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# Unlocking the Value of IoT Through Big Data

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# Executive Summary

The Internet of Things (IoT) is rapidly expanding worldwide, and will continue to grow in the years to come. There is as yet untapped potential for the generation of new services to be enabled via the rich sets of data available in the ecosystem and the more IoT solutions scale, the greater the incentive will be to leverage this data. This paper looks at how to unleash this potential and consequently unlock new monetisation opportunities for mobile operators and their ecosystem partners.

In the first wave of IoT, solutions are primarily being developed in specific vertical markets, for example, connected cars, mobile health or utilities smart metering solutions. Once data is collected by a device or sensor, data analytics may be applied to aid decision-making or otherwise help improve services, for example, when managing medication in connected health solutions or employing demand-based pricing in utilities. At present, IoT data is not commonly shared beyond the bounds of the vertical service provider, resulting in data residing in silos.

As businesses and technology evolve, these data silos are being increasingly viewed as data assets and companies are seeking ways to monetise these assets. Simultaneously, many organisations, from start-ups to established firms, are looking to develop the next generation of IoT solutions, which “mash up” and analyse data from multiple systems, organisations and verticals (so called, IoT Big Data). Both sets of companies face a number of commercial and technical barriers, including data accessibility and interoperability, privacy and security, innovation, skills and resource challenges.

To help remove these barriers, the GSMA and its mobile operator partners have a vision to collaboratively establish an IoT Big Data Ecosystem (IoT BDE). The intent of the IoT BDE is to enable the monetisation of data assets and to facilitate the development of the next generation of IoT solutions by enabling the participants to cost effectively create new data centric IoT solutions, products and services. The GSMA envisages the IoT BDE concept to be applicable across all vertical markets, enabling value creation for multiple industries, participating organisations and end customers alike.

Drawing on research the GSMA commissioned with Analysys Mason, it has been shown that – using deliberately conservative assumptions – the economic benefit of the IoT BDE to the global economy could be in the order of \$44 billion per annum by 2025. The IoT BDE concept outlined in this paper and the possible benefits have been validated by interviews with potential ecosystem stakeholders from different industry verticals. Based on that research and the insights gained, the GSMA has reached the following conclusions:

- **An IoT BDE has the potential to unlock the value of new and existing data silos.**
- **An IoT BDE will significantly help in the creation of the next generation of IoT businesses, products and services utilising data from multiple sources.**
- **Mobile operators have an opportunity to become key players in an IoT BDE.**

To accelerate the development of an IoT BDE, the GSMA and its members need broad engagement from a wide range of stakeholders, including companies seeking to share or monetise their data assets, vertical market specialists, technology companies, solution developers and the public sector. The GSMA invites stakeholders who wish to influence and participate in the evolution of this visionary IoT BDE to contact us through [connectedliving@gsma.com](mailto:connectedliving@gsma.com).



# 1 Big Data – A Key Enabler to Realising the Full Potential of IoT

## 1.1 Barriers to Data Sharing Are Constraining IoT's Full Potential

McKinsey estimates that in 2025, IoT could contribute up to \$11.1 trillion per annum to the global economy<sup>1</sup>. The value is delivered in two generic ways, by transforming and optimising existing business processes or by enabling the creation of new businesses, products or services. McKinsey also asserts that interoperable solutions are required to unlock around 40% of that potential value (\$4.4 trillion per annum).

Interoperability is a broad concept, covering areas such as network interoperability and communications of systems operating on different short-range and long-range networks; device-level communications enabling devices of differing models, makes and industries to communicate; and data interoperability where data generated by IoT systems is standardised and harmonised so as to allow sharing and use across multiple organisations and services.

When focusing on data interoperability, we see that organisations currently face a number of barriers. The barriers fall into two broad categories:

- **Business barriers that restrict innovation and lengthen time to market. Examples include:**
  - **Sourcing what is often proprietary data, owned and controlled by the originating company.**
  - **Establishing trust and commercial agreements between the parties.**
  - **Establishing legal and regulatory compliance (intellectual property, security, privacy, confidentiality).**
- **Technical barriers that increase complexity, reduce portability, reduce market potential and also lengthen time to market. Examples include:**
  - **Lack of standard data formats, resulting in the same type of data from different sources being presented in different data formats. This generally results in bespoke integration and data transformation reducing application reuse across multiple similar data sources.**
  - **Lack of developer friendly Application Programming Interfaces (APIs), resulting in extended product development timescales.**

As a result of these barriers, according to Cap Gemini, at present fewer than 15% of IoT applications are built on more than one source of data<sup>2</sup>.

<sup>1</sup> Source: [http://www.mckinsey.com/insights/business\\_technology/the\\_internet\\_of\\_things\\_the\\_value\\_of\\_digitizing\\_the\\_physical\\_world](http://www.mckinsey.com/insights/business_technology/the_internet_of_things_the_value_of_digitizing_the_physical_world)

<sup>2</sup> Source: <https://www.capgemini.com/beyond-the-buzz/monetizing-internet-of-things>

## 1.2 Vision for an IoT Big Data Ecosystem

To help unlock the full value of IoT data and to remove these barriers, the GSMA and its mobile operator partners have a vision to collaboratively establish an IoT Big Data Ecosystem (IoT BDE). The aim is to enable organisations to capitalise on the business opportunities inherent in the availability of massive amounts of data and to facilitate the development of the next generation of IoT solutions. This would be achieved by the creation of virtual marketplaces where harmonised context data, from both IoT and

other sources, is made available to those who wish to utilise it. These marketplaces would enable those organisations with valuable data stores to monetise their assets, whilst organisations seeking to develop data centric IoT services could easily locate and access a range of data sources.

To illustrate how data from multiple sources could be combined and utilised to the benefit of all parties, consider the following examples:



### SMART CITIES

Data from various sources could be used to improve traffic flow and optimise public transport in real time. For example, sensor data from public and private vehicles, traffic lights and road sensors may be combined with information on weather and large events or festivals, in order to optimise traffic flow and transport for event patrons.



### AUTOMOTIVE

Data sources such as car sensor data from a private vehicle, weather information from a government source, and driver information could be mashed up to enable services such as usage-based insurance, underwriting, pre-emptive maintenance, prediction of spare part requirements and pre-sales analytics. Services based on these data sources could be offered to many parties including drivers, automotive manufacturers and after-sales services providers such as insurance companies and mechanics.



### AGRICULTURE

Data from various sources such as soil conditions, climate, crop conditions, farm equipment, irrigation sensors, air pollution, cattle conditions, grain silos and more could be analysed to produce solutions that improve efficiency and increase yield, e.g. calculating the optimal level of fertilisers, stocking of feed, servicing of equipment, etc.

The concept of data harmonisation is central to the expected benefits of an IoT BDE. Data harmonisation allows a developer to create an application once and then deploy multiple instances without having to re-develop the application for each data source. This is because the data inputs to the application would be consistent (i.e. harmonised) for the same data types, removing the need for bespoke development on the data inputs

and resulting in the re-usability of applications across data sources. Referring to an example above, if a traffic management application was developed for the city of London, and data sources in Paris exposed all the input data in the same format, then the application could easily be deployed in Paris without incurring re-development costs.

### 1.3 Roles and Revenue Opportunities in an IoT BDE

To establish an IoT BDE, the GSMA envisions a simple value chain supported by key stakeholder roles as illustrated in Figure 1:

FIGURE 1: VALUE CHAIN IN AN IOT BDE

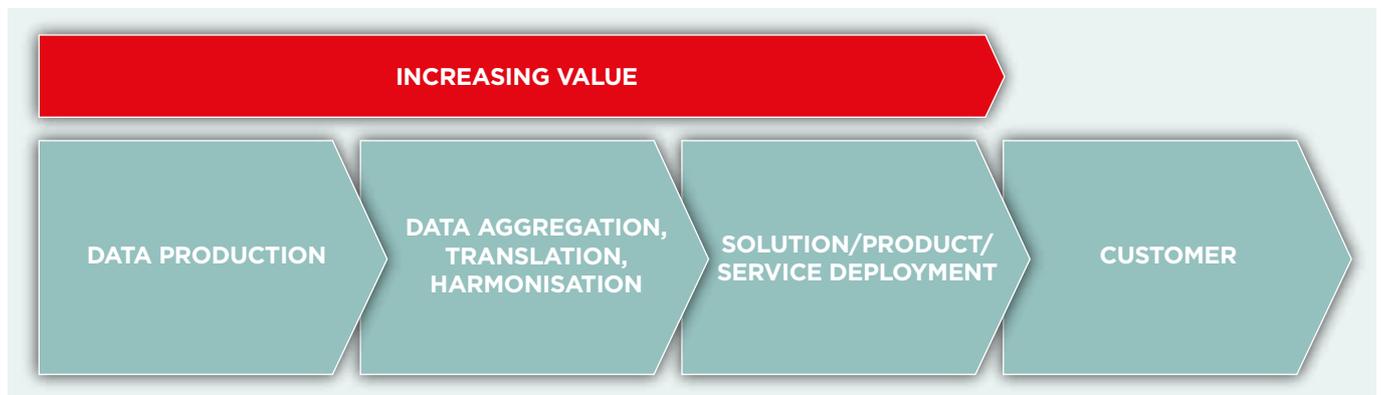


Table 1 provides detailed information about the key stakeholders, their role and the expected benefit of an IoT BDE to them.

TABLE 1: KEY STAKEHOLDER ROLES AND EXPECTED BENEFITS<sup>3</sup>

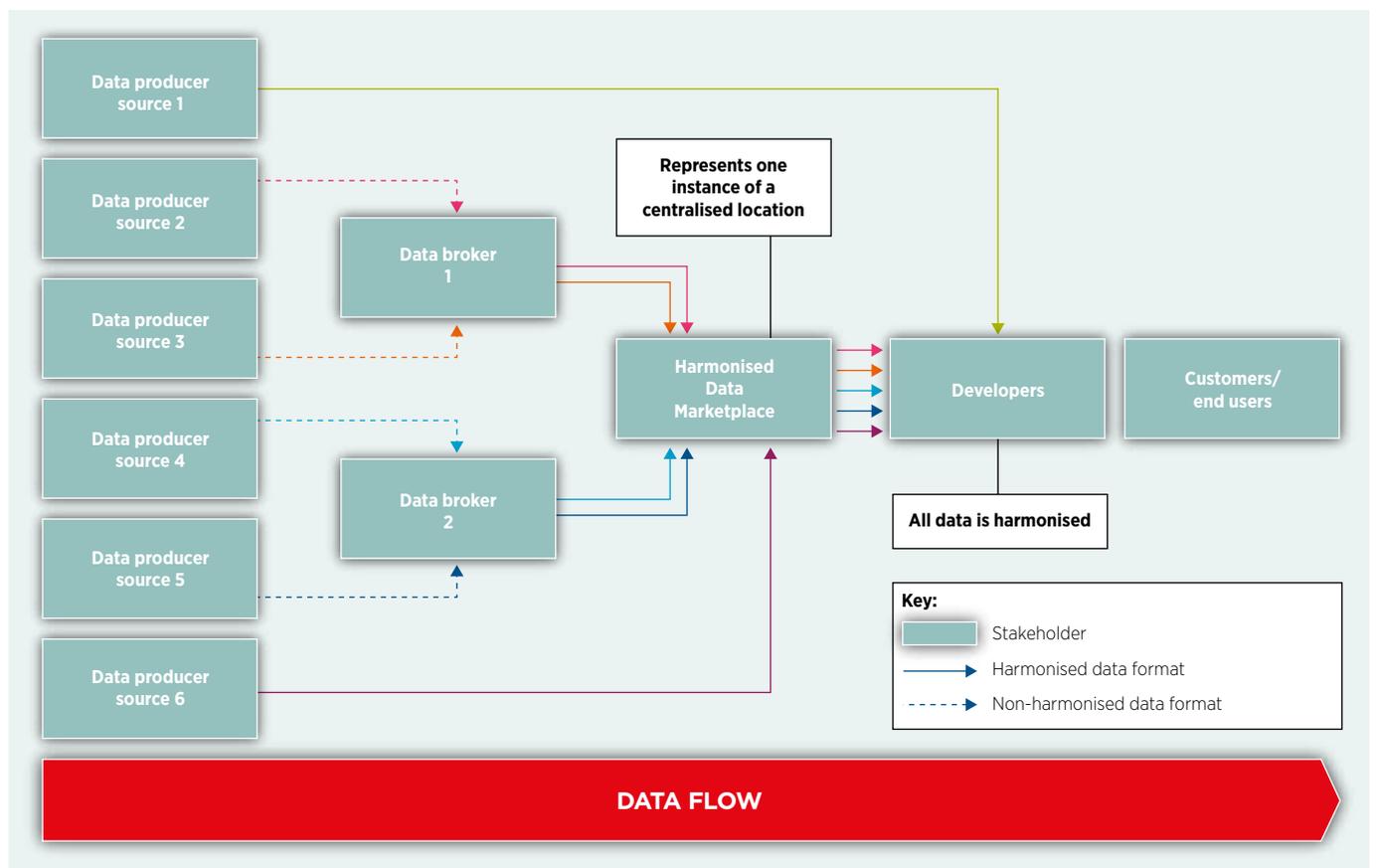
STAKEHOLDER	ROLE IN AN IoT BDE	REVENUE/BENEFIT FROM USING AN IoT BDE
<b>Customer/end user</b>	Purchases services / applications that utilise data from multiple sources	Benefits from compelling and valuable new products and services that may not otherwise exist
<b>Developer</b>	Uses APIs to access multiple data sources Buys or accesses data from the harmonised data marketplace providers, from data brokers or direct from data producers Creates a new data-centric business, product, or service	Revenue from providing innovative new IoT service to customer / end user Benefits from less effort and reduced time to market
<b>Harmonised data marketplace provider</b>	Provides developer access to a library of harmonised data APIs Provides a channel through which a data broker or data producer can make their data APIs available May provide mechanisms that allow for commercialisation e.g. registration and billing capability May provide legal, commercial, security and/or privacy frameworks for ecosystem participants	Potential revenue from developers by providing access to harmonised data e.g. revenue sharing and/or fees from developers accessing data Potential revenue from data brokers by providing mechanisms that allow commercialisation (e.g. registration and billing capability)
<b>Data broker</b>	Harmonises data Aggregates harmonised data Makes data available, harmonised or not, through a data API	Revenue from data producers by cleansing / aggregating / harmonising data ready for sale to developers
<b>Data producer</b>	Produces data Makes data available (free of charge, for a fee, for another benefit)	Revenue by selling data to be utilised for new innovative IoT services Potential benefit from gaining insight from data analysis

<sup>3</sup> Source: Analysys Mason, 2015

To illustrate how these roles translate into stakeholder interactions at the transactional level and how data travels between stakeholders within an IoT BDE, an example data flow is shown in Figure 2. In this example, the data produced by sources 1 and 6 is already in a harmonised format, and so can

be sold directly to a marketplace or to a developer. However, some sources (such as sources 2 to 5) will deliver data to a data broker in a non-harmonised format; the broker will harmonise the data and make it available to the marketplace or directly to developers.

FIGURE 2: DATA FLOW BETWEEN STAKEHOLDERS WITHIN AN IOT BDE



## 1.4 Operators Can Play a Key Role in an IoT BDE

The GSMA believes that the capabilities of mobile operators enable them to participate in a number of roles in an IoT BDE. These capabilities include:

- **IoT device and solution management**
- **Billing and charging mechanisms**
- **Network management**
- **Data management**
- **Data analytics and reporting**
- **Application development and management**
- **Security management**
- **Identity management**

In addition to their many capabilities, mobile operators also own and have access to a range of resources that an IoT Big Data ecosystem could leverage. On the one hand, these resources are a result of operators' experience in running efficiently functioning networks and serving businesses and consumers across numerous markets around the globe. On the other hand, operators' recent acquisitions and investments in the IoT space<sup>4</sup> have opened up access to new segments of customers, industry-specific expertise and additional capabilities for them.

Given their well-established and strong infrastructure to collect, store and process data, their geographically widespread networks across markets worldwide, and decades-long experience in serving consumers, enterprises and a range of other uses; mobile operators are able to take on a range of different roles in an IoT BDE. Table 2 summarises how they could harness their capabilities and resources to play multiple roles in an IoT BDE.

In the GSMA's view, mobile operators are particularly well placed to fulfil the role of a fully-fledged harmonised data marketplace provider. Operators have access to a range of technical, commercial and financial resources; they already have the IT infrastructure in place to create an ecosystem platform; and they also have the necessary commercial and legal frameworks. In addition, they have existing commercial relationships with many businesses that could fulfil other key participant roles such as data provider and product developers.

TABLE 2: MOBILE OPERATORS' ROLE IN AN IOT BDE<sup>5</sup>

POTENTIAL ROLE	COMMENTS
<b>Customer/end user</b>	Operators are likely to be customers for certain IoT services that they can resell or deliver as a bundle to a target segment within their customer base.
<b>Developer</b>	An operator may develop new IoT businesses, products and services based on data accessed through an IoT BDE.
<b>Harmonised data marketplace provider</b>	An operator may take on the role of managing a harmonised data marketplace, for example, as an offering to their developer programmes.
<b>Data broker</b>	An operator may anonymise, aggregate and harmonise data from enterprise customers with whom it has a commercial relationship. An operator may also anonymise, aggregate and harmonise data from internal sources or other public data sources.
<b>Data producer</b>	An operator may make available data from its IoT solutions and sensors, mobile / software applications and network infrastructure.

<sup>4</sup> Source: <http://www.analysismason.com/About-Us/News/Insight/operator-iot-investments-Jul2015/>

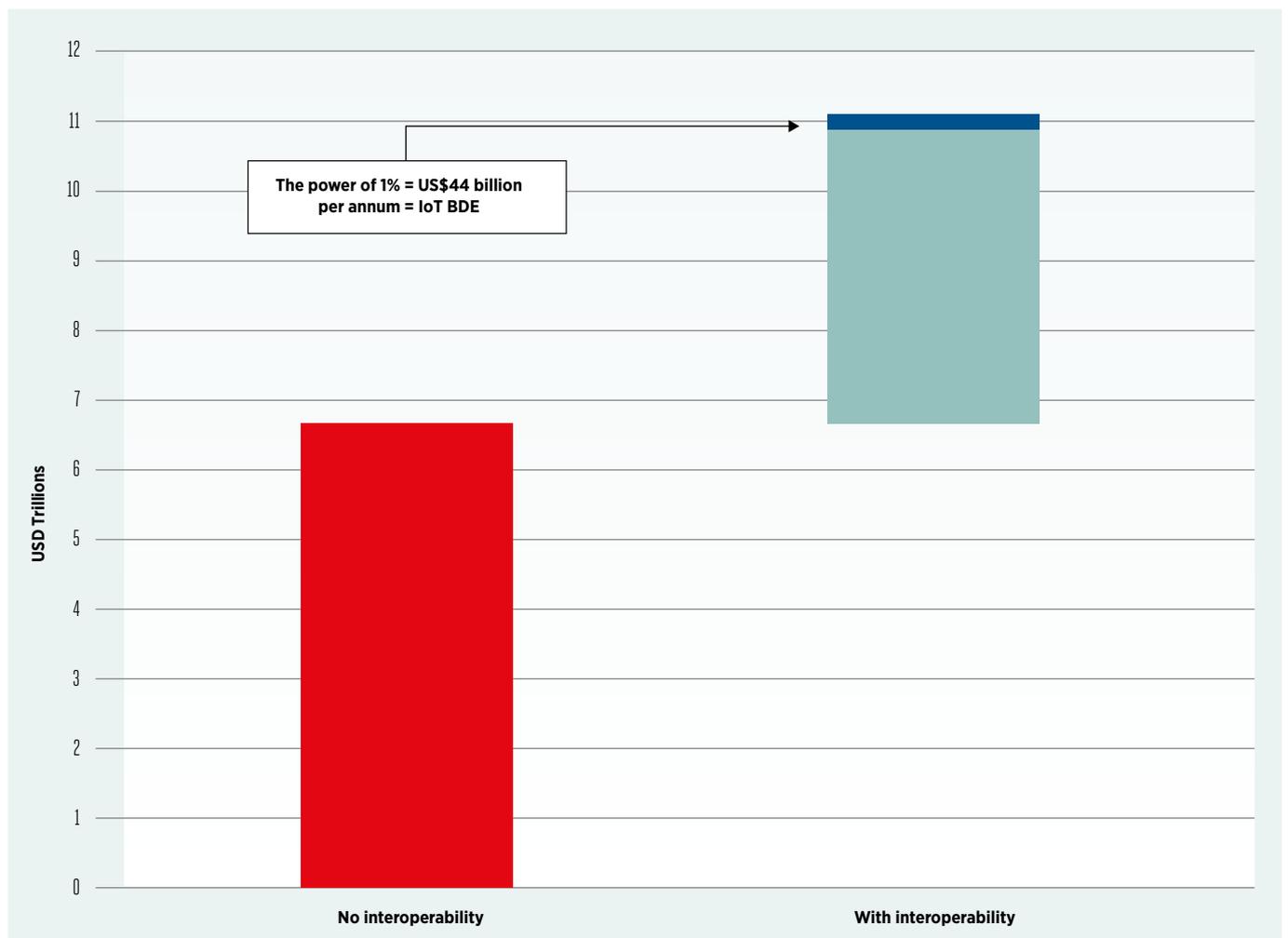
<sup>5</sup> Source: Analysys Mason, 2015

### 1.5 Potential Economic Impact of an IoT BDE

Precisely quantifying the value of the IoT BDE effect is difficult. We have adopted a “power of one percent” approach, assuming that the establishment of an IoT BDE results in achieving a deliberately conservative 1% of the \$4.4 trillion economic benefit from IoT interoperability forecast by McKinsey<sup>6</sup>. This results in

a \$44 billion per annum socioeconomic benefit, as shown in Figure 3, and consequently makes a robust business case for the establishment of an IoT BDE. The GSMA believes that the IoT BDE is a fundamental enabler for the Internet of Things and has value across all market verticals.

FIGURE 3: IOT BDE IMPACT ON THE ECONOMY IN 2025<sup>7</sup>



6 Source: [http://www.mckinsey.com/insights/business\\_technology/the\\_internet\\_of\\_things\\_the\\_value\\_of\\_digitizing\\_the\\_physical\\_world](http://www.mckinsey.com/insights/business_technology/the_internet_of_things_the_value_of_digitizing_the_physical_world)

7 Source: Analysys Mason, 2015

## 1.6 Key Success Factors

The ultimate measure of success of the IoT BDE vision is the establishment of a thriving ecosystem in which all participants are appropriately rewarded. There are number of critical factors that will determine the success of an IoT Big Data Ecosystem:

- **Ecosystem participants across multiple industries need to collaborate to enable the development of new data-centric IoT solutions, products and services.**

A multi-stakeholder collaborative approach will ensure the diversity of data available for use by developers, will drive a data-centric rather than a vertical approach to building solutions and will lead to the creation of common specifications and mutually beneficial commercial frameworks.

- **Participants need to agree common standards for data formats and access technologies, to ensure consistent and easy access to data.**

Common specifications will not only ensure quality of data, but will also lead to the “develop once” scenario, whereby applications only have to be designed and programmed once and then can be ported across multiple instances and geographies. This requirement is crucial to ensuring that global demand for services is met while reducing production time.

- **Participants need to ensure legal and regulatory compliance while pro-actively taking steps to respect consumers’ privacy and protect their data.**

The subject of privacy is particularly relevant when the sharing of data relates to individual consumers’ data as insights drawn from such data may impact their privacy. Industry members should have adequate measures in place to address privacy risks, while regulations should allow for innovative approaches. There are examples of policymakers at both a regional<sup>8</sup> and market<sup>9</sup> level who are considering regulatory frameworks that promote Big Data innovation.

Establishing commonly agreed privacy practices would address key concerns in this area. GSMA and its operator members have worked extensively on creating tools to protect consumers’ privacy, including the development of a set of universal Mobile Privacy Principles<sup>10</sup>, a more detailed set of Privacy Design Guidelines for Mobile Application Development<sup>11</sup> and a Privacy Accountability Framework<sup>12</sup>. This work will provide a foundation for establishing privacy principles for the treatment of data in the IoT space.

- **Policymakers should be engaged to support (and not restrict) innovation.**

Certain current regulations and policies may be interpreted as restricting how data could be used and this may inhibit true data-driven innovation from flourishing as part of an ecosystem. By actively engaging with the ecosystem, policymakers have the opportunity to play a key role as drivers of innovation while deriving socioeconomic value and meeting public policy objectives.

8 The proposed General Data Protection Regulation in Europe recognises the economic value that Big Data innovation could bring and seeks to ensure that the treatment of EU consumers’ data is consistent across all EU member states.

9 Japan’s amendments to its Personal Information Protection Act, due to become effective in 2017, support the expansion of Big Data and Big Data models in Japan.

10 <http://www.gsma.com/publicpolicy/wp-content/uploads/2012/03/gsmaprivacyprinciples2012.pdf>

11 <http://www.gsma.com/publicpolicy/wp-content/uploads/2012/03/gsmaprivacydesignguidelinesformobileapplicationdevelopmentv1.pdf>

12 <http://www.gsma.com/publicpolicy/accountability-framework-for-the-implementation-of-the-gsma-privacy-design-guidelines-for-mobile-app-development>

# 2 Ecosystem Concept Validation

The GSMA engaged Analysys Mason to conduct a series of interviews with potential ecosystem participants to validate both the concept, its value and the expected business benefits.

Those interviews demonstrated that the ecosystem concept was welcomed by many of the industry experts that were interviewed. The interviews validated that:

- **Data silos exist today.**
- **The technical and commercial barriers described are real and exist today.**
- **There is a need and a desire for collaboration.**
- **The ecosystem vision and participant roles are easy to understand.**

A number of interesting comments were left by interviewees representing a variety of verticals and organisations along the value chain. Their comments show an understanding of the benefits that the processing and intelligent analysis of IoT data from multiple sources could bring to stakeholders. Selected quotes from the interviews are included below, organised around the key themes:

## THE IoT BDE CONCEPT

“I have not come across other initiatives as comprehensive and high level as this concept of an IoT BDE, which is exciting.” – **Executive Director, Product Strategy & Innovation, Panasonic Automotive.**

“I am sure that IoT BDE delivers a strong message towards IoT ecosystem players to encourage them to create new value from M2M services.” **Senior Vice President, Convergence Technology Institute, KT Corp.**

## MOBILE OPERATOR ROLES

“We think that mobile operators could play an important role in building the IoT Data Business Ecosystem by assisting data producers to share their IoT data with other industry players through the harmonized IoT data API or mash-up API.” **Senior Vice President, Convergence Technology Institute, KT Corp.**

“Operators can play a fundamental role in data ecosystems for Smart Cities, being a broker for context data offered by multiple providers and exploited by developers or big software vendors, enabling new innovative IoT applications and enhancing overall customer experience.” **Senior Technological Expert, Telefónica R&D.**

## VALUE OF SHARING DATA ACROSS SYSTEMS AND ORGANISATIONS

“There is a definite need to bring external data into solutions – typically dynamic data like energy pricing or weather data.” – **Managing Director of an application platform provider.**

“We are interested in the monetisation of the data. To get everybody onboard, the ecosystem needs to help generate money for all parties.” – **IT Architect, Volvo Car.**

“Farmers typically lack the tools to process the data generated by their farm. They may be willing to make their data available in return of insight from combining that data. Ultimately they want control and ownership of their data and to benefit from the value.” – **CTO and Founder, aWhere.**

“The key question that needs to be answered is ‘How does the end user get the benefit?’ It doesn’t necessarily need to be a direct benefit – like a payment – but could be an indirect benefit,” mentioned **Executive Director, Product Strategy & Innovation, Panasonic Automotive.**

## HARMONISED DATA

“Ideally data is harmonised at source. You have to harmonise the data somewhere and if it happens in the application it makes the application more complex, and there is less you can do with the data.” – **Managing Director of an application platform provider.**

“When collecting data from the government, each government uses a different data format,” says The **IT Architect of Volvo Car.** “This means that we need to do a point-to-point integration with each government.”

Similar issues were noted by the **IT Architect of Volvo Car** in the private sector: “Everyone (manufacturer/supplier) has their own data format. There is a need for point-to-point integration with everyone.”

“Exposing data through common APIs and data models can foster the creation of Smart Applications which can work seamlessly on multiple domains such as cities, agriculture, and public safety, and with multiple data providers. In the end, this will enable the creation of a bigger market and further monetisation possibilities”. **Senior Technological Expert, Telefónica R&D.**

# 3 Conclusion and Next Steps

We have researched barriers to the growth of the future IoT market and have proposed an IoT Big Data Ecosystem vision to unlock the full value of the data generated by IoT.

We have shown that using deliberately conservative assumptions, the economic benefit of the IoT BDE to the global economy could be in the order of \$44 billion per annum by 2025.

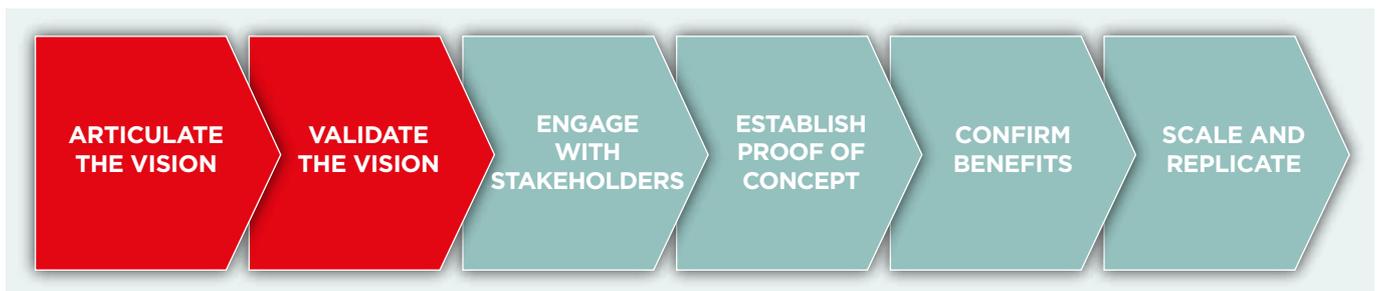
We suggest that the IoT BDE concept is an enabling solution that is applicable across all vertical markets. We also observe that independently of this GSMA initiative, ecosystems of this type are emerging within market verticals (for example, the EU’s cross-border Vehicle Big Data Marketplace project, AutoMat).

The IoT BDE concept outlined in this paper and the possible benefits have been validated by interviews with potential ecosystem stakeholders from within diverse industry verticals. Based on our research, the GSMA has reached the following conclusions:

- **An IoT BDE has the potential to unlock the value of new and existing data silos.**
- **An IoT BDE will significantly help in the creation of new IoT businesses, products and services.**
- **Mobile operators have an opportunity to utilise their existing capabilities to play one or more of the key IoT BDE stakeholder roles.**

Encouraged by the responses received in the interviews, the GSMA and its operator members plan to create a minimum viable proof (MVP) of concept of an IoT BDE as a next step. The focus of that MVP is to demonstrate the benefits of removing the technical barriers to IoT innovation that relies on data from multiple sources.

FIGURE 4: PROPOSED NEXT STEPS



To accelerate the development of an IoT BDE, the GSMA and its operator members need broad engagement from a wide range of stakeholders including companies seeking to monetise their data assets, vertical market specialists, technology companies, solution developers and the public sector.

The GSMA encourages potential stakeholders from the wider community to collaboratively participate in the evolution of this visionary IoT BDE and invites interested parties to contact the GSMA through [connectedliving@gsma.com](mailto:connectedliving@gsma.com).





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