



# **The Digital Catapult and productivity**

A framework for productivity  
growth from sharing closed data

Stuart Parris, Anton Spisak, Louise Lepetit, Sonja Marjanovic,  
Salil Gunashekar, Molly Morgan Jones

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## Executive Summary

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### Background, objectives and approach

Data-driven innovation is expected to be one of the most important technological advances in the recent years, ‘able to drive value creation, and foster new products, processes, and markets’.<sup>i,1</sup> Estimates show that data-driven innovation has the potential to create more than \$300bn of economic value in the next decade.<sup>ii</sup> One of the most pressing questions is whether data innovation helps organisations work smarter. Innovation economists estimate the output and productivity of firms that adopt data-driven decisionmaking are 5 per cent to 6 per cent higher than would be expected from other investments in information and communication technology (ICT).<sup>iii</sup> The potential of the data economy to improve productivity growth is significant, but some two-thirds of potential value generation is seen to be at risk from a failure to establish trusted flows of data.<sup>iv</sup> The barriers related to sharing closed and proprietary data, and associated trust and privacy issues, hinder opportunities to harness the value from data as a way of boosting economic productivity domestically and taking the lead with first-mover advantage in these areas internationally.

In order to harness the market opportunities from sharing closed data, numerous barriers to adoption need to be overcome. These include behavioural change and lack of trust, uncertainty around the return to innovation and the long timescales, the presence of positive externalities, the lack of effective links between firms, academia and/or government, and incomplete markets where an initial lack of demand can inhibit potentially profitable research and development (R&D).

The Digital Catapult, established by Innovate UK as a centre to help unlock new value from sharing closed and proprietary data, commissioned RAND Europe

to conduct a rapid scoping study with an objective to develop a framework to understand the present and prospective contribution of the Digital Catapult’s activities to the UK’s economic productivity. The study was not intended to provide an evaluation of the Digital Catapult’s contribution to productivity, although we envisage that further work can build on this framework to provide an assessment in terms of value added.

In undertaking this study, RAND Europe (i) reviewed barriers to achieving productivity growth from data innovation using a rapid evidence assessment of literature on productivity and digital and creative content innovation; (ii) identified how the Digital Catapult’s activities correspond to opportunities for unlocking productivity growth in the UK’s data economy, data collected from a one-day scoping workshop with the Digital Catapult’s senior management team, follow-up communications with key staff and a review of key documents from the Digital Catapult; and (iii) analysed and synthesised the evidence to contextualise it within a productivity conceptual framework.

### Key findings

In this report, RAND Europe concludes that the Digital Catapult can contribute to productivity growth across different sectors, disciplines and organisational types through three mechanisms of change aimed at overcoming inefficiencies: (i) enabling the development of core data infrastructure; (ii) increasing the absorptive capacity of organisations to derive the value from data, assimilate it and use it towards commercial ends; and (iii) convening expertise, providing leadership and fostering trust in key markets. If all of these work effectively, the Digital Catapult could accelerate the

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<sup>1</sup> Data-driven innovation refers to ‘techniques and technologies for processing and analysing large volumes of data that are becoming an important resource that can lead to new knowledge, drive value creation and foster new products, processes and markets’. Source: OECD. 2014. ‘Data-driven Innovation for Growth and Well-being, INTERIM SYNTHESIS REPORT.’ As of 10 September 2015: <http://www.oecd.org/sti/inno/data-driven-innovation-interim-synthesis.pdf>

adoption of data technologies and improve the capabilities of organisations to unlock the value from data, leading to reduced intra-organisational inefficiencies, such as more optimised production and delivery processes or better decisionmaking capabilities. Thus, in relation to productivity:

*the Digital Catapult aims to address market and innovation inefficiencies that currently inhibit the rapid commercialisation and uptake of data-driven innovation across firms and industries, thereby enabling the benefits that data could deliver to productivity growth in the UK.*

## Mechanisms for productivity

Table 1 below summarises the three mechanisms for overcoming market and innovation inefficiencies and supporting productivity growth identified in this

study. For each approach it describes how the Digital Catapult's activities aims to reduce inefficiencies, which barriers to productivity would be targeted and what productivity implications and outcomes could occur in the short and long term.

The combination of these three mechanisms can grow an ecosystem which, in turn, has the potential to unlock longer term productivity gains from follow-on 'ripple' effects. Such ripple effects would be likely to lead to optimised data processes, new enterprise and productivity growth from the diffusion of innovation throughout the economy.

This report and accompanying appendices present the analysis that has led us to these findings. The Digital Catapult could further use this developed framework to measure its progress towards achieving productivity gains, using it as a foundation for the development of evaluation indicators.

**Table 1: Mechanisms for productivity**

Mechanism	How does the Catapult do it?	Which market inefficiencies does this mechanism address?	What productivity implications does it have in the: short term	& long term?
1 <b>Enabling critical infrastructure for the sharing and flow of closed or proprietary data</b>	Supports the development of secure platforms to combine and manage access to closed data to unlock value.  Supports the development of trusted frameworks to promote open competition and enterprise.	<ul style="list-style-type: none"> <li>• Data liquidity</li> <li>• Lack of interoperable and support structures for sharing data</li> <li>• Lack of good quality, reliable and trusted data to share</li> </ul>		
2 <b>Increasing absorptive capacity of organisations to unlock the value from data</b>	Helps firms across sectors to realise value from data and so enhance market capacity to understand, assimilate and act upon data opportunities for commercial ends.	<ul style="list-style-type: none"> <li>• Inadequate access to and transfer of knowledge</li> <li>• Lacking business and managerial capacity to understand the opportunity and derive the value from data</li> <li>• Inadequate data analytical capabilities</li> <li>• Slow uptake of data technologies in the legacy markets</li> </ul>	<ul style="list-style-type: none"> <li>• Lower costs to understand and assimilate to data-driven models of production, delivery and decisionmaking</li> <li>• Faster adoption of data-driven business processes</li> <li>• New data-driven products and services</li> <li>• More optimised production and delivery processes</li> <li>• Improved decision-making capabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Better evidence for business performance assessment</li> <li>• Automated production and delivery business processes</li> <li>• Better flow of raw data and subsequently information in the markets</li> <li>• Enhanced R&amp;D processes</li> </ul>
3 <b>Convening, leading and fostering trust</b>	Creates more effective and targeted links between large enterprise, SMEs, universities and public sector for specific data-related challenges.  It reduces search and investment costs for organisations to locate key expertise and knowledge in challenge areas.  It acts independently and neutrally to build trust in sharing data in the market, reducing market frictions and the need for regulation.	<ul style="list-style-type: none"> <li>• Regulatory framework conditions for data privacy, ownership, copyright and security and integration with consumer policy</li> <li>• Consumer privacy and security concern</li> </ul>		



# Chapter 1 Introduction

## 1.1. Introduction to the Digital Catapult

The data economy has a large potential to boost the UK's economic growth and productivity. The emerging evidence on the contribution of data to productivity indicates that the value generated by data has a direct impact on the productivity of firms and the competitiveness of economies. Innovation economists estimate that the output and productivity of firms that adopt data-driven decisionmaking are 5 per cent to 6 per cent higher than would be expected from other investments in information technology.<sup>v</sup> Similarly, research finds that businesses adopting data-driven decisionmaking are 8 per cent more productive than their competitors.<sup>vi</sup> The potential of the data economy to contribute to productivity growth is significant, but some two-thirds of potential value generation is seen to be at risk from failure to establish trusted flows of data.<sup>vii</sup> The barriers related to sharing closed and proprietary data, and associated trust and privacy issues, hinder the opportunities to harness the value from data as a way of boosting economic productivity domestically and taking the lead with first-mover advantage in these areas internationally.

In order to harness the market opportunities from data and creative content innovation, numerous barriers to adoption need to be overcome. As our report highlights, these include uncertainty around the return to innovation and the long timescales, the presence of positive externalities, the lack of effective links between firms, academia and/or government, and incomplete markets where an initial lack of demand can inhibit potentially profitable research and development (R&D).

The UK government has acknowledged that the explosion of data and new capabilities to exploit these data is a strategic opportunity for businesses and for the UK's competitiveness.<sup>viii</sup> In order to address this, the Digital Catapult was established by Innovate UK in 2012.<sup>ix</sup> The

### *Data-driven economy*

An economic system where data enhance economic competitiveness and drive innovation and equitable and sustainable development.

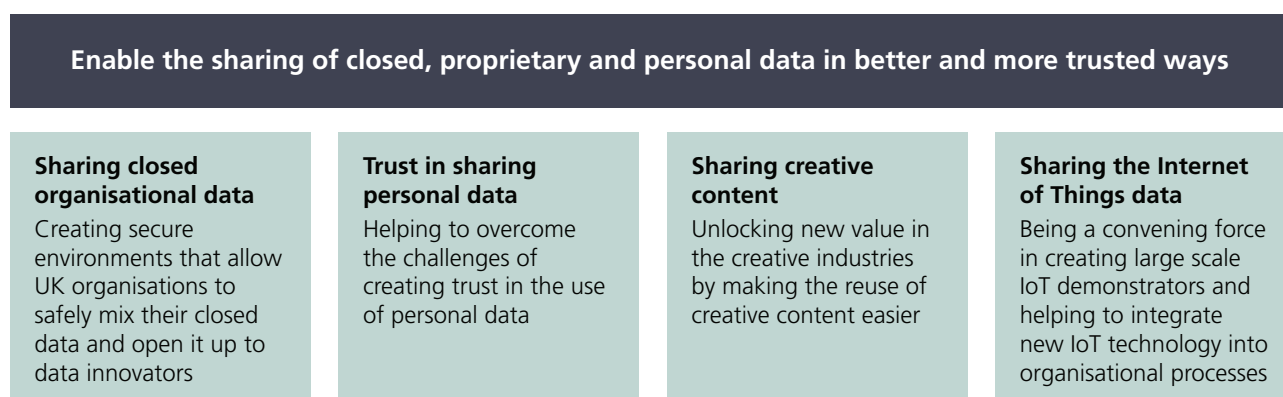
*Source: OECD 2013*

Digital Catapult aims to help businesses unlock value from data, in particular by accelerating the progress of data innovation from proof-to-market to marketable data-driven innovations.<sup>x</sup> It is one of a series of nine Catapult centres established across the UK to support early-stage innovation and foster future economic returns from innovation. The Digital Catapult has operated from its London base since November 2014, and is establishing additional local centres in Brighton, The North East and Tees Valley, and Yorkshire.

Building on evidence that improvements to the more effective sharing of data within and between organisations (i.e. 'data liquidity') can unlock £149bn of organisational efficiencies and £66bn of new business and innovation opportunities in the UK economy,<sup>xi</sup> the focus of the Digital Catapult lies in enabling the effective sharing of proprietary data in better and more trusted ways. The Digital Catapult aims to fulfil its mission by specifically addressing four challenge areas. These areas were identified as activities aligned with potential to unlock value from shared data value across various sectors of the UK economy.<sup>xii</sup>

The challenge areas build upon the UK's long-standing strengths and capabilities in the development of data technologies, with the rationale for the Digital Catapult's intervention being to further enhance the UK's international competitiveness in data. The challenge areas correspond to potential high growth markets in the UK expected to generate economic value at the national level as well as aligning with the UK's Digital Economy Strategy 2015–2018<sup>xiii</sup>

Figure 1.1: The Digital Catapult's challenge areas



and the European Commission's Big Data Strategy for closed data and personal data sharing. For instance the UK hosts high numbers of world-class collaborative efforts in the creative sector, which represent a 5 per cent share of the UK's economy.<sup>2</sup> The UK internet-based economy will represent 12.4 per cent of UK GDP by 2016<sup>xiv</sup> and the global opportunity for the industrial Internet of Things is estimated to be worth \$14.2trillion by 2030.<sup>xv</sup> This lays the ground for potentially rapid development of the Internet of Things, data analytics and data liquidity.<sup>xvi</sup> In terms of personal data, Boston Consulting Group estimated the market's economic value of consumers' data at €1trillion by 2020 across the EU<sup>xvii</sup>; similarly Nesta estimated the new class of Personal Information Management Systems (PIMS) to have a market opportunity of £16.5bn in the UK.<sup>xviii</sup> Activities related to sharing creative content, such as digital copyright, have been estimated to add £2bn value to the UK economy.<sup>xix</sup>

However, addressing these challenge areas is often too financially risky and complex for market forces alone. Therefore, the situation needs a coordination mechanism that bridges the efforts of the private sector and regulators, the supply and demand side of the market and the effective links between actors alongside the entire innovation chain – from universities to SMEs – translating concepts into commercial products. The Digital Catapult aims to full this role: acting as a neutral convenor to identify and help to address wider barriers to innovation and commercialisation from sharing closed data. In doing so, the Digital Catapult is using

the methods of 'open innovation', such as collaborative R&D projects or industry Pit Stops, which enable firms to absorb external ideas as well as build the capacity to take forward internal ideas. This not only helps them to advance their products and services, but also helps to generate and accelerate new learning for the industry as a whole.<sup>xx</sup>

## 1.2. Context and aims

The Digital Catapult commissioned RAND Europe to conduct a rapid scoping study with the objective of developing a framework in which to understand the present and prospective contribution of Digital Catapult to the UK's economic productivity. In doing so, RAND Europe (i) reviewed barriers to productivity growth from data innovation, building on the wider evidence base, and (ii) identified how Digital Catapult's activities respond to opportunities for unlocking productivity growth in the UK's data economy. By focusing on the drivers and barriers to productivity, we have aimed to articulate the potential relationships between the Digital Catapult's activities and productivity gains to the UK economy. This report is not intended to be a catalogue of the Digital Catapult's activities, nor an evaluation of the Digital Catapult's contribution to productivity. Rather, it sets out a framework for understanding how and where the Digital Catapult's activities could contribute to breaking down well-established barriers to productivity in the data-driven economy. Using this productivity framework, further work can assess the contribution of Digital Catapult to economic productivity in

<sup>2</sup> GVA of the Creative Industries was £76.9bn in 2013 and accounted for 5.0 per cent of the UK according to the UK Government Department for Culture, Media and Sports.

value-added terms. In this report, we focused on identifying how key areas of Digital Catapult's activities relate to the UK's policy framework for productivity<sup>xxi</sup> and the unique set of productivity challenges faced within the data sector. In order to do this, we:

1. Conducted a rapid evidence assessment of the literature on productivity and digital and creative content-based innovation.
2. Held a scoping workshop and multiple follow-up conversations with the Digital Catapult's senior management team in order to better understand

the existing relationship between activities and potential productivity gains.

3. Reviewed documents about the Digital Catapult's activities, strategy and projects.
4. Analysed and synthesised the evidence to contextualise it within a Digital Catapult productivity conceptual framework. This helped to reflect how the Digital Catapult is acting to unlock productivity gains.

A full description of our methodology is in Annex 1.



## Chapter 2 Productivity growth in the data economy

### 2.1. What is productivity growth and why does it matter?

Productivity growth is the main driver of economic growth (measured as GDP per capita) over the long term, and also constitutes one of the main drivers of higher living standards (measured as per capita income).<sup>xxii</sup> Productivity is a measure of production efficiency. It can be defined as the economic output per unit of input. It measures how well resources or inputs are utilised to create the desired outputs. Inputs encompass a mix of production factors, such as human or physical capital, energy, natural resources or raw materials used in the production process. Output is generally measured through the amount of goods and services produced in terms of gross-output or value-added. Measuring productivity is important as it deals with economic performance and measures the ability of national companies to compete internationally.<sup>xxiii</sup>

Productivity can be expressed as labour productivity or total factor productivity (TFP). Ideally, TFP measures should be used in order to account for all the factors influencing productivity, but the more straightforward and easier to apply measure of labour productivity is generally used.<sup>xxiv</sup> At a national level, governments tend to focus on labour productivity, often expressed as GDP/labour hour, as an indicator of how efficiently labour input is combined with other productivity factors.<sup>xxv</sup>

Productivity growth is driven by several interlinked factors including: investment in physical and human capital; investment in infrastructure (including digital infrastructure); creation of new firms (called the ‘growth effect’); replacement of less productive firms with innovative firms (the ‘shift effect’)<sup>xxvi</sup>; closer collaboration between the public and private sectors<sup>xxvii</sup>; and increased competition, pushing enterprises to innovate.<sup>xxviii</sup> One of the key drivers of productivity is innovation – it

- **Labour productivity:** output per unit of input (labour hours or amount of workers)
- **Total factor productivity (TFP):** measure of the output taking into account all production factors (labour, physical capital, energy or other inputs)
- **Multi-factor productivity (MFP):** takes account of only workers and physical capital

Source: OCED 2001 Manual

is the main factor sustaining long-term productivity growth.<sup>3</sup> Innovation can take various forms, from new product design to new production processes to a re-organisation in the way a service is delivered. Whatever form it takes, innovation increases output by enabling better use of existing tools through improving physical capital (allowing workers to work more efficiently and faster) and improving organisational processes.<sup>xxix</sup>

### 2.2. The opportunities from data to productivity growth are vast but the challenges remain significant

The growth of the data-driven economy and the expected productivity growth are closely linked to the continued development of ICT. At the national level, the data driven economy fosters across-the-board productivity growth coming from the increasing use of ICT across a wider range of sectors. As well as the direct productivity benefits for individual users adopting new data innovation and related ICT, it is often described as an enabling technology that spurs further innovation as it diffuses throughout the economy.<sup>xxx</sup> Table 2.1 summarises some of the main productivity implications from the data-driven economy.

<sup>3</sup> As emphasised, notably, by the New Growth theory (Romer, 1990; Aghion and Howitt, 1992).

**Table 2.1: Productivity implications from the data economy**

Optimisation of production processes
Optimisation or automation of distribution and delivery processes
Cost reduction of operations
Creation of new, more efficient data-based products and services
Better business intelligence
Improved decisionmaking within existing practices
Enhanced research and development

Sources: OECD (2013)

Seven key factors have been identified as critical for determining productivity growth in the UK: investment, including infrastructure, innovation, skills, enterprise and competition and finally rebalancing to ensure productivity gains are diffused across the UK.<sup>xxxi xxxii</sup> While some of these factors have a direct impact, such as changes in capital intensity or the skills of labour

force on the aggregate labour productivity, the impact of others on productivity is less direct. Despite opportunities, a diverse range of factors present barriers to improving efficiency and increasing productivity in the economy through data technologies. Key barriers to productivity growth, which map to the key drivers to productivity growth, are shown in Table 2.2.

**Table 2.2: Mapping key barriers to productivity growth in the data economy**

Productivity drivers	Barriers to unlocking productivity gains
Business investment	Access to risk capital to develop and adopt data technologies High capital investment for some technologies, in particular high-performance computing
Innovation	Inadequate access to and transfer of knowledge/technologies High search costs to locate new knowledge/technologies Underinvestment in basic R&D
Skills	Inadequate data analytical capabilities
Enterprise	High costs of adaptation to data by businesses and public sector Lack of business and managerial absorptive capacity to understand the opportunity and adapt business to opportunities of data
Infrastructure	Lack of good quality, reliable and trusted data coming from large datasets Unavailability of standards and interoperability for data Lack of solid enabling infrastructure (fast broadband, large and flexible computing resources, smart connected objects, availability of abundant bandwidth) Regulatory framework conditions for data privacy, ownership, copyright and security and integration with consumer policy
Competition and open markets	Unavailability of trusted data flows Technological cumulativeness leading to slow uptake of data technologies in the legacy markets where it takes time for firms to understand the market opportunity
Rebalanced economy	Effects of productivity drivers listed are localised and not diffused through the economy

Please note this list is non-exhaustive and lists the selected barriers in relation to data technologies

## Chapter 3     How can the Digital Catapult unlock productivity gains?

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Our analysis has identified three distinct mechanisms of change that the Digital Catapult uses to target the known productivity barriers in the digital and creative economy, and to unlock productivity gains by addressing market and innovation inefficiencies. Each is summarised in turn (though this is not to imply the approaches apply in a sequential order, necessarily). The mechanisms we have identified reflect recent conclusions by the OECD,<sup>xxxiii</sup> which highlight that the magnitude of productivity growth from data depends on a number of enabling and complementary factors, including access to relevant data and a readiness for organisational change (including the adaptation of internal and external business processes). Figure 3.1 below summarises how these mechanisms work in the context of the Digital Catapult and across its challenge areas. It highlights how many of the Digital Catapult's projects and activities aim to take advantage of multiple mechanisms to increase productivity and so apply in combination. Likewise the cross-cutting activities provide a framework to support the use of mechanisms to address productivity both within and across challenge areas.

### **Mechanism 1: Enabling critical infrastructure for the sharing and flow of closed/proprietary data**

By promoting data liquidity in the market and ensuring closed datasets are accessed via secure platforms to facilitate an 'ecosystem' for combining datasets, the Digital Catapult could enable the development of critical data infrastructure by helping data providers and SMEs to mitigate risk from the opportunities to release value from closed data. It can also support the development of trusted frameworks to encourage the flow of data to stimulate further productivity gains from competition and enterprise related to sharing of closed datasets.

Entry barriers such as closed datasets or data dispersed across multiple sources can create additional costs for firms and prevent their entry into new markets. If firms

duplicate effort by individually committing energy and resources to overcome the same barriers, it is also likely to reduce overall productivity. In contrast, by reducing the entry cost this also provides greater opportunity for the most productive firms to achieve scale up and contribute to increasing UK productivity. A key concern in the UK is the number of inefficient small firms operating within the economy that holds back UK productivity.<sup>xxxiv</sup> Removing obstacles that prevent firms from growing rapidly is crucial for allowing the entry of high-growth firms that can help improve UK productivity.<sup>xxxv</sup>

### **Mechanism 2: Increasing absorptive capacity of organisations to unlock the value from data**

By addressing high costs of adaptation to data by businesses and public sector organisations, the Digital Catapult increases the absorptive capacity<sup>xxxvi</sup> of organisations, allowing them to unlock the value from data by helping them to understand the gains from data innovation, how to assimilate to data innovation and how to apply it towards commercial ends. This also addresses the lack of organisational readiness and business and managerial capacity to understand the opportunity to derive value from data, as well as the slow up-take of data technologies in legacy markets.

**Absorptive capacity** is defined as a firm's 'ability to recognise the value of new information, assimilate it and apply it to commercial ends'.

*The ability to use outside knowledge depends on the level of prior related knowledge (which includes basic skills, shared language or the knowledge of the most recent scientific or technological developments in a given field).*

Source: Cohen and Levinthal (1990)



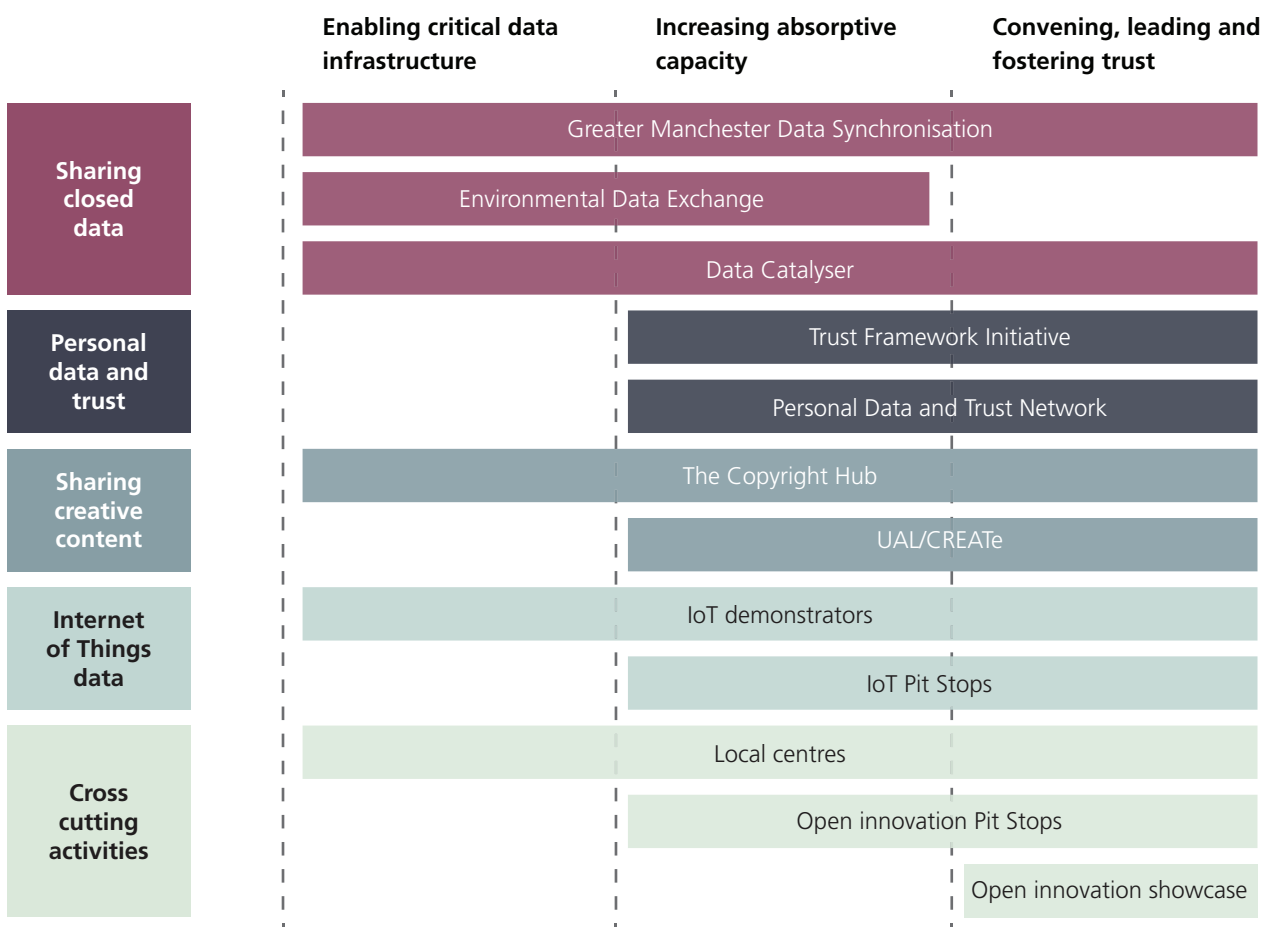
### Mechanism 3: Convening, leading and fostering trust

By being a neutral, independent but active convenor of stakeholders for the targeted development of opportunities from sharing closed data, the Digital Catapult can address key issues such as an inadequate access to and transfer of knowledge in relation to data innovation and support changes in the market behaviour of stakeholders and regulatory conditions to allow more effective collaboration and flow of data in markets. The Digital Catapult identifies and convenes experts targeted to challenge areas to help build relationships between large firms, SMEs, universities and public sector. It can provide leadership and foster trust at an industry level to create more effective links between diverse market actors around specific data-related challenges in the

market. In doing so it can also help reduce the search costs and improve the efficiency of firms and innovators looking to identify key expertise to support the development of close data sharing opportunities. By adopting a neutral and independent position within the industry that does not take intellectual property rights in any development process, it can informally help to foster trust in sharing data in markets, thus reducing the need for regulation.

While Figure 3.1 summarises the mechanisms in relation to the Digital Catapult's challenge areas, Table 3.1 describes how the Digital Catapult's activities could reduce inefficiencies, which barriers to productivity would be targeted, and what productivity implications and outcomes could occur in the short term, as well as the spillover related long-term effects.

**Figure 3.1: Mapping how the Digital Catapult's activities and methods address some of the barriers to achieving productivity growth in the UK's data economy**



Details of Digital Catapult projects listed are provided in Annex 3. Further background can be found on the Digital Catapult website: <http://www.digitalcatapultcentre.org.uk/about/projects/>



Table 3.1: Mechanisms for productivity

Mechanism	How does the Catapult do it?	Which market inefficiencies does this mechanism address?	What productivity implications does it have in the:	
			short term	& long term?
1 <b>Enabling critical infrastructure for the sharing and flow of closed or proprietary data</b>	Supports the development of secure platforms to combine and manage access to closed data to unlock value.  Supports the development of trusted frameworks to promote open competition and enterprise.	<ul style="list-style-type: none"> <li>• Data liquidity</li> <li>• Lack of interoperable and support structures for sharing data</li> <li>• Lack of good quality, reliable and trusted data to share</li> </ul>		
2 <b>Increasing absorptive capacity of organisations to unlock the value from data</b>	Helps firms across sectors to realise value from data and so enhance market capacity to understand, assimilate and act upon data opportunities for commercial ends.	<ul style="list-style-type: none"> <li>• Inadequate access to and transfer of knowledge</li> <li>• Lacking business and managerial capacity to understand the opportunity and derive the value from data</li> <li>• Inadequate data analytical capabilities</li> <li>• Slow uptake of data technologies in the legacy markets</li> </ul>	<ul style="list-style-type: none"> <li>• Lower costs to understand and assimilate to data-driven models of production, delivery and decisionmaking</li> <li>• Faster adoption of data-driven business processes</li> <li>• New data-driven products and services</li> <li>• More optimised production and delivery processes</li> <li>• Improved decision-making capabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Better evidence for business performance assessment</li> <li>• Automated production and delivery business processes</li> <li>• Better flow of raw data and subsequently information in the markets</li> <li>• Enhanced R&amp;D processes</li> </ul>
3 <b>Convening, leading and fostering trust</b>	Creates more effective and targeted links between large enterprise, SMEs, universities and public sector for specific data-related challenges.  It reduces search and investment costs for organisations to locate key expertise and knowledge in challenge areas.  It acts independently and neutrally to build trust in sharing data in the market, reducing market frictions and the need for regulation.	<ul style="list-style-type: none"> <li>• Regulatory framework conditions for data privacy, ownership, copyright and security and integration with consumer policy</li> <li>• Consumer privacy and security concern</li> </ul>		

### 3.1. Productivity benefits from the activities related to sharing closed and proprietary data

*The Digital Catapult closed data challenge area works to unlock productivity gains through:*

- *Targeting inefficiencies that prevent sharing of closed data and enabling digital infrastructure to support innovation around closed datasets.*
- *Establishing collaboration between organisations and individuals across different sectors and disciplines to increase absorptive capacity, change behaviour and establish trust.*
- *Provide leadership to the process of data sharing and enabling infrastructure to unlock productivity spillovers from enterprise and innovation.*

The Digital Catapult aims to unlock the value from closed and proprietary data and address market inefficiencies that prevent sharing closed/proprietary datasets. Digital Catapult's activities could lead initially to benefits such as better and more trusted flows of data in markets directly related to challenge areas. Subsequently, via both knowledge and network spillovers, other benefits from the development of large datasets could encourage additional innovation and entrepreneurial activity to drive additional increases in productivity.

The lack of trusted flow of data in the market leads to incomplete markets, where differences in the information held by different stakeholders (information asymmetries), for example regarding the availability of different data, can hamper usual market processes. Likewise, in the case of closed datasets the associated search and coordination costs of locating and bringing different data together are likely to be especially

high, particularly in the absence of historical collaboration between public and private stakeholders. As a result, new market opportunities may fail to materialise without additional support. Supporting the development of digital infrastructure to create new platforms for data sharing is therefore crucial for opening up opportunity for innovation and enterprise and reducing cost of entry. One example of this activity is the Data Catalyser that provides a safe and trusted space for the sharing of closed data. The Data Catalyser will be creating a trusted library of proprietary data sets for restricted access to be used by new companies giving insights by harnessing such datasets that may otherwise not be possible. This provides a platform for data providers and SMEs to reduce risk and start safely investigating opportunities to release value from closed data. In this way the Digital Catapult operates as a key intermediary, opening up new opportunities that may otherwise be reduced because of disincentives for private actors, such as market uncertainty, appropriation problems from positive spillovers, information asymmetries and coordination.

**Spillovers** are defined as externalities, where the benefits of their activities are not fully appropriable by the economic agents. Two types of spillovers relevant to the activities of the Digital Catapult include:

- **Knowledge spillovers:** occur when other actors, not necessarily part of the same industry, can appropriate and absorb knowledge created in a given sector. They have a strong geographical dimension.
- **Network spillovers:** arise when single organisations network with other individuals, organisations, ideas or other sectors. This helps achieve a 'critical mass' enabling the generation of better innovative ideas and at a faster pace than if the firms or individuals were innovating alone. Achieving the critical mass of users means that the take-up of the innovation by additional users increases the value of the innovation to existing users.

Source: ICF GHK, 2014. *An economic analysis of spillovers from programmes of technological innovation support*. Department for Business, Innovation & Skills, London.

Examples of other new platforms developed at the Digital Catapult include the Greater Manchester Data Synchronisation project and the Environmental Data Exchange.<sup>4</sup> In these examples, as well as the Data Catalyser, the role of the Digital Catapult is to support and partner with external experts to develop platforms that bring together closed datasets from multiple sources, in order to provide access to innovators and entrepreneurs that could subsequently develop new applications. This could help avoid the upfront cost and productivity loss that would otherwise be duplicated across different firms attempting to overcome data sharing barriers to exploit commercial data opportunities, and release the potential productivity gains from follow-on spillover effects.<sup>5</sup>

### 3.2. Productivity benefits from the activities related to personal data and trust

*The Digital Catapult's personal data and trust challenge area works to unlock productivity gains through:*

- *Unlocking barriers that prevent sharing of personal data to open up opportunities to develop new markets and enterprise.*
- *Acting as a neutral and trusted partner to convene experts in personal data and privacy to develop an industry roadmap to overcome inefficiencies and barriers in the development of new opportunities.*

One of the major barriers to unlocking the economic value of data is trust and privacy concerns related to sharing personal data. A recent survey by the Digital Catapult showed that 60 per cent of UK consumers said they were uncomfortable sharing personal data.<sup>xxxvii</sup> A primary reason for this appears to be distrust in businesses' openness and transparency in how and when they use consumer data. The personal data and trust challenge area is organised to address the barriers to productivity growth related to consumer and privacy barriers, which may otherwise hold back the development of digital services and related productivity benefits, and an inadequate regulatory and social infrastructure that

<sup>4</sup> For a discussion of the Greater Manchester Data Synchronisation project, see Annex 3 – Case 3; for the Data Catalyser see Case 4.

<sup>5</sup> See Annex 3 for a discussion of two Closed Data projects.

could encourage the development of trust in the management and use of personal data in the data economy.

The Digital Catapult is currently working to establish an ambitious Trust Framework Initiative (TFI) to create a framework for unlocking the value of personal data. It is also developing a Personal Data and Trust Network (PDT) to bring together a community of interest around trust and personal data and develop an industry roadmap for the successful development of the digital economy around personal data and privacy.<sup>6</sup> Overall, the Digital Catapult provides leadership in developing and coordinating communities of innovation and industry experts to create an industry roadmap to support the use of personal data in the digital economy and avoid system level failures.

### 3.3. Productivity benefits from the activities related to sharing creative content

*The Digital Catapult's creative content challenge area works to unlock productivity gains through:*

- *Enabling the development of key digital infrastructure to target inefficiency in markets for intellectual property, driving down the cost of licensing of creative content and improving efficiency.*
- *Acting as a neutral independent convener for creative content producers to collaborate and learn from industry experts to increase awareness of the opportunity to derive value from copyright and related intellectual property.*

The creative economy in the UK has grown employment opportunities at approximately four times the UK average and contributes over 8 per cent to UK service exports.<sup>xxxviii</sup> In the sharing creative content challenge area, the Digital Catapult targets productivity from digital infrastructure to unlock new markets in trading intellectual property, starting with copyright licensing. It does so by providing platforms in partnership, such as the Copyright Hub developed with the Copyright Hub Foundation as a not-for-profit company.<sup>7</sup> The Copyright Hub enables individuals to

get the permissions they need to use copyright material with a single click, thereby allowing content users to optimise their search processes and content creators to derive new economic value from their creative content. The Copyright Hub operates as a platform that can be scaled to overcome market and innovation inefficiencies linking digital content providers to a functioning marketplace. The Copyright Hub is an example of how the Digital Catapult aims to engage with all three productivity approaches identified. It provides a platform that identifies owners of copyright; supports content providers and innovators to understand the market opportunity to unlock value from data; and as a neutral facilitator helps provide credibility and trust to support the process. The Copyright Hub aims to enable the flow of copyright data and content between owners and potential buyers and users, reducing the cost of trading copyright and potentially other forms of intellectual property. This project could contribute to productivity by creating the type of copyright marketplace that the Hargreaves Review<sup>xxxix</sup> identified could deliver to the UK economy, driving down the cost of licensing of creative content and improving efficiency.

### 3.4. Productivity benefits from the Internet of Things related activities

*The Digital Catapult Internet of Things challenge area works to unlock productivity gains through:*

- *Enabling large scale infrastructure demonstration projects for IoT technologies to reduce entry costs for firms and accelerate scale-up.*
- *Convening experts to foster absorptive capacity in the area of IoT to help drive the development of new markets and enterprise.*

One of the priority areas for the Digital Catapult is enabling the sharing of Internet of Things (IoT)-related data. The Catapult carries out enabling demonstrator projects that seek to establish the necessary infrastructure for IoT technologies to take hold and scale-up. In addition, it also convenes a series of IoT development activities including Pit Stops, showcases, clinics and pop-up accelerators, all of which help to establish a community of innovators, experts and businesses who

<sup>6</sup> See Annex 3 for examples in Cases 5 and 6.

<sup>7</sup> See Annex 3 – Case 7.

**Internet of Things (IoT)** *The Internet of Things builds out from today's internet by creating a pervasive and self-organising network of connected, identifiable and addressable physical objects enabling application development in and across key vertical sectors through the use of embedded chips, sensors, actuators and low-cost miniaturisation.*

*Source: Schindler, H.R., J. Cave, N. Robinson, V. Horvath, P. Hackett, S. Gunashekar, M. Botterman, S. Forge and H. Graux. 2012. Europe's policy options for a dynamic and trustworthy development of the Internet of Things: SMART 2012/0053*

can meet, collaborate and embark on development work to help support IoT and establish markets.

Developing large-scale demonstrator projects for IoT helps to overcome system coordination failures and lower the cost of entry for firms in IoT. The Digital Catapult's activities thus hold the potential to reduce the costs of entry for new or existing enterprises by creating platforms for them to engage with, unlocking their innovative potential and reducing coordination inefficiencies.

An example of an IoT demonstrator project is in the Milton Keynes Low Power Wide Area Network where the Digital Catapult, in partnership with the Future Cities Catapult, Milton Keynes Council, the Open University and BT, has developed one of the first large-scale IoT telecommunication demonstrators in the world, upon which enterprise can develop new commercial applications. This project provides an example of how the Digital Catapult is helping to develop digital infrastructure that could overcome productivity barriers related to IoT, reducing entry cost and providing a mechanism to encourage the system level coordination of different innovative and entrepreneurial actors.

### 3.5. Productivity benefits from the activities related to cross cutting activities across the UK

*The Digital Catapult's cross cutting activities work to unlock productivity gains through:*

- *Operating as a neutral convener that establishes targeted development activities (e.g. Pit Stops and showcases) to enable knowledge exchange, build absorptive capacity and target key stakeholders across the economy tackling barriers to productivity that delay data sharing and slow down the development of relationships that drive competitive markets.*
- *Being a convener of stakeholders targeted to the challenge areas to address key issues in the data economy that can result in inefficiency, hold back markets and restrict productivity.*
- *Facilitating the diffusion of knowledge of innovation around the country, taking advantage of local skills and know-how to support regional digital economy development.*
- *Supporting innovation around sharing closed and proprietary datasets across different UK locations to achieve scale-up and rebalancing.*

As a neutral convener, the Digital Catapult organises a variety of targeted development interventions in each challenge area in the form of specialist 'Pit Stops' designed to bring together leading expertise in identified challenge areas to stimulate and support the fostering of interdisciplinary, cross sector linkages between large corporates, SMEs, universities and public sector organisations. These open innovation type activities provide development opportunities to bring together selected individuals and organisations to work on specific issues and problems related to innovation around sharing closed and proprietary datasets, supported by the neutral position of the Digital Catapult to create an appropriate environment to develop trust. For example, Pit Stops in the emerging market of IoT technologies may help to establish markets more quickly and more efficiently than would otherwise be possible. As a neutral convener with an open innovation philosophy, it has the potential to

<sup>8</sup> See IoT Case 1 in Annex 3.



help firms take advantage of positive spillovers from knowledge co-creation platforms and associated activities and to increase the innovative efficiency and the productivity of organisations in the short and long term. Participating organisations could gain insight and knowledge at a reduced cost, having to invest less time and manpower to secure it.<sup>9</sup> This type of targeted approach, focused on developing solutions to identified challenges, includes activities related to the second and third mechanisms for change to overcome barriers to productivity and ultimately aims to help accelerate the innovation process.

As of 2015, the Digital Catapult has a national presence with local Digital Catapult Centres identified through an open call. Digital Catapult Centre North East & Tees Valley is focused, 'specifically on projects related to controlled delivery and security of data'<sup>xi</sup> working in a partnership led by Sunderland Software City and regional university partners, with the aim of unlocking new value from data and innovations around data sharing. The Digital Catapult Centre Brighton's focus is on encouraging 'innovation and value from real-time and location-based data'<sup>xli</sup> in collaboration with Coast to Capital LEP, University of Brighton and Wired Sussex. The Digital Catapult Yorkshire operates as a 'place of innovation for start-ups and small business' to showcase ideas for digital products and services and develop capabilities in collaboration with Digital

Health Enterprise Zone, Bradford Council and BT; it has a focus on digital health and social care.

As well as providing a similar knowledge exchange and engagement role as the activities from the London based Digital Catapult, the local centres aim to facilitate the diffusion of knowledge of innovation around the country, taking advantage of local skills and know-how to support regional digital economy development. In addition to the expected productivity gain from targeting innovation and the development of new markets and enterprise, this also gives an opportunity for activities to lead to productivity growth across the UK through scale-up and rebalancing.

Other examples of cross cutting activities at the Digital Catapult include showcase events as well as specialist 'hustings'. Showcases for data innovators provide a space to demonstrate their ideas and potential. Showcases also provide the opportunity for knowledge exchange and convening different stakeholders with an interest in data sharing. They may also tackle barriers to productivity such as a lack of coordination between different stakeholders that delay innovation and slow down the development of competitive markets.<sup>10</sup> Likewise, organising 'hustings' around key data innovation topics helps attract high profile speakers and experts to attend Digital Catapult locations and provides opportunities for individuals and firms to understand and more easily exploit the data market opportunities.

<sup>9</sup> See IoT Case 2 in Annex 3.

<sup>10</sup> A recent example of a firm working with the Digital Catapult is Chirp.io that developed data-sharing technology using sound. The Digital Catapult provided space at a showcase hosted at the Digital Catapult Centre, provision for investment pitches and meetings, and involvement in the Contributor programme. During this time the Digital Catapult report that Chirp.io raised over £425k from crowdfunding supported by the Catapult, generated 58 new business opportunities, held 10 business pitches at the Catapult Centre and moved 5 products to market (see <http://www.digitalcatapultcentre.org.uk/about/videos-and-downloads/> for case studies).



## Chapter 4 Conclusion

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In the fast-paced innovation context in which the Digital Catapult operates, future productivity outcomes are uncertain and subject to a range of competing factors which operate at both firm and economy level. In order to unlock productivity gains, the Digital Catapult builds linkages between key actors interested in innovation around sharing closed and proprietary data. It aims to select individuals and organisations on the leading edge of developments in data innovation in identified challenge areas, whether in public or private sectors, small or large firms, or universities and research institutes. By convening groups of key experts to work across sectors and disciplines, the Digital Catapult responds to challenges that could restrict data sharing in the economy and so create barriers to productivity growth. Less than a year after inception, the Digital Catapult has implemented projects and activities directly targeting existing barriers and accelerating progress towards productivity growth.

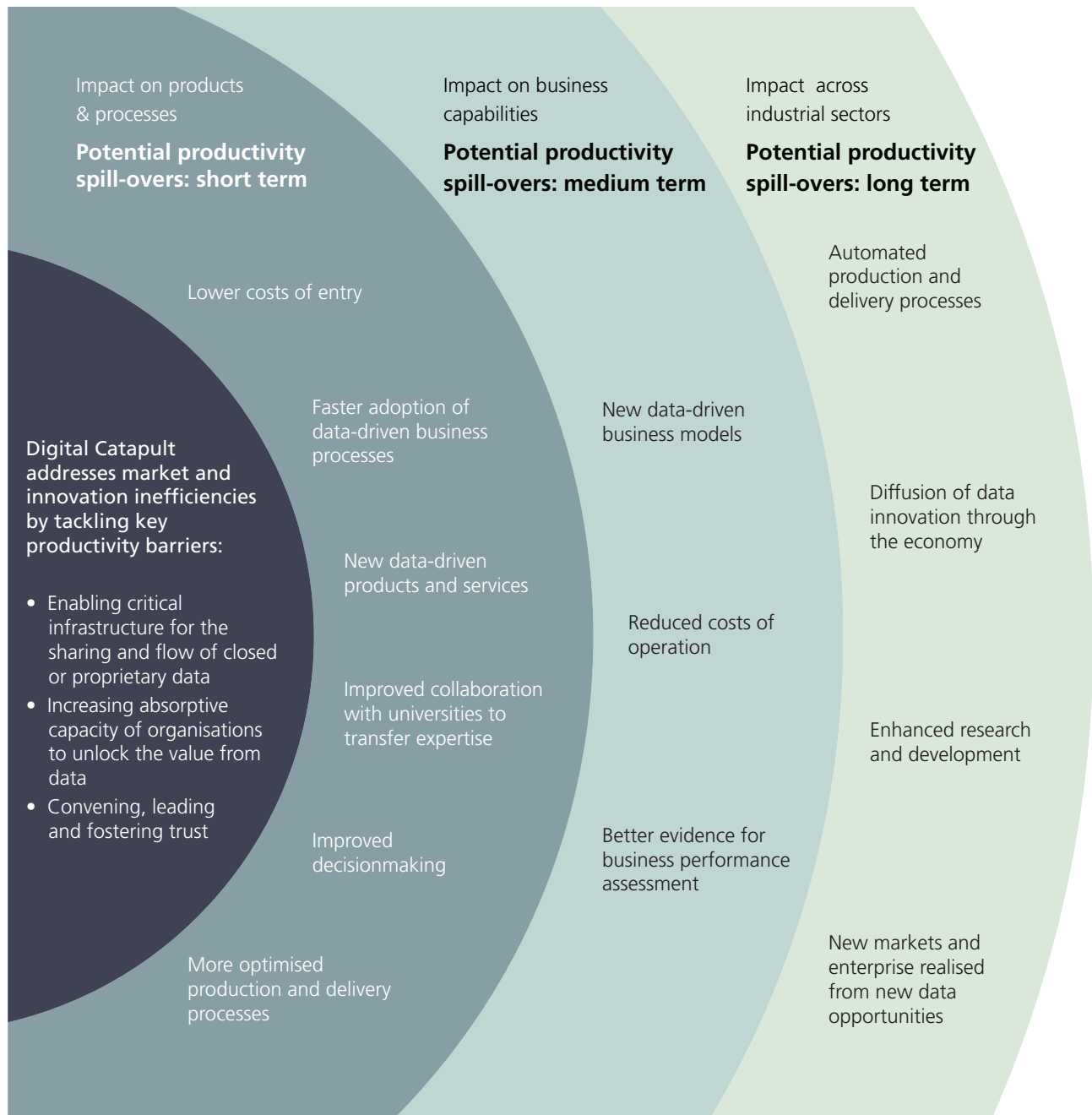
The figure overleaf illustrates the ‘ripple’ effect productivity spillovers could have as a result of the full potential of a data-driven economy being realised. The Digital Catapult can play a role in this by addressing market and innovation inefficiencies, thereby helping to accelerate the rate at which the ripple effect takes place.

The figure demonstrates how, in the short term, there is first an influence on productivity at the level of innovations for products and processes in the economy. In the medium term, we would expect to see an impact on business capabilities, and in the longer term, an impact on industrial sectors. Given the nature of innovation

in the data-driven economy, longer timescales must be appreciated in order for economy-wide productivity gains to be realised. If realised, such ripple effects might lead to optimised data processes, new enterprise and productivity growth from the diffusion of innovation throughout the economy. The challenge for the Digital Catapult, and other organisations working in this space, is to understand collectively how their activities contribute to this ripple effect. The challenge of attribution versus contribution is one that is well known, but is particularly acute when considering productivity gains at an economy-wide level, as no single activity is likely to lead to long-term gains. Over time, successful innovations may drive substantial changes at the business level as new innovations deliver alternative business models and replace outdated and less efficient processes and decisionmaking. Eventually, productivity gains increase as innovations diffuse through the economy creating further opportunity for productivity growth from additional innovation and enterprise.

This emphasises the importance of the Digital Catapult’s efforts to support the mechanisms to target key productivity barriers as a crucial foundation for achieving wider productivity gains that will cut across sectors, industries and businesses. This provides both a challenge and an opportunity for the Digital Catapult. In order to realise productivity gains, the innovation activities it engages with must not only be taken up within firms and businesses, but they must diffuse outwards so that they work between and across organisations, industries, sectors and the wider economy.

**Figure 4.1: The data-driven productivity ripple effects**





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## Annex 1 Methodology

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The Digital Catapult commissioned RAND Europe to conduct some initial and bounded work that clearly articulates the relationship between the activities and focus of the Digital Catapult and productivity growth to the UK economy. The work includes reflection on process, product and organisational innovation and change and its relationship to productivity enhancement. The main components of the work have included:

- Conducting an initial scoping of the literature and activities of the Digital Catapult.
- Facilitating a scoping workshop with the senior leadership team at the Digital Catapult and those with challenge area responsibilities. A total of 16 staff attended.
- Communications following on from the workshop regarding specific projects with the Digital Catapult CEO, Commercial Officer and Marketing Director and Senior Manager of Creative Programmes.
- Conducting a rapid evidence assessment exploring the relationship between productivity growth and the four challenge areas of the Digital Catapult (incl. cross cutting activities used by the Catapult).
- Providing a framework for the Digital Catapult to better understand its activities in relation to how it

contributes to productivity growth across the UK economy.

- Producing a short report and related project summaries.

To address the questions outlined above, our research drew on two sources of information: desk-based research to carry out a rapid evidence assessment and the outputs from a one-day workshop. The workshop's aim was to: (i) gain a deeper understanding of the relationship between specific projects and activities of the Digital Catapult and productivity growth; and (ii) develop the foundational thinking for the theory of change, specifically focusing on how the Digital Catapult contributes to productivity gains in the UK economy.

A 'theory of change' helps an organisation to identify what it wants to achieve, and the steps it needs to take in order to achieve it. The theory of change can help set out the building blocks needed to deliver on a programme goal, in this case productivity gains, and specifies the range of assumptions about the underlying logic that can lead to desired results.<sup>11,12</sup> The workshop allowed us to develop the Digital Catapult's theory of change in relation to productivity across its four challenge areas.

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## Annex 2      Rapid Evidence Review

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We conducted a rapid evidence assessment in order to provide an overview of the available literature on the relationship between data innovation and productivity. The literature search was designed to capture two broad categories of literature:

- Wider literature on data and creative content innovation and productivity.
- Wider literature on the effect of public funding and public intermediaries on private sector productivity.
- Literature on productivity-related aspects of the Digital Catapult's four challenge areas (Closed Organisational Data; Personal Data and Trust; Creative Content and the Internet of Things).

A number of strings of search terms were developed for each category and sub-category. In order to cover a sufficiently broad range of literature while maintaining a high degree of relevance, each set of strings ranged from general terms (e.g. "ICT" AND "economy" OR "economic") to highly specific terms (e.g. "cloud computing" AND "productivity"). The complete list of search terms is provided in Table A2.1 overleaf.

The search was conducted using EBSCOhost, Google Scholar and a standard Google search in order to ensure coverage of the full range of academic, policy and consultancy literature. The first 100 results of each search (with results ordered by relevance) were screened and relevant documents extracted. No restrictions were placed on date of publication.

Table A2.1: List of search terms used in the rapid evidence assessment

Category of literature	Sub-category	Search terms
Literature on digital innovation and productivity	N/A	<ul style="list-style-type: none"> <li>• "ICT" AND "productivity"</li> <li>• "ICT" AND "productivity growth" OR "productivity drivers" OR "productivity barriers"</li> <li>• "ICT" AND "creative economy"</li> <li>• "ICT" AND "creative economy" AND "productivity"</li> <li>• "digital" OR "digital innovation" OR "digital economy" AND "productivity"</li> <li>• "digital economy" OR "digital innovation" AND "productivity growth" OR "productivity drivers" OR "productivity barriers"</li> <li>• "data" OR "data innovation" OR "data economy" AND "productivity"</li> <li>• "data" OR "data innovation" OR "data economy" AND "productivity" OR "productivity drivers" OR "productivity barriers"</li> <li>• "digital" AND "creative economy" AND "productivity"</li> </ul>
Literature on the effect of public funding and public intermediaries on private sector productivity	N/A	<ul style="list-style-type: none"> <li>• "public spending" OR "public expenditure" OR "public investment" AND "productivity"</li> <li>• "public spending" OR "public expenditure" OR "public investment" AND "productivity growth"</li> <li>• "government spending" OR "government expenditure" OR "government investment" AND "productivity"</li> <li>• "government spending" OR "government expenditure" OR "government investment" AND "productivity"</li> <li>• "government spending" OR "government expenditure" OR "government investment" AND "productivity growth"</li> <li>• "public spending" OR "public expenditure" OR "public investment" AND "ICT" AND "productivity"</li> <li>• "public spending" OR "public expenditure" OR "public investment" AND "ICT" AND "productivity growth"</li> <li>• "government spending" OR "government expenditure" OR "government investment" AND "ICT" AND "productivity"</li> <li>• "government spending" OR "government expenditure" OR "government investment" AND "ICT" AND "productivity growth"</li> <li>• "public spending" OR "public expenditure" OR "public investment" AND "digital innovation" AND "productivity"</li> <li>• "government spending" OR "government expenditure" OR "government investment" AND "digital innovation" AND "productivity"</li> <li>• "government spending" OR "government expenditure" OR "government investment" AND "creative economy" AND "productivity"</li> <li>• "public spending" OR "public expenditure" OR "public investment" AND "creative economy" AND "productivity"</li> <li>• "public-private partnerships" AND "productivity"</li> <li>• "public-private partnerships" AND "productivity growth"</li> <li>• "public-private partnerships" AND "ICT" AND "productivity"</li> <li>• "public-private partnerships" AND "digital innovation" AND "productivity"</li> <li>• "public-private partnerships" AND "creative economy" AND "productivity"</li> <li>• "public intermediaries" OR "public intermediary" OR "public technology intermediaries" OR "public technology intermediary" AND "productivity"</li> <li>• "public intermediaries" OR "public intermediary" OR "public technology intermediaries" OR "public technology intermediary" AND "ICT" AND "productivity"</li> <li>• "public intermediaries" OR "public intermediary" OR "public technology intermediaries" OR "public technology intermediary" AND "digital innovation" AND "productivity"</li> <li>• "public intermediaries" OR "public intermediary" OR "public technology intermediaries" OR "public technology intermediary" AND "creative economy" AND "productivity"</li> </ul>



Category of literature	Sub-category	Search terms
Literature on productivity-related aspects of the Digital Catapult's four challenge areas	Closed Organisational Data	<ul style="list-style-type: none"> <li>• "closed organisational data" AND "productivity"</li> <li>• "open data" OR "closed data" AND "productivity"</li> <li>• "open data" OR "closed data" AND "productivity growth"</li> <li>• "open data" OR "closed data" AND "economy" OR "economic"</li> <li>• "open data" OR "closed data" AND "creative economy"</li> <li>• "open data" OR "closed data" AND "creative economy" AND "productivity"</li> <li>• "data exchange" AND "productivity"</li> <li>• "data exchange" AND "productivity growth"</li> <li>• "data exchange" AND "economy" OR "economic"</li> <li>• "data exchange" AND "creative economy"</li> <li>• "data exchange" AND "creative economy" AND "productivity"</li> <li>• "proprietary data" AND "productivity"</li> <li>• "proprietary data" AND "productivity growth"</li> <li>• "proprietary data" AND "economy" OR "economic"</li> <li>• "proprietary data" AND "creative economy"</li> <li>• "proprietary data" AND "creative economy" AND "productivity"</li> </ul>
	Personal Data and Trust	<ul style="list-style-type: none"> <li>• "personal data" OR "trusted data" AND "productivity"</li> <li>• "personal data" OR "trusted data" AND "productivity growth"</li> <li>• "personal data" OR "trusted data" AND "economy" OR "economic"</li> <li>• "personal data" OR "trusted data" AND "creative economy"</li> <li>• "personal data" OR "trusted data" AND "creative economy" AND "productivity"</li> </ul>
	Creative Content	<ul style="list-style-type: none"> <li>• "copyright" AND "productivity"</li> <li>• "copyright" AND "economy" OR "economic"</li> <li>• "copyright" AND "creative economy" AND "productivity"</li> <li>• "copyright" AND "creative economy" AND "economy" OR "economic"</li> <li>• "digital license" OR "digital licence" OR "digital licensing" AND "productivity"</li> <li>• "digital license" OR "digital licence" OR "digital licensing" AND "creative economy" AND "productivity"</li> <li>• "digital license" OR "digital licence" OR "digital licensing" AND "economy" OR "economic"</li> </ul>
	Internet of Things	<ul style="list-style-type: none"> <li>• "internet of things" AND "productivity"</li> <li>• "internet of things" AND "productivity"</li> <li>• "internet of things" AND "economy" OR "economic"</li> <li>• "big data" OR "cloud computing" OR "machine to machine" OR "cyber-physical systems" AND "productivity"</li> <li>• "big data" OR "cloud computing" OR "machine to machine" OR "cyber-physical systems" AND "economy" OR "economic"</li> </ul>



## Annex 3 Case studies of Digital Catapult projects and activities

This appendix provides an overview of the activities of the Digital Catapult and forms the foundation of analysis in Section 3. The data was collected from an initial scoping of the literature, a workshop with the Digital Catapult and follow-on discussions with senior staff members.

### Closed Data Case 1: Greater Manchester Data Synchronisation Project (GMDSP)

The Digital Catapult worked with FutureEverything and Future Cities Catapult to create a Manchester-wide environment that allows the free flow of data between public sector organisations while creating a public facing mechanism for the release of open data. GMDSP built infrastructure through a resource description framework (RDF) linked to data store that allowed Greater Manchester's open data to be linked and queried, which in turn may encourage developers to make use of the data for new commercial product development.

By opening up closed datasets, the project could lay the foundations for an enabling data infrastructure. This may allow an easier and more effective access to datasets

that would otherwise have been closed and underused for commercial purposes. GMDSP also provides an example of how the problems of data liquidity may lead to incomplete markets whereby information asymmetries and associated search and coordination costs are especially high, often between public and private stakeholders, such that new market opportunities may fail to materialise without additional support.

In addition, by coordinating diverse efforts of local councils through the development of a set of standards and best practice that can be shared with other cities, the Catapult addresses the lack of coordination that may have prevented the integration of diverse datasets across Manchester and may build absorptive capacity for organisations to recognise and identify future opportunities more efficiently. For public services in Greater Manchester, the release of data and new products for public services could lead to more optimised delivery and business processes, providing stronger incentives for achieving greater efficiency in the delivery of public services.

GMDSP is now releasing open data for all central and south Manchester boroughs in the country, with a

**Table A3.1: An overview of the activities of the Digital Catapult and their links to challenge areas**

Challenge area	Project
Closer organisational data	Greater Manchester Data Synchronisation Project (GMDSP)
Closer organisational data	Data Catalyser
Personal data and trust	Trust Framework Initiative (TFI)
Personal data and trust	Personal Data and Trust Network (PDTN)
Creative content	The Copyright Hub
Creative content	UAL/CREATE
Internet of Things	Milton Keynes Low Power Wide Area Network Project (MKLPWAN)
Internet of Things	IoT showcase

*This list represents selected projects of the Digital Catapult, after the consultation with the client*

population of 1.5 million of the region's 2.7 million. The release of data may have led to lower costs of entry for businesses to utilise open data from local authorities, supporting the creation of new commercial opportunities, such as the Light Raider app. As firms may have to commit fewer resources to gain access to the data it would be expected to increase their productivity too.

### **Closed Data Case 2: Data Catalyser**

Sharing closed data safely across organisational boundaries has become a major problem that prevents businesses from developing more data-driven products or services. The Data Catalyser is now creating a trusted library of proprietary data sets for restricted access to be used by new companies giving insights by harnessing such datasets that may otherwise not be possible. In Fintech, for example, accessing proprietary data in a secure and trusted way would technologically allow and encourage new companies to build new commercial products and thus could drive substantial improvements in easing payment processing, reducing fraud and removing lack of transparency.

In this way, Data Catalyser may overcome the barrier of lacking integrated and trusted data framework conditions and could allow the market to work more efficiently and fairly to overcome the problems of externalities and appropriation that prevent the sharing of data and hinder business growth. The Catapult aims to tackle market inefficiency by enabling businesses securely to combine and analyse proprietary data without compromising intellectual property, data privacy or confidentiality and thus to ensure the better flow of data in the market. For SMEs, it may lower the costs of entering new markets and increase firms' and organisations' awareness of the value that can be unlocked from data, and so increase demand for the use of data in business. Addressing data sharing barriers could enable SMEs to access the shared data and better exploit the economic value of data.

### **Personal Data Case 3: Trust Framework Initiative (TFI)**

The TFI aims to create a consumer-centric set of guidelines that empower the individual if they choose to share their data. Empowering individuals to share their

data may address the lack of consumer trust and privacy concerns that could hinder the data sharing benefits for individuals and businesses. By creating infrastructure and framework conditions in which to nurture trust between diverse market players, TFI could systematically address the inadequate flow of data in the economy to unlock new economic value from data.

By addressing these barriers, it is anticipated the TFI could lead to more optimised product development, distribution and delivery processes that could deliver productivity benefits at firm level, but also have implications for business models in various sectors, in particular retail, financial services and healthcare.

### **Personal Data Case 4: Personal Data and Trust Network (PDT)**

As the internet becomes increasingly central to our everyday social and economic activity, significant amounts of personal data are stored online. The future development of the online economy is likely to need the successful generation and management of personal data to inspire consumer trust and confidence to use online services. The Digital Catapult via the PDT established a community from corporates, universities and SMEs to create a research roadmap to try and unlock the opportunities and challenges around the use of personal data, develop trust and change behaviours. The PDT could provide an important leadership role in shaping the key priority areas and convening experts in research, technology and business. It may help provide coordination and identify the system level failures to be challenged to try and ensure the development of the data economy.

### **Creative Economy Case 5: The Copyright Hub**

The Digital Catapult's development of the Copyright Hub, in partnership with the Copyright Hub Foundation, has the vision of creating a functional marketplace for rights on the internet via a licensing model. The idea behind the Copyright Hub is to improve the ease of purchasing, or obtaining permission to use, somebody else's work. It provides a way to manage and protect the copyright of individual users' creative work.<sup>13</sup> The Digital Catapult has partnered with the Copyright Hub Foundation to create an online

<sup>13</sup> Copyright Hub (homepage). 2015. As of 11 September 2015: <http://www.copyrighthub.co.uk/>

platform that builds out foundational architecture for web-based licensing that allows users trade copyright material with a single click. By focusing on reducing the transactional friction in licensing for the legitimate reuse of digital content, the project could open up new opportunities for digital content producers and may create an informal regulatory framework to support the value of digital content.

From a productivity perspective, the Copyright Hub may provide an infrastructure platform for both increasing the transactional efficiency of licensing and reducing the costs and inputs of time spent searching for copyright holders and working through licence agreements. If the licensing cost can be reduced, new market opportunities may be opened up to wide groups of users, allowing small businesses, professionals and amateur innovators to unlock trapped value in copyrighted material and monetise creativity and content reuse in new ways in the connected digital economy. By targeting a known infrastructure barrier to create the platform and conditions for licensing to occur, it may unlock an opportunity to increase productivity in the short term for creators and users of creative content, but also may address the challenge of reducing firms' cost to help drive productivity via enterprise. The Copyright Hub can also be developed for use to trade any intellectual property

### **Creative Economy Case 6: UAL / CREATE**

CREATE and the Digital Catapult partnered to develop 'a set of copyright information tools that are responsive to the needs of primary creators and creative businesses in the digital world.'<sup>14, 15</sup> The Digital Catapult in partnership with CREATE and the Copyright User project produced a series of events run within the Creative challenge area focused on understanding copyright law for different artistic and creative digital groups including photographers, musicians and the archive sector. Such groups may lack awareness of copyright law and potentially lack skills and knowledge of how to best protect their work. The workshops are designed to provide sector specific guidance for independent creators and digital SMEs within the creative industries to help them

make the best decisions regarding copyright, licensing and capture the potential value of creative work. It also brings together communities of individuals and SMEs to exchange experiences, knowledge and best practice with the expected effect of overcoming inefficiencies in the licensing and reuse of digital content and thus may increase the productivity of digital innovators and producers of digital content.

By taking a leading role in increasing the knowledge of copyright law and providing guidance on appropriate practice, the Digital Catapult – in conjunction with partners – could overcome barriers such as lack of knowledge surrounding opportunities from data and creative content, and build the absorptive capacity of SMEs to engage in licensing that may otherwise restrict the economic opportunities from creative content. In doing so this may connect with productivity drivers around the development of stimulating markets in digital content, expanding enterprise in the digital economy and supporting the wider diffusion of digital innovation through the economy.

### **IoT Case 7: Milton Keynes Low Power Wide Area Network Project (MKLPWAN)**

The Digital Catapult is working in collaboration with the Future Cities Catapult, Milton Keynes Council, the Open University and British Telecom to develop what the Digital Catapult considers to be 'one of the first large-scale, pilot/demonstrators for IoT telecommunications in the world.'<sup>16</sup> With an overarching aim to generate a city-wide, open access, demonstration platforms using licence-free wireless sensors, the Milton Keynes Low Power Wide Area Network (MKLPWAN) project could provide a stable technology environment for new products and services in the rapidly advancing field of IoT to be tested and scaled-up. MKLPWAN relies on a large scale open access platform providing a connected sensors infrastructure, on which enterprises can develop new commercial applications.

The project aims to drive creation of a more efficient data infrastructure to allow new and existing

<sup>14</sup> Meletti, B. 2015. *Chronicle Collaboration: CREATE, CopyrightUser.org and the Digital Catapult*. As of 10 September 2015: <http://www.create.ac.uk/blog/2015/06/11/chronicle-collaboration-create-copyrightuser-org-and-the-digital-catapult/>

<sup>15</sup> Meletti, B. 2015. *Chronicle Collaboration: CREATE, CopyrightUser.org and the Digital Catapult*. As of 10 September 2015: <http://www.create.ac.uk/blog/2015/06/11/chronicle-collaboration-create-copyrightuser-org-and-the-digital-catapult/>

<sup>16</sup> Digital Catapult (2015). 'Milton Keynes Low Power Wide Area Network Project'. As of 11 September 2015: <http://www.digitalcatapultcentre.org.uk/project/mklpwan/>

enterprises to adopt IoT innovation at lower costs. The city-wide open access to sensors applications seeks to increase the awareness of business and consumers to highly innovative commercial applications and aims to lower the risk of new investments for firms. The collaborative nature of the project could help increase coordination among the various actors and foster knowledge spillovers.

In the short term, adopting IoT telecommunication at the city level could have nearer term effects on reducing operations costs, optimising production processes and improving business intelligence at the level of the city and of local enterprises. Knowledge spillovers and open access platforms could make it easier and more efficient for firms to enter into IoT markets and provide new commercial applications, potentially creating a powerful network of innovative firms. Over the long term, the creation of an ecosystem based on trust could help companies to scale-up, unlock innovation and drive the adoption of IoT by public and private actors, improving market conditions and leading to the creation of new business models and more efficient data-based products and services.

### **IoT Case 8: Internet of Things (IoT) Showcase**

The Digital Catapult provides a 'space' for new and existing entrepreneurs, SMEs and researchers to

showcase their Internet of Things projects and meet with interested parties. The Digital Catapult has hosted numerous events, meetings and networking opportunities since it was launched in November 2014, bringing together leading industry figures, journalists and entrepreneurs.<sup>17</sup>

By bringing together problem owners and solution providers, the IoT challenge area activities facilitate the exchange of knowledge and foster cross-industry collaboration on specific IoT applications, to enable a potentially faster adoption and deployment of IoT technologies across the UK. By acting as a trusted partner and host, the Digital Catapult could enable a better collaboration between different stakeholders and help to accelerate the development of IoT-related markets.

The IoT Showcase fosters companies' absorptive capacity providing an opportunity for knowledge exchange and learning between organisations, which may lead to organisational change and improved decisionmaking and process efficiency. In the context of the rise of the UK's data economy, by creating synergies between IoT entrepreneurs as well as exposing other sectors and enterprises to new and innovative IoT products and services, showcases could play an important role in reducing barriers to entry and may help the market operate more efficiently, particularly with regard to SMEs.<sup>18</sup>

<sup>17</sup> In 2014, across all challenge areas, the London centre received 120 applications from SMEs for 27 available spaces to showcase at the centre during the launch. The opening season featured 39 events over 32 days, attracting 2010 attendees from 1488 organisations (Digital Catapult 2015 annual report).

<sup>18</sup> Recently, two companies that were part of the IoT Showcase at the Digital Catapult London, Chirp and BleepBleeps, partnered together. BleepBleeps aims to make parenting easier, with a range of hardware that integrates with smartphones. Chirp uses sound to transfer data using a tiny sound clip called a chirp: any data can be chirped, from pictures to payments. BleepBleeps will embed Chirp technology into an upcoming device to be announced, thereby creating a new data-driven innovative product. (see <http://www.digitalcatapultcentre.org.uk/digital-catapult-showcase-companies-team-up/>)