throughout this report):

- **Annex 2:** Detailed explanations of KPIs (methodology, response rates, assessment, and detailed input) and questionnaires used to collect data.
- **Annex 3:** Results call for proposals 2019 and 2020
- **Annex 4:** Mobilisation of stakeholders, outreach, and success stories (details)
- **Annex 5:** Association reports 2019 and 2020.

## Annex 1 Part 1: Common Priority Key Performance Indicators

Key Performance Indicator (KPI)		Value in 2019 and 2020	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
I.1	Mobilised Private Investments	<p>Direct leverage (A = A1 + A2) (2019-20): <b>25,07 M€</b>                      Indirect leverage (B = B1 + B2): <b>601,94 M€</b>                      Total leverage (2019-20): <b>627,1 M€</b></p> <p>Accumulated (2020): <b>2.258,2 M€ (2,26 B€)</b>                      Leverage factor: <b>5,93</b></p>	N/A	2 billion € (total accumulated of private investments) Leverage factor: 4	<p>Total private investment mobilised in other R&amp;D activities related to the cPPP since the launch of the cPPP (2015) is <b>2.258,2 M€ (2,26 B€)</b></p> <p>2015: 280.9 M€                      2016: 338.5 M€                      2017: 482,25 M€                      2018: 467,47 M€  <b>2019-20: 627,1 M€</b></p> <p>Total investment from EU to the cPPP: <b>380,8 M€</b></p> <p><b>Leverage factor: 5,93</b></p>
I.2	New skills and/or job profiles	<p><b>114 job profiles</b> were identified or established in 2019, and <b>74 new job profiles</b> have reportedly been created in 2020 (total 188). 1000 new job profiles are estimated to be created by the end of the projects<sup>56</sup> and linked to the project activities</p>	2017: 0 2018: 48 job profiles created or identified by projects	>0	<p><b>35% of the projects which answered the questionnaire and that were running in 2019-2020, reported contribution to the creation of new job profiles.</b> Projects reported <b>114 job profiles</b> were established in 2019, and <b>74 new job profiles</b> have reportedly been created in 2020. Moreover, almost 1000 new job profiles are estimated to be created by the end of the projects<sup>57</sup> and linked to the project activities. Projects directly contributing to new job profiles are BigMedilytics, MORE, DataMarketServices, SYNERGY, Boost 4.0, DataPorts, EUHubs4Data, IoTwins, EDI, TT, Lynx, QROWD.</p> <p>67,5% of the responding projects to the questionnaire reported contribution to the generation of new skills by end of the project</p> <p>Among the BDVA members, 50% of organisations responding the questionnaire have reported contribution to the creation of new Job Profiles (with a total of 391 new job profiles) and 54% contribute to the creation of new skills linked to the Big Data Value.</p> <p>Finally, 45% of the projects in 2019 and 67,5% in 2020 as well as 63% of the BDVA members who replied to the questionnaires have reported contributions to the to the Skills Agenda for Europe.</p> <p>Details to support this KPI are provided on Annex 2 section 3.1.2</p>

<sup>56</sup> The end of each project may differ according to the starting date

<sup>57</sup> The end of each project may differ according to the starting date

Key Performance Indicator (KPI)		Value in 2019 and 2020	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
					70% of the BDV cPPP projects that replied to the survey indicated their project will contribute to job creation by the end of 2023. Job creation in discrete numbers is not possible to calculate precisely at this stage but estimated numbers go over 8.158 new jobs created until 2024 linked to project activities Details to support this KPI are provided on Annex 2 section 3.1.1
I.3	Impact of a cPPP on SMEs	<p><b>For 2019-20:</b></p> <p>Total turnover (reported for cPPP SMEs for 2018): <b>259 M€</b>. Increase of turnover: <b>206,92 %</b> (baseline 2014) Last year increase of turnover (2018-2019): <b>23,62 %</b> <b>Last year increase of turnover (2019-2020): -3,41%</b></p> <p><b>FTE evolution: 300%</b> increase respect to 2014, and <b>8,92%</b> from 2018 to 2019 and a <b>decrease of 10,23%</b> from 2019-2020</p>	<p><b>Year 2017:</b> Total turnover (reported for cPPP SMEs for 2017): <b>175,8 M€</b>. Increase of turnover: <b>69%</b> (baseline 2014) Last year increase of turnover (baseline 2016): <b>10,6 %</b> FTE evolution: <b>52%</b> respect to 2016 (and over 180% since the launch of H2020). <b>For 2018:</b> Total turnover (reported for cPPP SMEs for 2018): <b>260,3 M€</b>. Increase of turnover: <b>60%</b> (baseline 2014) Last year increase of turnover (baseline 2017): <b>17,7 %</b> FTE evolution: <b>74,9%</b> increase respect to 2014, and <b>11,8%</b> respect to 2017.</p>	N/A	<p>Profile participating SMEs: In total 43 SMEs provided input to the Monitoring report 2018 for this KPI (88% non BDVA members and 12% are BDVA members):</p> <ul style="list-style-type: none"> <li>• 19% are medium-size companies (8),</li> <li>• 47% are small companies (20) and,</li> <li>• 35% are micro companies (15).</li> </ul> <p>Average age of the SMEs is 18,2 years, and in particular:</p> <ul style="list-style-type: none"> <li>• 19% of the SMEs (0 to 4 years old)</li> <li>• 21% of the SMEs (5 to 10 years old)</li> <li>• 42% of the SMEs (&gt; 10 years old)</li> </ul> <p>Geographical distribution of the SMEs providing input to this KPI is large covering the following European Countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Portugal, Romania, Slovenia, Spain, Switzerland and UK. The geographical distribution of SMEs Involved In the ecosystem (projects and BDVA members) Is larger Including Estonia, Latvia, Bulgaria, Czech Republic, Cyprus, Romania, The Netherlands, Poland, Norway, Luxembourg and Servia Details to support this KPI and mapping of SMEs are provided in Annex 2 (section 4.1)</p>
I.4	Significant Innovations	<b>328 Innovations of exploitable value are reported as delivered in 2019 and 2020.</b> or delivered earlier but further <b>developed during that period. 89 of them (27%) are labelled as innovations of significant value.</b>	<p>N/A 2017: <b>45</b> innovations of exploitable value (MR2017). 26 a per MR2018<sup>58</sup> 2018: <b>106</b> innovations of exploitable value, <b>39</b> of which</p>	>0	<p><b>328 Innovations of exploitable value</b> are reported as <b>delivered in 2019 and 2020</b> or delivered earlier but further developd during that period</p> <ul style="list-style-type: none"> <li>• 89 significant impact (27%)</li> <li>• 239 of medium impact (73%)</li> </ul> <p>Type of Innovation:</p> <ul style="list-style-type: none"> <li>• 204 incremental innovations (62,2%)</li> <li>• 41 architectural innovations (12,5%)</li> </ul>

58 Note that some of the innovations delivered in 2017 were advanced during 2018. Report 2018 differentiates in between innovations of exploitable value delivered in 2017 and no progress in 2018 (26 reported), delivered in 2017 and progress in 2018 (e.g advancing TRL or functionality), and the ones delivered directly in 2018.

Key Performance Indicator (KPI)	Value in 2019 and 2020	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
	<p>The number of unique innovations delivered in 2019-20 is <b>274</b>:</p> <ul style="list-style-type: none"> <li>• 81 during 2019</li> <li>• 193 during 2020</li> </ul> <p>54 were reported as delivered in 2018 and just Improved during the reporting period</p>	<p>are significant innovations (37%) (significant impact).</p>		<ul style="list-style-type: none"> <li>• 82 disruptive innovations (15%)</li> <li>• 1 radical innovation (0,7%)</li> </ul> <p>282 can generate <b>economic impact</b> (86%) and 99 (30%) <b>societal impact</b></p> <p>Exploitable Innovations include <b>technologies</b> (including platforms) (55%), <b>systems</b> (33%), <b>services</b> (15%), <b>products</b> (14%), <b>methods</b> (8%), <b>systems</b> (8%), 5% is <b>software</b>, components or/and <b>modules</b> (4%), <b>frameworks and architectures</b> (2%) and <b>others</b>, including <b>processes, tools and toolkits, spin-offs, datasets, ontologies, patents and knowledge</b> (9%).</p> <p>Innovations can be exploitable in a single sector or in multiple sectors. <b>23% of the innovations are fully cross-sectorial. 12%</b> provide solutions to the <b>Transport, mobility and logistics sector; 10%</b> relate to <b>health and healthcare; 9%</b> to <b>industry and manufacturing; 4%</b> of the innovations relate to <b>Public services and Smart Cities; 4%</b> to the <b>ICT market; 3%</b> to the <b>energy sector; 3%</b> to <b>commerce; 2%</b> are linked to <b>Marketing activities; 1%</b> to the <b>bio-economy; 5%</b> to <b>others</b> (including media, business services, and retail mainly).</p> <p>In relation to the Maturity levels and TRLs, 168(over 50%) of the listed Innovations delivered or enhanced In 2019-20 did not Indicate any TRL level. For those ones Indicating the TRL level (and using percentages over the total) 2% of the innovations delivered are TRL 3, 10% are TRL, 16% is TRL5 or TRL 6, 15% is TRL 7, 4% is TRL 8 and 1% TRL 9.</p> <p>Further details, full list of innovation in Annex 2.</p>

## Annex 1 Part 2: Specific Key Performance Indicators

KPIs listed in the PPP Contractual Agreement or/and the Multi-annual Roadmap of the PPP and not covered in Part 1.

KPI domain	Key Performance Indicator (KPI)	Value in 2019-20	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
II.1 (CA1)	Market Share of the European suppliers of the global Big Data Market	2019 [M€]: EU: 83,545 US: 184,873 BR: 7,905 JP: 32,929 Total: 309,252  EU-Share: 27,07%	2013 [M€]: EU: 47 801 US: 97 237 BR: 4 703 JP: 23 021 Total: 172 762  2018: EU-Share: 47 801/172 762 = 27.7%	>27.6%	The monitoring of the macro-economic KPIs (KPI II.1, II.2, II.3 and II.5) is based on input from the European Data Market (EDM) study <sup>59</sup> as they are presented in the most recent report <sup>60</sup> by IDC (data March 2020, publication July 2020)  Details and contributions from projects in Annex 2.
II.2 (CA5)	Number of Data Companies	2019: 290,000 Delta (2019-2018) 6 900 Delta (2019-2013): 60 154	2013: 239 846  2018: 283 100 2017: 271 700	>0	Baseline: IDC report "European Data Market – SMART 2013/0063" D6 – First Interim Report  The monitoring of the macro-economic KPIs (KPI II.1, II.2, II.3 and II.5) is based on input from the European Data Market (EDM) study <sup>61</sup> as they are presented in the most recent report <sup>62</sup> by IDC (data March 2020, publication July 2020)  Details and contributions from projects in Annex 2.

<sup>59</sup> SMART 2016/0063 – Study "Update of the European Data Market Monitoring Tool", IDC and Lisbon Council

<sup>60</sup> [The European data market monitoring tool - Publications Office of the EU \(europa.eu\)](#). Final Study Report (Deliverable D2.9), IDC and the Lisbon Council, July 2020

<sup>61</sup> SMART 2016/0063 – Study "Update of the European Data Market Monitoring Tool", IDC and Lisbon Council

<sup>62</sup> [The European data market monitoring tool - Publications Office of the EU \(europa.eu\)](#). Final Study Report (Deliverable D2.9), IDC and the Lisbon Council, July 2020

KPI domain		Key Performance Indicator (KPI)	Value in 2019-20	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
II.3 (CA6)	Revenue generated by European Data Companies	Increased revenue generated by European data companies compared to baseline in terms of: Absolute growth Relative growth.	Revenue: 2018: 80 000 MB  Growth (2019/18): absolute: 2 918 M€ relative: 4% Growth (2019/13): absolute: 32 199 M€ relative: 67%	2013 [M€]: 47 801 M€ 2017: 68 846 M€ 2018: 77 082 M€	>0 >0%	The monitoring of the macro-economic KPIs (KPI II.1, II.2, II.3 and II.5) is based on input from the European Data Market (EDM) study <sup>63</sup> as they are presented in the most recent report <sup>64</sup> by IDC (data March 2020, publication July 2020)  Details and contributions from projects in Annex 2.
II.4 (CA7)	Enable advanced privacy and security respecting solutions for data access, processing and analysis	Number of patents filed by cPPP projects that enable ...  Number of publications by cPPP projects that describe ...  Number of OSS contributions/ products/ SW components resulting from cPPP projects that enable ...  ... advanced privacy and security respecting solutions for data access, processing and analysis	2019-2020: <b>10</b> patents 2021+ (planned): 49 patents  2019-2020: 173 publications 2021+ (planned): 189 publications  2019-2020: 158 2021 (planned): 115	2017: 3 patents 2018: <b>2</b> patents  2017: 23 publications 2018: <b>61</b> publications  2017: 7 2018: <b>24</b>	>0  >0  >0	From the PPP projects, 3 technical projects were fully dedicated to advanced state of the art in privacy-preserving Big Data technologies: SPECIAL, SOI and MHMD and ended on 31/12/2019. However many other projects contribute to these KPIs as expected during 2019 and 2020 from projects belonging to the ICT-13-2018-19 call for proposals, focused on scaling privacy preserving technologies and close to deployment industrial and data platforms.  <b>Details and contributions from projects in Annex 2.</b>

<sup>63</sup> SMART 2016/0063 – Study “Update of the European Data Market Monitoring Tool”, IDC and Lisbon Council

<sup>64</sup> [The European data market monitoring tool - Publications Office of the EU \(europa.eu\)](#). Final Study Report (Deliverable D2.9), IDC and the Lisbon Council, July 2020

KPI domain	Key Performance Indicator (KPI)	Value in 2019-20	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments	
II.5 (CA8)	Employment	Increased Number of European Data Workers	2019: 7 600 000 Delta (2019/18): 374 190 (5%) Delta (2018/13): 1 836 000 (32% growth)	2013: 5 772 000 2017: 6 666 109 2018: 7 225 810	>200 000	From the PPP projects, 3 technical projects were fully dedicated to advance the state of the art in privacy-preserving Big Data technologies: SPECIAL, SODA and MHMD and ended on 31/12/2019. However many other projects contribute to these KPIs as expected during 2019 and 2020 from projects belonging to H2020-ICT-13-2018-19 call for proposals, focused on scaling privacy preserving technologies and close to deployment industrial and data platforms Details and contributions from projects in Annex 2.
II.6 (CA9) (D9)	Contribution to the reduction of energy use	Energy saved in big data analytics using a specified benchmark through solutions provided by specific cPPP projects compared to baseline at beginning of H2020	2019-2020: (N/A) but 5 projects active	1 2017: N/A 2018: (N/A) but 1 project active with objectives to optimise calculations, leading to decreased use of energy.	<0.9	5 projects (DataBench, TT, IoTwins, Everest and Daphne) reported they are monitoring Energy Efficiency in their projects . Details in Annex 2.
II.7 (CA10)	New economic viable services of high societal value	<b>146</b> new economically viable services of high societal value were developed during 2019-2020: <ul style="list-style-type: none"> <li>67 in 2019</li> <li>79 in 2020</li> </ul> 67 forecasted for the period 2021-2024	2017: 1 2018: <b>63</b>	>0	<b>146 new economically viable services of high societal value were developed during 2019-20 as result of the projects.</b> 32,5% (13 projects) contributed to this KPI for 2019 and 37,5% (15 project) for 2020  Additionally, projects have forecasted (2021-2024) additional <b>64</b> new economically viable services of high societal value as result of their projects in the upcoming 4 years (2021-2024). 47,5% of the projects active in 2019-2020 are planning to contribute  Details in Annex 2.	
II.8 (CA11)	Higher establishment availability of big				47,5% (2019) and 50% (2020) of the cPPP projects which replied to the questionnaires have developed training programs arising from the cPPP in 2019-2020 and have reported <b>375 training activities during 2019-2020</b>	

KPI domain	Key Performance Indicator (KPI)	Value in 2019-20	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments	
(D3, D4)	data value creation skills development	<p>Number of training programs established arising from cPPP.</p> <p>Number of European training programs involving 3 different disciplines arising from cPPP</p> <p>Number of Master and PhD students involved in PPP projects</p> <p>Number of dissemination events, seminars, conferences organised in cPPP projects (including number of participants)</p> <p>Number of other actions that contribute to .... (e.g. updated curricula, etc)</p>	<p><b>4375 training activities</b> involving over <b>150.000 participants</b>.</p> <p><b>180 interdisciplinary programs</b> arising from the cPPP with around <b>1685 participants</b>.</p> <p><b>786 equivalent FTEs</b> of the mentioned profiles (503 Master and 283 Phd).</p> <p><b>708 events</b> outreaching over 114.110 people.</p> <p>N/A</p>	<p><b>2017: 18</b> involving around <b>1700 participants</b> <b>2018: 181 training activities</b> involving over <b>18200 participants</b></p> <p><b>2017: 0</b> <b>2018: 16</b> interdisciplinary programs with around <b>250</b> participants</p> <p><b>2017: 49 FTEs</b> (19 Master and 30 PHD) <b>2018: 396 FTEs</b> (260 Master and 136 Phd)</p> <p><b>2017: 100 events</b> <b>2018: 323 events</b> outreaching over 630.000 people</p>	<p>&gt;49</p> <p>&gt;9</p> <p>N/A</p> <p>N/A</p>	<p>involving <b>6.421 participants</b>. <b>BDVA members</b> have reported additional <b>4000 training activities</b> with over <b>139.000 participants</b> involved during the years 2019 and 2020 (out of the context of the cPPP projects but linked to the BDV SRIA topics).</p> <p>7 projects which answered the questionnaire (17,5%) have contributed to this KPI and in total <b>62 developed interdisciplinary programs arising from the cPPP during 2019-2020</b> (27 for 2019 and 35 for 2020), with around <b>1800 participants</b>. <b>4 BDVA members</b> have reported <b>118 training programmes with a total participation of 685 attendees</b></p> <p>During 2019-2020 52,5% for 2019 and 67,5% for 2020 of the 40 <b>projects</b> that replied the questionnaire reported involvement of <b>Master students</b> and 55% for 2019 and 70% for 2020 the involvement of <b>PhD students</b> involved in project development. Overall, <b>786 equivalent FTEs</b> of the mentioned profiles (503 Master and 283 Phd).</p> <p>To mobilise stakeholders the projects have developed intensive communication and dissemination campaigns, with a result of <b>708 events in total organised by the responding projects during 2019 and 2020</b> (including own events, seminars, conferences, etc.) outreaching 114.112 participants with the objective of raising awareness about their different activities, to engage new stakeholders, and to keep expectations about future upcoming results.</p> <p>In relation to the number of people outreached and engaged in dissemination activities developed by the projects during 2019-20, projects have reported <b>10,6 Million people</b> outreached (over 114.000 have been outreached through events, conferences, etc; over 40.000 have been engaged in online activities such as webinars, online training, etc; over 5,2 Million people have been outreached via mass media, online or physical format; and over 113.000 people have been outreached via other ways of communication and dissemination).</p>

KPI domain	Key Performance Indicator (KPI)	Value in 2019-20	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
II.9 (CA12)	Ensure efficiency, transparency and openness of the cPPP's consultation process	Number of overall contributors in the SRIA consultation process  Number of events to collect feedback from the community	N/A	2017: 1592 Total: 4227 2018 : 2085 Total: 6422  2017: 7 Total: 23 2018: 12 Total: 35	
II.10 (CA13)	Ensure that technology progress is in line with multi-annual roadmap of SRIA	% of research priorities covered compared to overall scope of research priorities defined in SRIA (differentiate running, upcoming and not covered yet)	Delivered in 2019: 100%: Delivered In 2020: 100% Ongoing 2021 and planned for 2021+:: 100%	Delivered in 2017: 67% Delivered in 2018: 100% (which is as reported as planned in MR2017) Ongoing: 100% Planned for 2018+: 100%	The major focus of technical contributions lies in the <b>"Data Analytics"</b> priority, followed by "Data Management". and "Data Processing Architectures". All priorities and topics are covered substantially and with a large number of contributions."Data Protection" shows a clear Increase during the years 2019 and 2020 due mainly to the contribution of the ICT-13 projects or Data Platforms. <b>"Data Management"</b> has also been Influenced by the ICT-13 with an solid Increase In contributions during 2019 and 2020. <b>"Data Processing Architectures"</b> doubles Its number of expected contributions In 2021+ thanks to the contribution of the recently started projects part of the ICT-51 topic. "Data Analytics", the priority with the highest number of contributions, keeps quite a steady line along the years, also showing Increase for the 2021+ contributions. For the <b>"Data Visualisation and user Interaction"</b> 2019 is the year where more contributions have been received.  Details reported in Annex 2
II.11 (D1)	Large Scale experiments conducted in cPPP projects and I-Spaces involving closed data	Number of large-scale experiments conducted in cPPP projects and BDV I-Spaces involving closed data	<b>1202</b> (1078 from projects and 24 from i-Spaces)	0 2017: 19 2018: 92 (64 from projects and 28 from BDVA i-Spaces)	>49  Projects reported <b>1078 large scale experiments</b> (aggregated number of experiments conducted by all projects in 2019-2020), of which the majority involve closed (private) data (with the project Exa-mode reporting more than 1000 experiments).  BDVA i-Spaces reported 24 large scale experiments, 14 of them involving closed data  Projects also provided criteria to for experiments to qualify as "large-scale" with following criteria being mentioned: <ul style="list-style-type: none"><li>Large number of users involved with high TRLs</li></ul>

KPI domain		Key Performance Indicator (KPI)	Value in 2019-20	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
						<ul style="list-style-type: none"> <li>• Large geographical coverage</li> <li>• Large number of involved actors and users</li> <li>• High data value flowing cross-border</li> <li>• A combination of data volume, data complexity and velocity.</li> <li>• Complex datasets integrating data in some case from different countries</li> <li>• Number of data sources</li> <li>• Significant impact for society and/ or business</li> </ul> <p>Details in Annex 2.</p>
II.12 (D2)	Uptake of BDV use cases and experiments	Year over Year increase of the number of Big Data Value use cases supported in I-Spaces and cPPP projects	<b>1251</b> experiments (increase of 558% with respect of 2018)	2017 from projects: 151 (baseline for the PPP to assess evolution)  2018 from projects: <b>224</b> <b>48,3% increase</b> with respect to 2017 (baseline) 2018 from BDVA I-Spaces: <b>165</b>	30% (p.a.)	Projects reported <b>1251 use cases or/and experiments</b> conducted during 2019-2020 with a contribution from 40 different projects (many experiments performed along the 2 years BDVA i-Spaces have reported additional <b>194 experiments</b> with 3 i-Spaces contributing to this KPI. In total the cPPP has developed <b>1445 experiments</b> .  Details in Annex 2.
II.13 (D3)	Support major sectors and major domains by Big Data technologies and applications	Number of sectors and major domains supported by Big Data technology and applications developed in cPPP projects	2019-2020: Lighthouse projects: 6 sectors Total: > 17	2017: Lighthouse projects: (2 active and 2 selected) and 10 sectors and major domains  2018: Lighthouse projects: 4 Total: >15	>9	The BDV cPPP lighthouse projects active in 2019-2020 focused on the Bio economy (Agriculture, Fisheries, and Forestry) ( <b>DataBio project</b> ), Transport, mobility and logistics ( <b>Transforming Transport project</b> ), Health and Healthcare ( <b>BigMedilytics project</b> ) and Manufacturing ( <b>BOOST4.0</b> ). In addition to these main 4 sectors, other large-scale projects were launched as part of the calls 2019, covering Finance (Infinitech) and energy (Platoon, BD4Opem, Synergy) with a total of <b>6 major sectors supported</b> by Lighthouse projects and therefore widely supported with multiple use cases, scenarios and solutions.

Sector/application domain	Projects addressing this sector/application domain (% over active projects in 2019-2020)	Innovations to market (delivered in 2019-20, % over the total)
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KPI domain	Key Performance Indicator (KPI)	Value in 2019-20	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments																																																						
					<table border="1"> <tr><td>Cross-sectorial</td><td>10%</td><td>23%</td></tr> <tr><td>Public services</td><td>25%</td><td>4%</td></tr> <tr><td>Smart Cities</td><td>32,5%</td><td>4%</td></tr> <tr><td>Transport and logistics</td><td>47,5%</td><td>12%</td></tr> <tr><td>Mobility</td><td>40%</td><td>12%</td></tr> <tr><td>Retail</td><td>30%</td><td>-</td></tr> <tr><td>Business Services</td><td>35%</td><td>-</td></tr> <tr><td>Environment</td><td>27,5%</td><td>-</td></tr> <tr><td>Health and healthcare</td><td>47,5%</td><td>10%</td></tr> <tr><td>Manufacturing</td><td>35%</td><td>9%</td></tr> <tr><td>Media</td><td>30%</td><td>2%</td></tr> <tr><td>Finance</td><td>42,5%</td><td>27%</td></tr> <tr><td>Telecommunication</td><td>20%</td><td>-</td></tr> <tr><td>Energy</td><td>37,5%</td><td>3%</td></tr> <tr><td>Bio-Economy</td><td>15%</td><td>1%</td></tr> <tr><td>Water and natural resources</td><td>17,5%</td><td></td></tr> <tr><td>Earth Observation</td><td>27,5%</td><td></td></tr> <tr><td>Others</td><td>20%</td><td></td></tr> </table> <p>Others (20% of the projects; this includes sectors such as insurance, public safety, personal security, public tenders, e-commerce, marketing, fashion industry, citizen engagement, ICT/Cloud services, social networks, procurement, legal domain, etc)</p> <p>It is important to highlight <b>that 10% of the projects are fully cross-sectorial</b> (their outcomes can be used in any sector or application domain) and <b>77,5% of the projects are working in more than 1 sector or application domain</b>.</p> <p>Details in Annex 2.</p>	Cross-sectorial	10%	23%	Public services	25%	4%	Smart Cities	32,5%	4%	Transport and logistics	47,5%	12%	Mobility	40%	12%	Retail	30%	-	Business Services	35%	-	Environment	27,5%	-	Health and healthcare	47,5%	10%	Manufacturing	35%	9%	Media	30%	2%	Finance	42,5%	27%	Telecommunication	20%	-	Energy	37,5%	3%	Bio-Economy	15%	1%	Water and natural resources	17,5%		Earth Observation	27,5%		Others	20%	
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Business Services	35%	-																																																									
Environment	27,5%	-																																																									
Health and healthcare	47,5%	10%																																																									
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Earth Observation	27,5%																																																										
Others	20%																																																										

KPI domain		Key Performance Indicator (KPI)	Value in 2019-20	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
II.14 (D6)	Amount of data that has been made available to I-Spaces (including in particular closed data)	Number of Exabytes of data made available in cPPP projects and I-Spaces (including closed data) (access to data for experimentation) This include data made available for experimentation (e.g. Data incubators and I-Spaces) and data made available internally in the projects for experimentation purposes (e.g. Lighthouses and other projects)	<b>0,001709 Exabytes</b> (1,709 Petabytes).	0 2017: 0,0854 Exabytes (85,4 Petabytes)  2018: 0,10696 Exabytes (106,96 Petabytes)	>10	20 projects provided data for this KPI reporting a total of <b>0,001669 Exabytes (1,669 Petabytes)</b> for 2019-2020.  3 i-Spaces contributed to this KPI reporting additional <b>0.04 Petabytes</b> of data for experimentation
15 (D7)	Availability of metrics for measuring the quality, diversity and value of data assets	Number of metrics developed by cPPP that allow for assessing quality, diversity and value of data assets	2019-2020: 14 projects using metrics. Some projects have developed their metrics	2017: 7 projects using metrics. 0 new metrics developed by cPPP 2018: 15 projects using metrics. 0 new metrics developed by cPPP	>0	42,5% of the projects that participated to the questionnaire confirmed they assessed quality, diversity and value of data assets
16 (D8)	Increase the speed of data throughput compared to 2014	Data throughput of specified benchmarks increases by contributions of cPPP projects and other technology advancements by a factor of 100 compared to 2014.	2019-2020: 400-500% in some projects ( Safe-Deed, Cloudbutton, and Lynx)	Baseline: 1 2017: 150-200% reported in 1 project. +30% projects expect to improve data throughput  2018: over <b>1000%</b> reported in 2 projects (BigDataOcean and FashionBrain).	100	47,5% of the projects answering the questionnaire, reported they expect project to improve data throughput. In particular Safe-Deed, Cloudbutton, INFORE, Kraken, SmartDataLakes and Infinitech reported expected outcomes in this area.  Some projects such Safe-Deed, Cloudbutton, and Lynx has measured improvements of 400-500%. Other such as INFORE has measured improvements over 1000%. Kraken experienced an annual increase in the number of data platform users of 20%, number of user/buyer organisations using industrial data platforms of 30%, users

KPI domain	Key Performance Indicator (KPI)	Value in 2019-20	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
			40% projects expect to improve data throughput		subjects) in the personal data platforms of 50% and finally an increase in of business (turnover) channelled through the platforms of 20%.  Details in Annex 2
II.17 (CA 4)	New systems and technologies	Number of systems and technologies developed in the relevant sector in cPPP projects (beyond state of the art)  <b>337</b> (141 in 2019 and 196 in 2020)	2017: 32 2018: <b>204</b>	>0	Projects have reported <b>337 new systems and technologies</b> developed during 2019-2020 (141 in 2019 and 196 in 2020). Many of them are reported already as part of the KPI "Significant innovations to Market". Others are additional technological components (not directly related to an exploitable value in the market).  Details in Annex 2. Details about application areas in I.4 and II.13
II.18 (CA3)	Participation and benefits for SMEs	Number of SMEs participating in cPPP projects  Share of participation of SMEs in cPPP projects  Estimation of the increase in turnover in SMEs participating in the cPPP projects (Reported in I.3)	Calls 2019-20: 610 SMEs (25,8% organisations,)  Projects 2019-20: 88 SMEs (22,9% organisations, 18,95% budget)  Total turnover (reported for cPPP SMEs for 2018): <b>259 M€</b> . Increase of turnover: <b>206,92 %</b> (baseline 2014)	Call 2018: 22 SMEs (25,3% organisations, 23,5% budget)  Projects 2018: 131 SMEs (69% of all total enterprises)  %Organisations 2018: 25,3% %Budget 2018: 23,5%  Increase of turnover: 60% (baseline 2014)	20%  Details provided in Annex 3 and comments provided to KPI I.3 (and Annex 2)

KPI domain	Key Performance Indicator (KPI)	Value in 2019-20	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
		<p>Last year increase of turnover (2018-2019): <b>23,62 %</b>  <b>Last year increase of turnover (2019-2020): -3,41%</b></p> <p><b>FTE evolution: 300%</b> increase respect to 2014, and <b>8,92%</b> from 2018 to 2019 and a <b>decrease of 10,23%</b> from 2019-2020</p>	<p>Last year increase of turnover (with respect to 2017): 17,7 %</p> <p>%annual increase: 11,8%            %increase on baseline: 74,9%</p>		
II.19	Contribution to the reduction of energy use and CO2 emissions	<p>Contribution of the cPPP projects to the reduction of energy use in the area of the cPPP</p> <p>Contribution of the cPPP projects to the reduction of CO2 emission in the area of the cPPP</p>	<p>2019-20: 17,5% of the projects contributing. Ranges depend on pilot up to 80%</p> <p>Savings up to 37% in CO2 and other emission reductions.</p>	<p>2017: Early results show 12-40% energy efficiency in some pilots</p> <p>2018: range between <b>25% and 51%</b> in transport sector</p> <p>2017: 3 projects contributing. Early results show 20% reduction in some pilots</p>	<p>27,5% of the projects replying to the questionnaire have reported contribution to the reduction of CO2 and in particular BigMedilytics, Daphne, Everest, More, BD4OPEM, Synergy, Boost 4.0, TT, Lynx, QROWD, DataBench.</p> <p>It is important to highlight that mostly all the projects contributing to this KPI are linked to the transport and mobility sector or the energy sector (maritime, aviation, terrestrial transport and mobility in general). Even projects focused on other sectors such as healthcare reductions of CO2 relate to the reduction of needs or mobility.</p> <p>Only one project, TT, provides evidence in measurements in CO2 reductions reporting Improvements concerning CO2 and other emissions such as NOX and PM, savings reach up to 37%.</p> <p>Details can be found in Annex 2.</p>
II.20	Contribution to the reduction of waste	Contribution of the cPPP projects to the reduction of waste in the area of the cPPP	2019-20: Up to 32% reduction	<p>2017: 2 projects. Up to 10% reduction*</p> <p>2018: 3 projects.</p>	<p>10% of the projects that replied to the questionnaire have reported contributions to the reduction of waste (DataBench, TT, Boost4.0, BigMedilytics).</p> <p>Details can be found in Annex 2.</p>

KPI domain	Key Performance Indicator (KPI)	Value in 2019-20	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
			Up to <b>10%</b> reduction in DataBio and potential <b>25%</b> reduction in TT		
II.21	Contribution to the reduction in the use of material resources	Contribution of the cPPP projects to the reduction of material resources in the area of the cPPP	2019-20: no quantitative data provided. 15% projects contributed	2017: 2 projects contributing  2018: Asset Management pilot in BigMedilytics project aims to reduce the no. of unused mobile assets in hospitals by up to 20%	15% of the projects running in 2019-2020 and that have participated to the questionnaire have reported contribution to the reduction in the use of material resources. 3 running lighthouses projects (TT, BOOST4.0 and BigMedilytics) contribute to this KPI in addition to DataBench, IoTwins, DataPorts, Daphne. No quantitative data were provided by the responders Further details in Annex 2



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