



Digital opportunities and harms

PwC

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Executive summary

Digital has transformed all parts of the economy and is an ever-expanding part of our daily lives. It is generating huge economic value, unprecedented opportunities for society, greater connectivity and more efficient services. However, as well as opportunities, digital also brings new risks and challenges.

In the UK, the Government is taking action to unlock the opportunities that digital presents, including in relation to security, prosperity and democracy, while managing the novel risks. In parallel, action is being taken internationally which could set new norms for the rules that govern digital.

The widespread impacts of digital cut across traditional sector definitions. A robust and complete understanding of how digital can drive both beneficial and harmful outcomes is necessary to respond effectively to the new opportunities and challenges brought on by digital.

Purpose and scope of report

To support this need, PwC was commissioned by the Department for Digital, Culture, Media and Sport (DCMS) to develop a strategic framework for thinking about how government can shape the role of digital in our economy and society based on addressing two questions.

First, we examine how to define the scope of digital and conclude that no one existing definition is sufficient for policy development purposes. Although existing definitions of information and communications technology (ICT) related occupations or sectors, can be helpful for specific policy purposes, a combination of approaches is required to respond effectively to new challenges and opportunities brought on by digital in a holistic way.

Second, we consider distinctively digital characteristics – characteristics that are unique to, or are materially amplified by, digital – and how these characteristics can drive potential harms (or forgone benefits). Potential harms (or forgone benefits) arise where the economy and broader society incur costs and/or fail to capitalise on the opportunities presented by digital.¹ We find that distinctively digital characteristics often appear in combination. In all cases, we find that the relationships between characteristics, opportunities and harms are complex.

We also examine that further evidence is required to inform policy development and suggest the future focus for this work: conducting further analysis and evidence gathering; broadening the analysis; and considering the potential implications of this work on governance, policy and regulation.

The issues we consider are intended to focus on those that we believe are key, rather than to provide a comprehensive assessment of the causes of opportunities and harm for all aspects of digital.

¹ Following HM Treasury's Green Book guidance, we define these harms as either losses of social welfare (a harm) or the failure to realise the full potential (a forgone benefits).

Methodology and analytical framework

We develop a framework with which to analyse how and where the distinctive characteristics of digital drive the most significant potential harms (or forgone benefits) which may justify further policy intervention, based on market (and policy) failures.

Our approach to answering these questions has been systematic, collaborative and iterative. It is based on an extensive review of the relevant literature, two workshops with policymakers and our own analysis and framework development.

Key findings

Defining the parameters of digital

The rapid pace of digitally driven change and the mass uptake of digital innovations have led to a complex landscape: governments, international organisations, industry and academia have developed different definitions and typologies to conceptualise digital. This has led to multiple, often competing, definitions of digital each of which varies in its scope.

A definition and conceptualisation of digital which can be widely accepted and adopted by key stakeholders is a foundation for effective policy making.

Policymakers have traditionally relied on categorisations of sectors, occupations and goods and services to define and measure the economic contribution of digital. For consideration of certain specific policy issues these categorisations can remain helpful. But they are less useful for broader strategic purposes where there is a need to define the scope of digital more holistically to take account of differences in the level of digital intensity² and the potential risk of harm.

We conclude that there are many ways to conceptualise digital. We identify and review existing definitions of digital in six dimensions that capture the key elements and issues for policymakers:

1. **Digital goods and services:** Goods and services can be considered across two axes: the extent to which they are digitalised (i.e. ranging from digital to digitally enabled) and whether they are sold/delivered digitally: using this approach, the only truly non-digital goods and services are those which are non-digital and not sold or delivered digitally.
2. **Digital sectors:** Defining digital from a sectoral perspective is particularly challenging as digital technologies have permeated almost all sectors of the economy to varying degrees. Ultimately, a satisfactory definition of digital sectors needs to be consistent with that of digital goods and services (i.e. the extent to which traditional sectors have been digitalised, ranging from fully digital sectors to digitally enabled sectors).
3. **Digital occupations:** Digital occupations can be thought of as three types: novel occupations that can exist only in the digital age, occupations that are augmented by digital and occupations that are automated by digital.
4. **Digital activities:** Digital activities can be defined as the new and established activities of businesses (producers), employees, consumers and government, often underpinned by data. A helpful distinction is between production activities (including data collection and

² OECD (2019). *Measuring the Digital Transformation: A Roadmap for the Future*. (Link [here](#), accessed March 2020)

processing) and those of consumption (including online purchasing and content generation, both underpinned by data).

5. **Digital business models:** A definition of digital business models builds on the definition of activities and broadens it to consider the broader value chain in terms of: data exploitation, service interaction, target customer, revenue model and labour input.
6. **Digital technologies:** Digital technologies can be classified by reflecting their underlying attributes (service, content, network and device).

The digital ecosystem is complex and no single dimension is able to describe it with sufficient precision to meet all the needs of policymakers. Instead, we find that considering combinations of the dimensions, how they interact and their associated characteristics is more useful for defining the scope of digital. That said, we believe that digital activities and their impact on shaping new business models are particularly useful when considering the novel opportunities and harms that might arise from digital.

Identifying the distinctive characteristics of digital

Identifying and analysing the underlying drivers of harms and benefits arising from digital are key to targeting policy interventions efficiently. There is already extensive work on the characteristics of digital, for example Ofcom's recent paper exploring the key characteristics of online services.³

We examine the distinctive characteristics of digital – characteristics that are unique to, or exacerbated by, digital – and how they may give rise to potential harms (or forgone benefits) for individuals or organisations, recognising that used appropriately they can also deliver important benefits for individuals, businesses and society. In doing this, we incorporate our analysis of the characteristics associated with the six digital dimensions. We find that these characteristics often appear in combinations that we term 'thematic clusters'. These thematic clusters of distinctively digital characteristics are of concern because they correlate to potential harms (or forgone benefits).

Based on our review of the existing literature, a series of workshops with government policy teams and regulators and our own analysis (see Section 3 for further details), we identify six key thematic clusters of characteristics:

- **Ownership and portability of personal data.** Personal data is one of several types of data that underpin digital. Consumers regularly provide it to digital businesses, for example when they search, browse and buy/sell online. The use and value of this data is not always recognised by its owners but is an important, often critical, element in digital value chains, especially as it can be combined with other data to provide business insights. Consumers may not be aware of how their data is being used and stored. This may lead to privacy concerns and violations as well as security breaches.
- **Identity, verification and oversight of digital content.** Digital has transformed the way that we generate and consume content and communicate with each other. The volume of content has grown exponentially with content accessible across the globe at speed. Whilst this creates considerable benefits, it also creates the potential for harm or forgone benefits: for example, content without proper verification or oversight may lead to consumer harms as a result of a lack of accountability.

³ Ofcom (2019). *Online market failures and harms*

- **Transparency of digital technologies, data and algorithms.** Data about personal choices and preferences can be and is frequently collected, for example whilst searching, browsing and buying/selling online. This data can be used by companies to personalise advertising and pricing with a view to influencing consumer choice. If consumers are unclear how their data is being used within digital business models (and/or cannot control it), they may not appreciate what choices and trade-offs they are (implicitly) making when engaging in digital markets and this can lead to distrust in digital.
- **Digital scale, scope and network effects.** In some important digital markets (e.g. search and online advertising), digital has enabled a few to become large, interconnected businesses that span geographies across multiple categories of goods and services. In some cases, these multinational businesses that make up the 'big tech' companies have been able to build their position in the market to a point that potential harms would arise if they were to abuse their market power.
- **The critical role of digital infrastructure and networks.** Digital infrastructure includes connectivity networks (e.g. payment systems and communication networks), enabling infrastructure (e.g. 5G network infrastructure and the cloud) and online services (e.g. search functions). Its critical role is widely evident, not least during the current Covid-19 pandemic where much of the economy has moved to working from home and relying on digital infrastructure. Digital infrastructure underpins both the economy and wider society by enabling us to pay for goods and services, communicate, work and socialise online. Increasingly, the infrastructure and networks which underpin it is part of a global ecosystem: this creates risks and vulnerabilities.
- **The global nature of data and digital.** Digital permeates almost all parts of society and the economy. It allows connectivity and communication across nations and means that businesses can scale quickly and with relative ease. The global nature of digital has implications for all the other thematic clusters.⁴

We conduct a qualitative assessment of these thematic clusters based on potential scale, severity, longevity and the likelihood of causing harms. On the basis of this process, we focus on four thematic clusters of distinctive characteristics:

- Thematic cluster #1 – Ownership and portability of personal data;
- Thematic cluster #2 – Identity, verification and oversight of digital content;
- Thematic cluster #3 – Transparency of digital technologies, data and algorithms; and
- Thematic cluster #4 – Digital scale, scope and network effects.

Developing theories of harm and their implications

For each of the four thematic clusters, we develop a theory of harm which links the relevant digital dimensions to the distinctive characteristics to the resulting market (and policy) failures and, finally, to the potential harms (or forgone benefits). All the relationships are complex with multiple, interconnected factors. To illustrate this, for each thematic cluster, we assess a particular subset of the characteristics, the resulting market failures and the potential harms (or

⁴ We note that measures being taken in some countries, such as China and Russia, may limit globalisation of digital.

forgone benefits) which arise. This means that the theories of harm developed here are not exhaustive. Instead, they demonstrate the key issues arising from selected thematic clusters.

Our key findings are summarised below.

Summary of thematic cluster theory of harm analysis

Thematic cluster	Key characteristics and market failures	Key findings and further evidence required
Ownership and portability of personal data	The value of data in digital business models and the issues arising from an <i>absence of property rights</i> and <i>externalities</i> in relation to personal data	Lack of individual ownership over data, weak portability and interoperability and an inefficient 'market' for personal data drive harms for individuals and society. These include the welfare impacts of loss of privacy and the potential for data abuse and security breaches.
Identity, verification and oversight of digital content	The role of identity and lack of verification in driving <i>externalities</i> which reduce incentives to oversee digital content and communication	Where online content can be created and shared, externalities can arise, especially if it is unclear who is accountable for the consequences of content. As a result, potential harms can affect individuals and society.
Transparency of digital technologies, data and algorithms	The impact of <i>behavioural biases and information failures</i> on consumers' ability to make informed and rational decisions	Individuals can be influenced by digital choice architectures honed on live experiments to make decisions they would not otherwise have and/or to follow recommendations which are biased. Individuals' consumption of digital goods and services may also be distorted where they lack trust or are over confident. Both effects may result in negative welfare impacts for them.
Digital scale, scope and network effects	The characteristics which can cause markets to 'tip' leading to <i>market power</i> in digital markets	Distinctively digital characteristics may make market power more likely in digital markets. The tendency for digital markets to concentrate lead to potential economic harms and may also exacerbate social harms. The absence of effective competition may further exacerbate other market failures and their associated harms.

Report implications, limitations and areas for further research

We identify three areas in which our work could be developed and consider each in turn.

Conducting further analysis and evidence gathering

Additional analysis could be useful in building the evidence base to enable the findings to be tested and refined. This includes: quantification of the scale of the welfare impacts of distorted consumption decisions driven by digital information asymmetries or bias manipulation; analysis of the forgone benefits of reduced consumption of digital content from lack of trust; and, whether and how assigning property rights and developing a stronger market for personal data could reduce this potential welfare loss.

Broadening the analysis to include other aspects of the thematic clusters

Our analysis is intended to inform development of a framework which can be used to shape a strategic approach to digital policy, governance and regulation based on understanding how the distinctive characteristics of digital link to the potential for harms (or forgone benefits). To achieve this, further aspects need to be examined including: deeper exploration of the complex interactions within and across thematic clusters.

Potential implications for governance, policy or regulation

The scope of our work does not extend to assessing the appropriate policy, regulatory or governance responses to particular market failures and their associated harms. However, we anticipate that the findings in this report may be used to consider a number of different aspects of future policy development including:

- The scope of digital policy and regulation;
- Designing policy interventions;
- The value of horizon scanning;
- The regulatory regime; and
- International governance.

1. Introduction

Digital has transformed all parts of the economy and is an ever-expanding part of our daily lives. It has generated considerable economic value and supports jobs across the economy. Digital innovations mean that goods and services are more personalised than ever before; markets have become more efficient with online platforms facilitating connections between buyers and sellers; the global cost of communications has drastically fallen and society's ability to process information has risen.

As well as opportunities, digital also brings new risks. For example: online communications can enable the spread of terrorist material, abuse and bullying or undermine civil discourse and democratic processes; growing online footprints leave individuals vulnerable to breaches of their privacy and cybercrime; increasingly sophisticated data processing techniques can create powerful insights which can be used to support business practices many consider unfair; and the rise of large and powerful digital platform and 'ecosystem' businesses across the economy raises competition concerns.

We are at a juncture where governments and international organisations are considering how to manage the disrupting aspects of digital. In the UK, the government is taking action to maximise the advantages and opportunities digital presents, drive benefits around security, prosperity and democracy, while managing the novel risks. For example, the Online Harms White Paper puts forward proposals to protect users' online safety through a duty of care.⁵ Furthermore, the Government is implementing all six of the strategic recommendations of the Furman Review, which makes proposals to ensure adequate competition in digital markets,⁶ and the Cairncross Review, which considers how to protect quality online news journalism.⁷ In parallel, action is being taken internationally which could set new norms for the rules that govern digital (for example the European Commission has announced plans to update liability and safety rules for digital platforms, services and products, with a new Digital Services Act).⁸

The widespread impacts of digital cut across traditional sector definitions. A robust and complete understanding of how digital can drive beneficial and harmful outcomes is necessary to respond effectively to the range of new challenges and opportunities.

Purpose and scope of report

To support this need, PwC was commissioned by the Department for Digital, Culture, Media and Sport (DCMS) to develop a basis for understanding the role of digital in our economy and society.

For DCMS, establishing clear definitions for describing the scope of digital is complex but important for ensuring clarity on digital policy issues. The cross-cutting nature of digital issues poses a particular challenge and disrupts traditional policy and regulatory approaches. Identifying and analysing the underlying drivers of harms and benefits arising from digital is therefore key to targeting policy interventions in a streamlined and efficient way.

⁵ HM Government (2019). *Online Harms White Paper*.

⁶ HM Government (Digital Competition Expert Panel) (2019). *Unlocking digital competition [The Furman Review]*

⁷ HM Government (2019). *The Cairncross review: a sustainable future for journalism*

⁸ European Commission (2020). *Shaping Europe's digital future*. (Link [here](#), accessed March 2020)

This report examines how to define and categorise 'digital' and develops an understanding of the distinctive characteristics of digital. It also examines how these characteristics can drive potential harms and benefits. We recognise that further evidence is required to inform policy development and make suggestions for the focus of this work.

The long term aim is to inform the strategic implications of digital for policy, governance and regulatory approaches. This work will inform the analysis of gaps in government's policy responses, and identify where new approaches to digital policy might be necessary.

This means that the issues we consider are intended to focus on those that we believe are key, rather than to provide a comprehensive assessment of the theories of harm for all aspects of digital.

We do not examine any policy or regulatory implications which flow from our analysis. This includes institutional implications, for example how regulatory responsibilities could be allocated among existing UK regulators. Furthermore, this work does not make an assessment of any policy, regulatory or governance responses to particular market failures or harms.

Methodology and analytical framework

To help answer the questions posed by DCMS we develop a methodology that focuses on two key questions:

1. What is in scope of 'digital'?

We develop a consistent basis for analysing and understanding the role of digital in our economy and society.

2. What are the distinctive characteristics of digital that cause potential harms (or forgone benefits) which are not addressed by existing policy, governance and regulation?

We develop a framework to analyse how and where the distinctive characteristics of digital drive the most significant potential harms (or forgone benefits) which may justify further policy intervention based on market (and policy) failures. We consider what evidence will be required to develop these interventions, and make suggestions for the focus of this work.

Our approach to answering those questions has been systematic, collaborative and iterative. It has involved:

1. A systematic literature review and desk research on issues relevant to this report (for example market failures, harms and opportunities, typologies, government policy documents etc.). The sources we have reviewed (listed in the bibliography in the Appendix) include:
 - UK and international policy reviews undertaken by government departments and regulators (including the European Commission, the Organisation for Economic Cooperation and Development (OECD));
 - Academic research;
 - Papers prepared by think tanks and civil society organisations;
2. Workshops involving a diverse range of stakeholders. The workshops were used to generate ideas, receive expert insight and challenge and refine our thinking. Participants at these workshops included:

- DCMS digital policy teams (including Digital Regulation & Markets, National Data Strategy, Security and Online Harms) relevant cross-Whitehall policy teams (including The Department for Business, Energy and Industrial Strategy (BEIS), The Home Office, The Cabinet Office) and UK regulators: Ofcom and the Competition & Markets Authority (CMA); and
 - PwC digital and sector experts.
3. Rigorous analysis to bring expert views together into consistent and refined report findings and next steps.

Our approach has been iterative across our two key questions. We approach this topic from multiple perspectives and recognise that the two questions cannot be answered in isolation. That is, our consideration of how ‘digital’ can and should be defined is influenced by our understanding of how the distinctive characteristics of digital can drive potential harms (or forgone benefits) and vice versa. Our work therefore followed a series of iterative steps to draw insights between the areas of analysis.

Report structure

The rest of our report is divided into four further sections:

- Section 2 defines the different dimensions of digital;
- Section 3 considers the distinctive characteristics of digital that may lead to potential harms (or forgone benefits);
- Section 4 assesses the theories of harm and implications and policy of specific thematic clusters; and
- Section 5 sets out conclusions and the proposed next steps.

The Appendix provides a bibliography of the literature that we have reviewed and a list of workshop attendees.

2. Defining the parameters of digital

Introduction

Digital now plays an increasingly prominent role in our daily lives and for businesses across all sectors. The rapid pace of change and mass uptake of digital innovations has led to a complex landscape; governments, international organisations and industry have developed multiple definitions and typologies to conceptualise digital. This has led to multiple, often competing, definitions of digital which vary in scope.

Together, digitisation and digitalisation enable traditional activities to be updated and leads to new practices and activities that are unique in the digital space⁹.

A definition and conceptualisation of digital which can be widely accepted and adopted by key stakeholders is a foundation for effective policy making. In this Section we explore different ways of defining digital.

We consider six dimensions of digital found in policy papers and the academic literature. For each dimension we examine current definitions used by policymakers and regulators. Where relevant, we also outline other approaches that have been suggested for defining digital using the dimension.

We consider and assess the usefulness and feasibility of each of the six dimensions to determine which may be the most helpful for policymakers to define the scope of digital.

We also explore the characteristics of each digital dimension and their economic significance; in the following section we use the economic implications to explore the potential harms (or forgone benefits) associated with specific characteristics. The characteristics we identify are features of digital with significant societal implications, and, consequently, may have the potential to deliver valuable benefits as well as potential harm.

Overall, we find that no one dimension is sufficient in itself to define the scope of digital. Rather, we find that there is a need to take an inclusive approach to defining digital to more effectively identify the distinctive characteristics of digital and the corresponding range of ways in which digital can lead to potential harms and opportunities.

We, therefore, consider the scope of digital to be most appropriately described by the interconnections between the six digital dimensions.

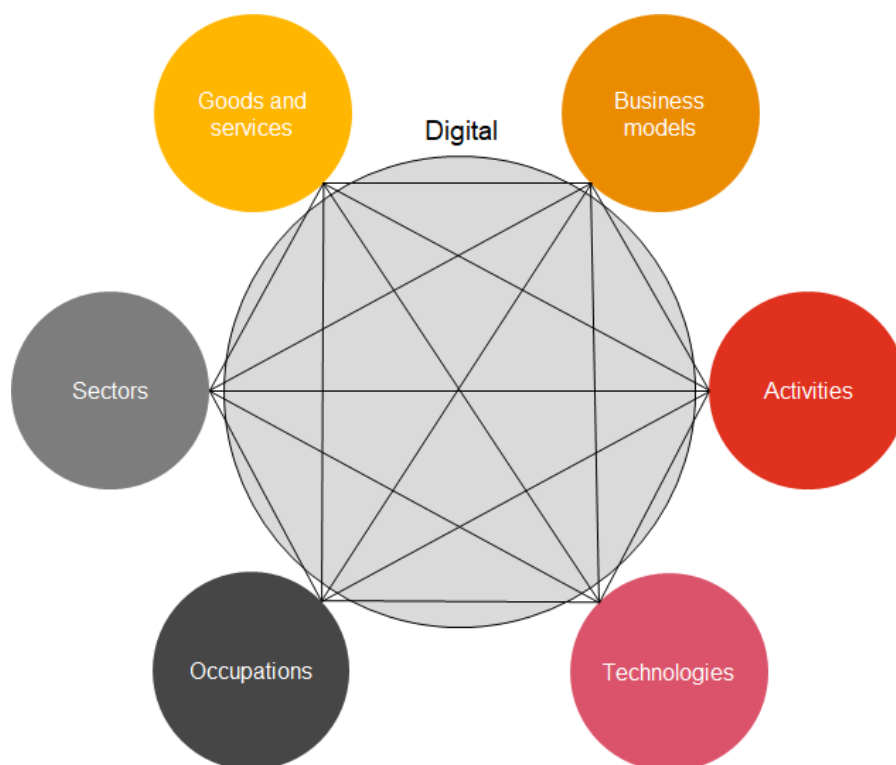
The six dimensions of digital

Our analysis is structured around six related, intersecting dimensions of digital (see Figure 1): digital goods and services; digital sectors; digital occupations; digital activities; digital business models; and digital technologies. We focus on these dimensions as they are used to describe digital in the current literature. All the dimensions are linked to each other as reflected in the lines that connect them; for example, digital activities are a key aspect of digital business models which, in turn, underpin provision of personalised digital services to customers. We consider the

⁹ Digitisation is the process of converting information from a physical format into a digital one, whilst digitalisation leverages digitisation to improve everyday processes.

scope of digital to be all the interconnections (as represented by the circle around the connections between the digital dimensions).

Figure 1: The six digital dimensions



We identify and review existing definitions of digital from six dimensions that capture the key elements and issues for policymakers:

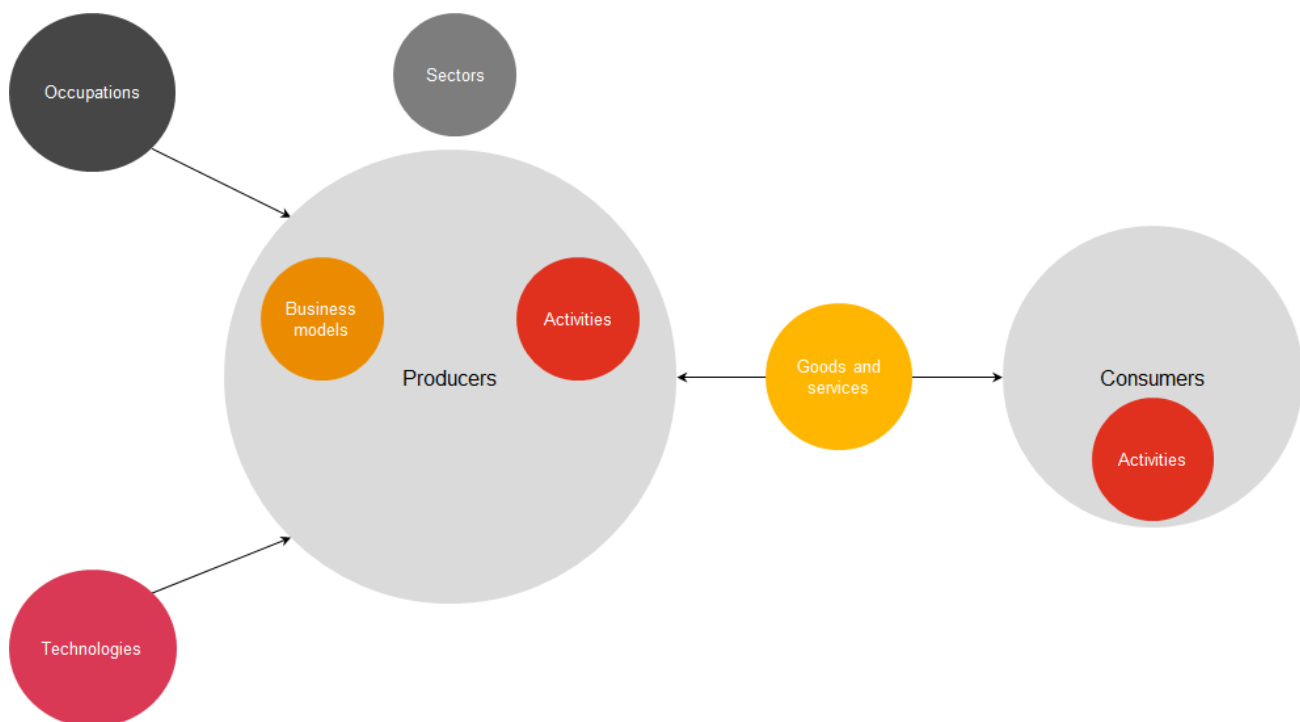
1. **Digital goods and services:** Goods and services can be considered across two axes: the extent to which they are digitalised (i.e. ranging from digital to digitally enabled) and whether they are sold/delivered digitally: using this approach, the only truly non-digital goods and services are those which are non-digital and not sold or delivered digitally.
2. **Digital sectors:** Defining digital from a sectoral perspective is particularly challenging as digital technologies have permeated almost all sectors of the economy to varying degrees. Ultimately, a satisfactory definition of digital sectors needs to be consistent with that of digital goods and services (i.e. the extent to which traditional sectors have been digitalised, ranging from fully digital sectors to digitally enabled sectors).
3. **Digital occupations:** Digital occupations can be thought of as three types: novel occupations that can exist only in the digital age, occupations that are augmented by digital and occupations that are automated by digital.
4. **Digital activities:** Digital activities can be defined as the new and established activities of businesses (producers), employees, consumers and government, often underpinned by data. A helpful distinction is between production activities (including data collection and processing) and those of consumption (including online purchasing and content generation, both underpinned by data).
5. **Digital business models:** A definition of digital business models builds on the definition of activities and broadens it to consider the broader value chain in terms of: data exploitation, service interaction, target customer, revenue model and labour input.

6. **Digital technologies:** Digital technologies can be classified by reflecting their underlying attributes (service, content, network and device).

Taken together, these dimensions make up the digital value chain (the range of processes that businesses and workers do to bring a product from its conception to its end use and beyond). Figure 2 below sets out an illustrative example of this value chain and a set of possible connections between the dimensions. Each dimension contributes to different (and sometimes multiple) parts of this value chain:

- Digital occupations and technologies describe inputs to the production process within the value chain;
- Groups of digital producers of similar goods and services (i.e. digital sectors) – businesses or individuals – can be described in terms of their activities and their business model;
- Digital producers also provide consumers with digital goods and services; and
- Acts of consumption by consumers can also be described through digital activities.

Figure 2: Elements of the digital value chain



Describing the digital dimensions

Below we describe two aspects of each digital dimension:

- How – if at all – the dimension(s) is currently used by UK policymakers to define digital and what – if any – other approaches have been suggested for defining digital using the dimension; and

- The key characteristics of digital highlighted by the dimension. The characteristics are not intended to be mutually exclusive or exhaustive, rather they describe the most significant features. Characteristics are not present in all cases, and certain characteristics will be more prominent in specific areas. Some characteristics are present across multiple dimensions which supports understanding of the connections between each dimension.

Digital goods and services

There are wide ranging definitions of digital goods and services, some more inclusive than others

Our literature review shows that the definition of digital goods and services is drawn broadly in various legislation, institutional regulation and guidance, for example:

- In the EU E-Commerce Directive, an ‘Information Society service’ is defined as one that is “normally provided for remuneration, at a distance, by electronic means and at the individual request of a recipient of services”¹⁰; and
- Under the UK Communications Act 2003, electronic communications mean any information sent between particular parties over a phone line or internet connection and a service provider is someone who provides any service allowing members of the public to send electronic messages whilst a communications provider is someone who provides an electronic communications network or electronic communications service¹¹.

The OECD acknowledges that while there is no single recognised and accepted definition of digital trade, there is a growing consensus that it includes the digitally-enabled trade of:

- Products and services that exist and are delivered solely online; and
- Products and services that are sold online but are delivered physically.¹²

In the US, the Bureau of Economic Analysis defines digital goods and services to include:

- The digital-enabling infrastructure needed for an interconnected computer network to exist and operate;
- The e-commerce transactions that take place using that system; and
- Digital media, which is the content that digital users create and access.¹³

The range of definitions shows that digital goods and services cover a broad scope. The definitions reflect different aspects of digital goods and services depending on the purpose/use of the definition and ability of institutions to collect appropriate data. This highlights the challenge of defining goods and services as “digital” (or non-digital).

¹⁰ EU Regulation (2015). *Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015*

¹¹ ICO. *Guide to PECR, Key concepts and definitions*. (Link [here](#), accessed March 2020)

¹² OECD. *The impact of digitalisation on trade*. (Link [here](#), accessed March 2020)

¹³ US Bureau of Economic Analysis. *Digital Economy, Toward a Digital Economy Satellite Account*. (Link [here](#), accessed March 2020)

An alternative approach is to categorise digital goods and services by the extent of their digitalisation and whether they are sold/delivered digitally

To capture an inclusive and precise definition of digital goods and services, we categorise digital goods and services on two axes:

- The extent of digitalisation (from fully digitalised to non-digital):
 - Digital good or service: A good or service wholly dependent on processing data;
 - Digitised good or service: A good or service that could be analogue but exists in a digital format;
 - Digitally augmented good or service: A good or service that is embedded with digital components;
 - Digitally enabled good or service: A good or service that has been enhanced in some way by digital technology (for example digital technology has been used to develop it);
 - Non-digital or digitalised goods or services; and
- Whether or not the good or service is sold/delivered digitally.

Using this approach, the only truly non-digital goods and services are those which are non-digital and not sold or delivered digitally. This approach is set out in Table 1.

Table 1: Categorisation of digital goods and services

	Sold/delivered digitally	Not sold/delivered digitally
Digital good or service	Software sold online	Software sold in-store
Digitised good or service	Album (CD) sold online	Album (CD) sold in-store
Digitally augmented good or service	Smartwatch sold online	Smartwatch sold in-store
Digitally enabled good or service	Printed report emailed to client	Printed report delivered by courier
Non-digital or digitalised good or service	Potato sold online	Potato sold in-store

A limitation of this classification system is that it can only really be applied on a product by product basis which means it is of limited value in considering the wider landscape. It is also worth noting that it does not fully capture all digital processes of production (for example, food products would be non-digital goods despite potentially being produced/packaged using digital technology).

Digital goods and services are wide ranging and can be described on the basis of several characteristics and economic effects

Another possible approach is to consider the characteristics of digital goods and services. Digital goods and services cover a broad range of products which are often intangible (i.e. consumed or experienced only digitally), instantaneous and increasingly personalised. Some are delivered 'free' to consumers in exchange for their personal data (for example, access to social media

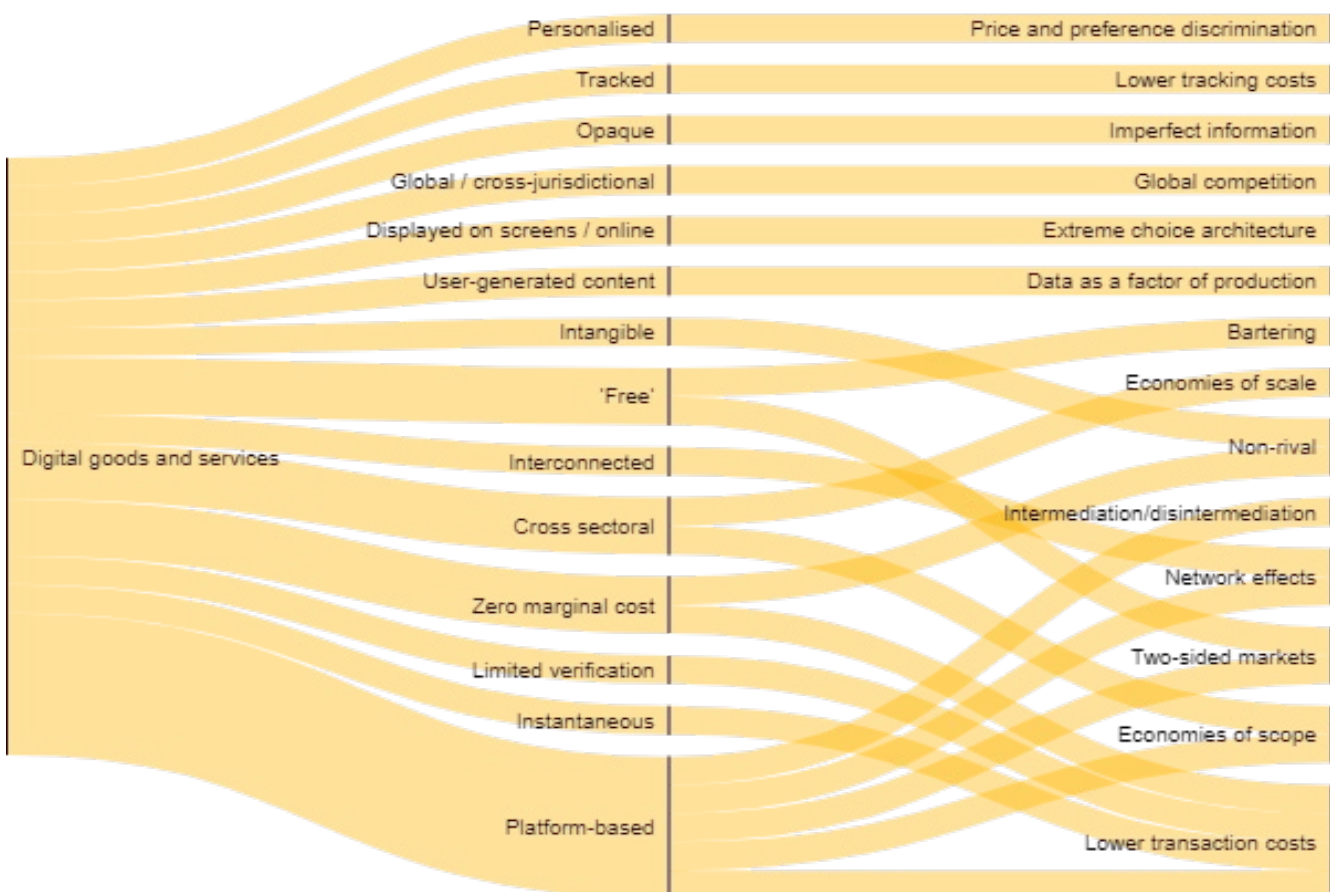
networks or media platforms); elsewhere in the value chain, this data may create revenue for businesses for example, as it is combined and sold for consumer insights.

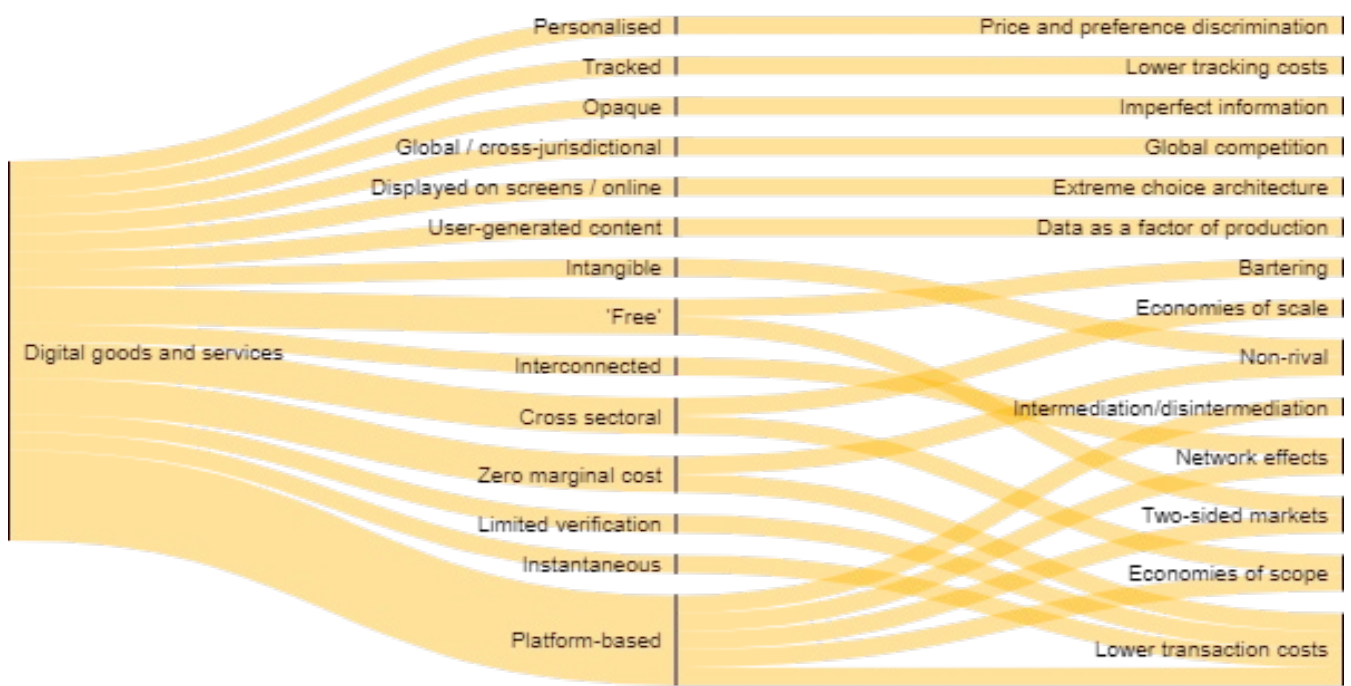
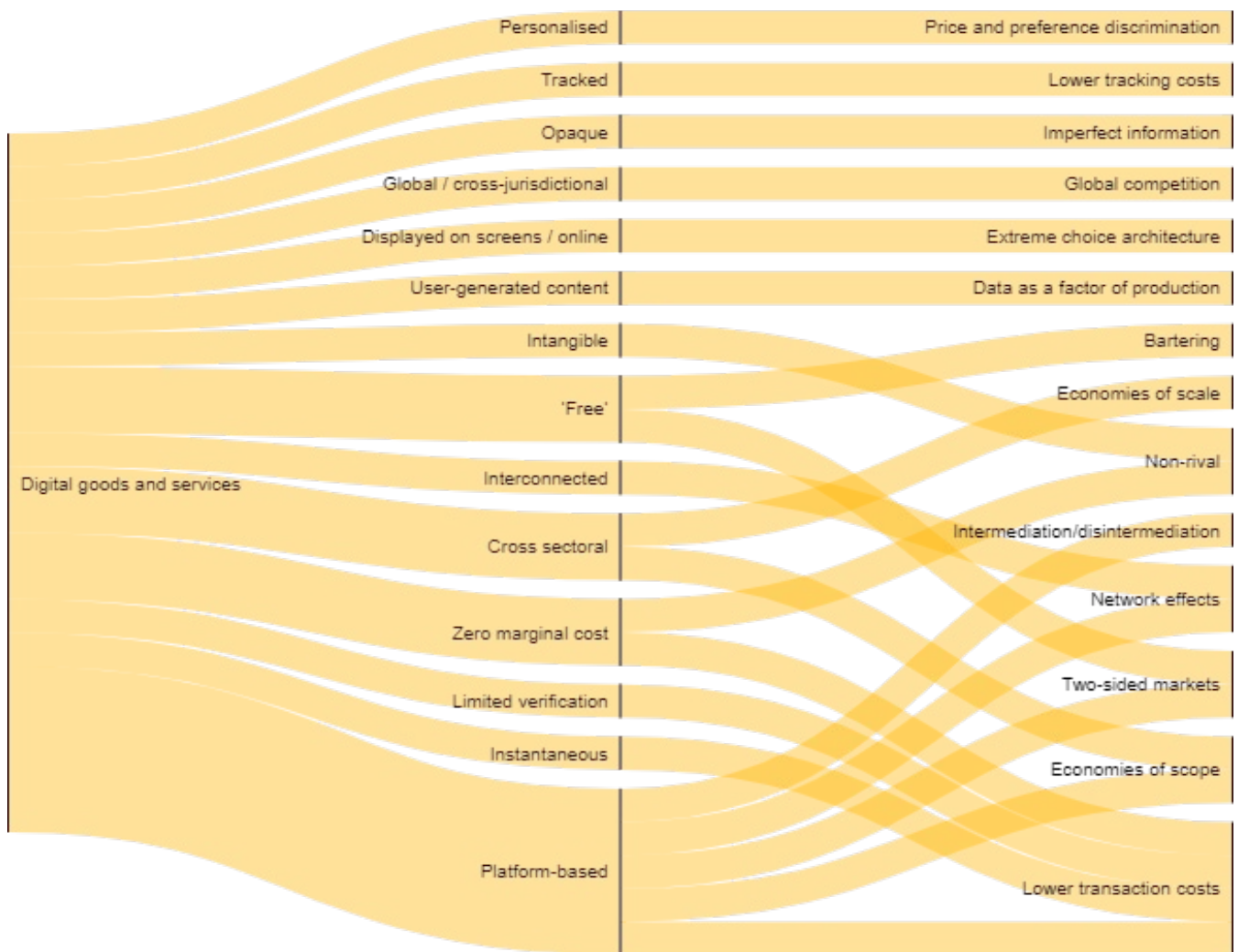
Consumers frequently purchase digital goods and services online. In recent years, the volume purchased through platform based business models has increased steadily. Digital technologies have enabled digital goods and services to be sold and delivered globally by connecting networks of consumers, businesses and governments.

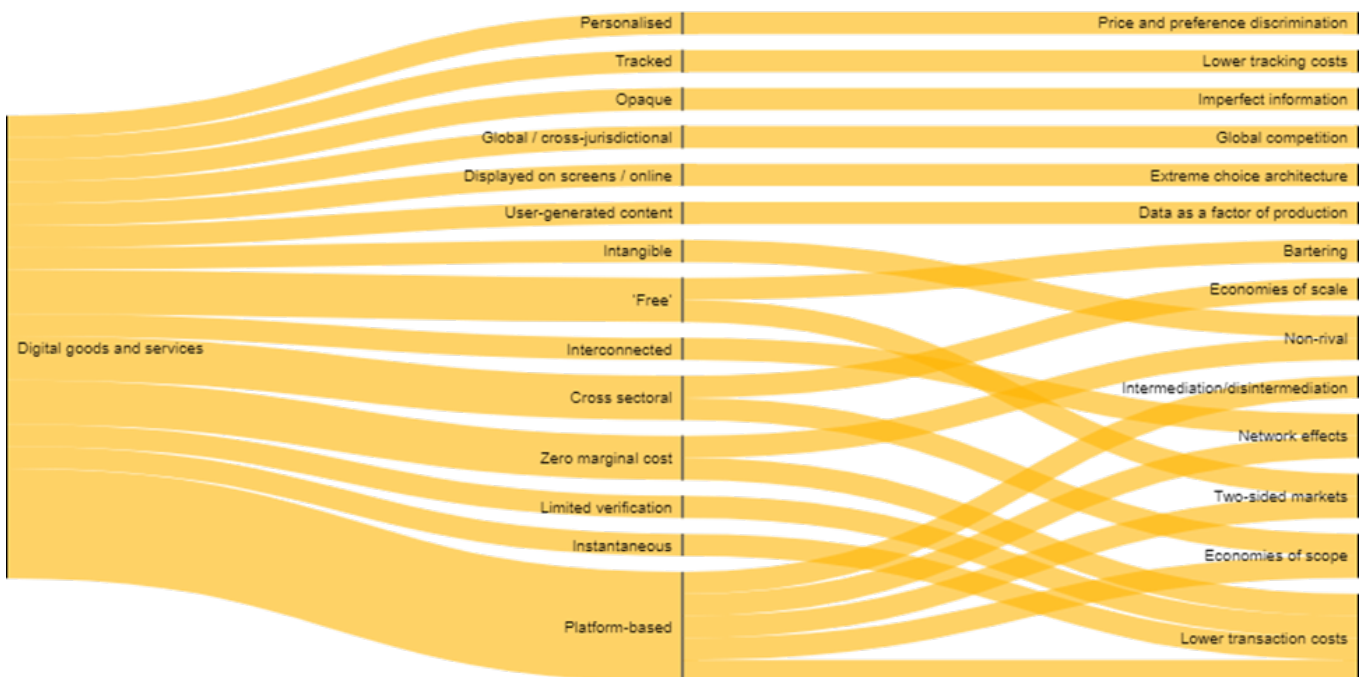
The characteristics of digital goods and services are significant from an economic perspective (see Figure 3):

- Suppliers can personalise them in terms of price and quality, often based on the application of machine learning and AI to increasing volumes of data;
- Many are non-rivalrous which means that their marginal costs of provision are (close to) zero and they can be consumed without others being precluded from doing so (for example, an e-book has a marginal cost of zero);
- Better technology has led to lower transaction and tracking costs;
- Platform-based business models enable two-sided markets in which goods and services are sold/shared (for example, online marketplaces connect buyers and sellers at a much greater scale); and
- Businesses can design services so as to frame choices in a controlled, monitored and centralised way (“choice architecture”), which can impact consumer decision making.

Figure 3: Characteristics of digital goods and services







Digital sectors

Traditional definitions of digital sectors generally focus on industries that supply information and communications technology products and services

We can also think about defining digital in terms of industry sectors. Various attempts have been made by governments around the world to describe digital sectors and to use the resulting definition to measure the size of the “digital economy”, the “internet economy” or the “information economy”. For example, the OECD defines digital sectors as those which fulfil or enable ‘information processing and communication by electronic means’.¹⁴

DCMS builds on this definition and describes digital sectors using group 4-digit SIC codes¹⁵, including:

- Those industries that supply digital goods and services such as computer equipment; and
- Industries that have been ‘digitised’ such as the broadcasting and telecommunications sectors, and also search.¹⁶

These definitions are useful for policymakers as a starting point for considering the significant benefits and impacts of digital on economies across countries. It is acknowledged by the OECD¹⁷ and others, however, that they may not be sufficiently broad (in reference to actors, products and

¹⁴ OECD (2003). *A Proposed Classification of ICT Goods, OECD Working Party on Indicators for the Information Society*.

¹⁵ Standard industrial classification of economic activities (SIC) is a common classification of business activity information for the UK. See Office for National statistics. *Standard industrial classification of economic activities (SIC)*. (Link [here](#), accessed March 2020)

¹⁶ The Department for Digital, Culture, Media and Sport (2019). *DCMS Sector Economic Estimates Methodology* (Link [here](#), accessed March 2020)

¹⁷ OECD (2019). *Measuring the Digital Transformation: A Roadmap for the Future*. (Link [here](#), accessed March 2020)

transactions) to fully describe and define the perimeter of digital. Governments and organisations have sought to produce a broader working definition. For example, the OECD has set out a forward looking roadmap for measuring digital transformation that suggests how to measure the “digital intensity” of sectors using input-output matrices as a means of broadening the scope of the definition.¹⁸ Although this may be useful for certain policy purposes, it may not serve as a perimeter for digital as it rests on a narrow definition of digital in terms of the use of information and communications technologies (ICT) as inputs.

Other approaches to defining digital sectors consider what is being produced and supplied (i.e. whether products or services are digitally ordered and digitally delivered). This has some paradoxical implications: for example, a smart speaker bought in-store is classified as non-digital whilst a bag of potatoes ordered online is digital.

Ultimately, a satisfactory definition of digital sectors, as a perimeter of digital, needs to be consistent with the categorisation of digital goods and services summarised earlier (i.e. digital sectors vs. digitised sectors vs. digitally augmented sectors vs. digitalised sectors).

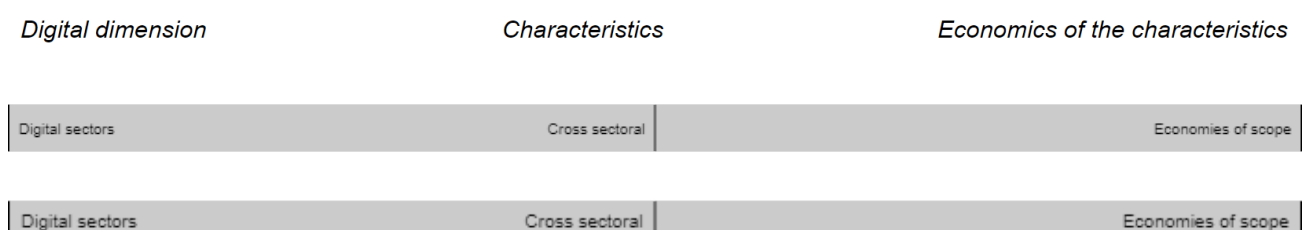
The additional characteristics of sectors are limited

We also consider what characteristics distinguish different types of digital sector from those which are non-digital (see Figure 4). In practice, since sectors are usually defined in terms of groups of businesses producing similar products (goods and services), the additional characteristics of sectors (over and above those of digital goods and services) are limited.

Similarly, the challenges of defining digital goods and services also apply to sectors. For example, some goods and services are delivered online but some are not. Furthermore, traditional sector classifications do not categorise businesses in terms of whether and how they embed digital technologies in their production processes as well as their products. Digital has also created a number of ‘novel’ sectors such as online search which do not fall into all existing classifications.

Traditional sector definitions are, however, likely to remain a helpful way to think about some existing consumer harms (or forgone benefits): for example, food standards issues raised by platform based food delivery services. Nevertheless, the cross sectoral nature of digital means that specific issues may permeate traditional sectors in new ways. To the extent that digital technologies create new approaches to business (for example the sharing economy), they may cut across sectors as they are typically defined. This is significant from an economic perspective as digital enables businesses to scale without mass and means that they can be structured horizontally across sectors so as to take advantage of economies of scope.

Figure 4: Characteristic of digital sectors



¹⁸ OECD (2019). *Measuring the Digital Transformation: A Roadmap for the Future*. (Link [here](#), accessed March 2020)

Digital occupations

Traditional definitions of digital occupations are based on information and communications technology related occupations

An approach to defining digital based on occupations encounters similar issues to those based on sectors, although occupations reflect (labour) inputs rather than outputs as in sectors.

For statistical purposes, DCMS defines the digital economy as 'all jobs in the digital sector (see above definition), as well as all those working in digital occupations in non-digital sectors'. The definition of digital occupations used by DCMS focuses on those working in IT-related occupations (based on codes from the Standard Occupational Classification (SOC)¹⁹) across all sectors. This means it excludes those workers who use digital technologies in roles not currently defined as IT-related and/or other occupations in digitally intensive sectors.²⁰

An alternative approach may consider how an occupation is digitalised

An alternative taxonomy of (digital) work developed by Mrass, Li & Peters focuses on the ways in which occupations may be digitalised: for example, digital technologies may modify or augment tasks by providing platforms to collaborate, share and trade, making people more efficient.²¹ Digital occupations can be thought of in a number of ways. Some are novel and can exist only in the digital age (for example an AI software engineer); others automate jobs that historically humans performed (for example self-checkout machines in supermarkets); finally, some are augmented by digital (for example the many ways we use a computer to boost productivity). This may be a useful way to broaden the definition of digital occupations as a perimeter for digital as it captures a broader set of occupations beyond IT-related roles.

A definition of digital based on occupations may not provide a clear, unambiguous categorisation which is robust to changes in the application of digital technologies across businesses and over time. This does not, however, imply that consideration of digital occupations is unimportant since significant labour market issues have been associated with the growth of digital businesses, for example the use of zero-hour employment contracts and the absence of worker protections in the so-called gig economy.²²

Digital occupations can be defined in terms of labour-replacing and labour-augmenting economics

We also consider the characteristics that can be used to describe the occupations dimension. Increasingly, digital technologies characterise the way we work, driving trends towards flexible and remote working. This can be seen in the emergence of the gig economy in which tasks are allocated tasks via digital marketplaces to workforces that may be anywhere in the world and workers often take on a portfolio of tasks. Occupations can also be automated or augmented.

The characteristics of digital occupations are significant from an economic perspective (see Figure 5):

¹⁹ The SOC is a common classification of occupational information for the UK. See Office for National statistics. *Standard Occupational Classification (SOC)*. (Link [here](#), accessed March 2020)

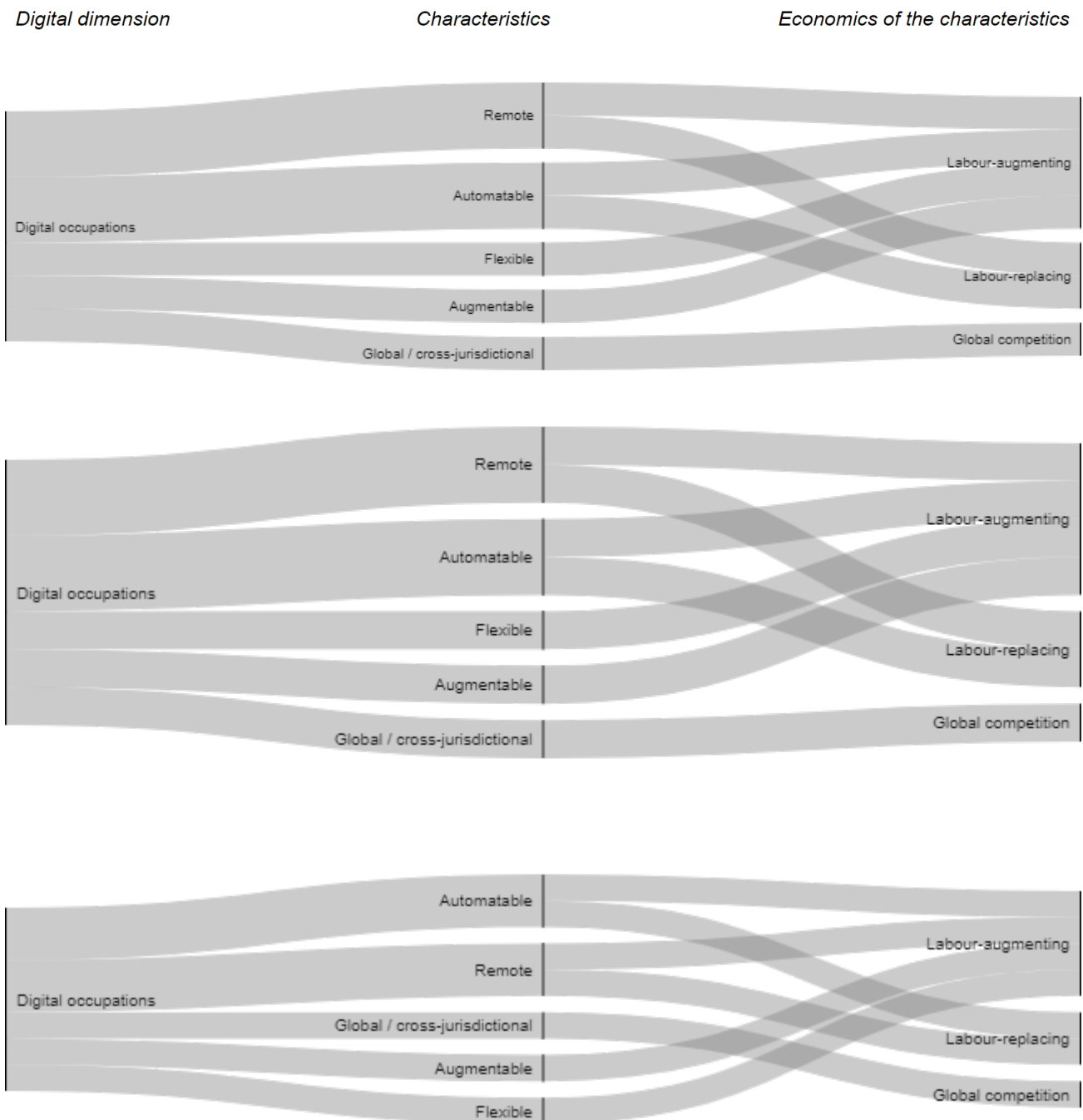
²⁰ The Department for Digital, Culture, Media and Sport (2019). *DCMS Sector Economic Estimates Methodology*

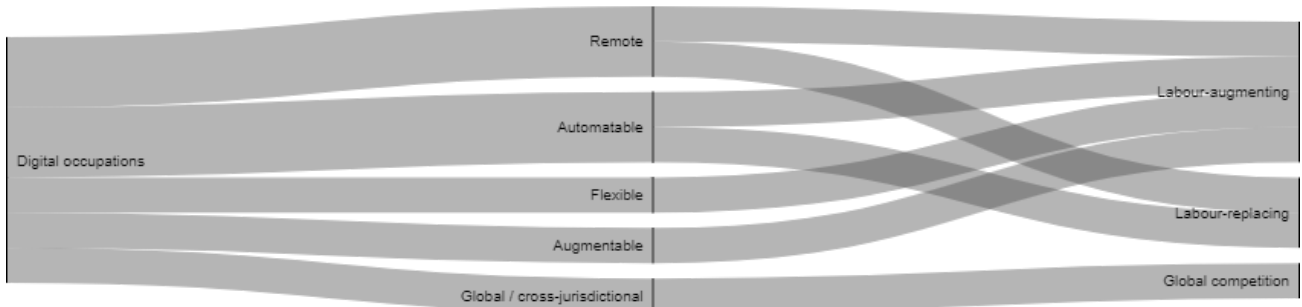
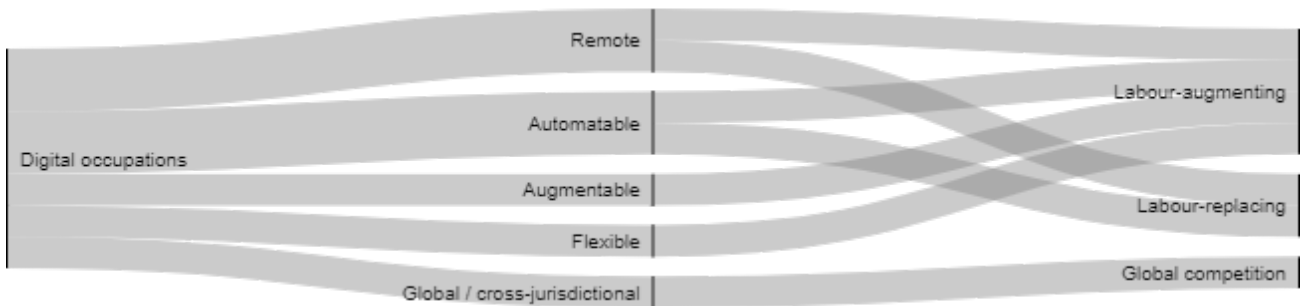
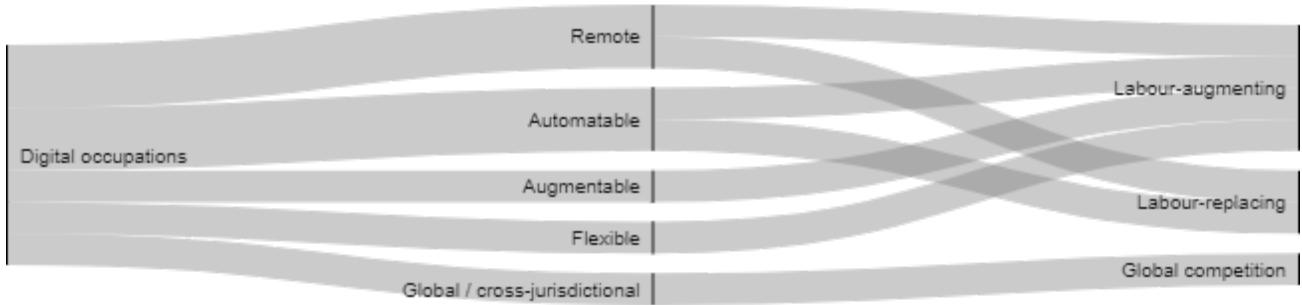
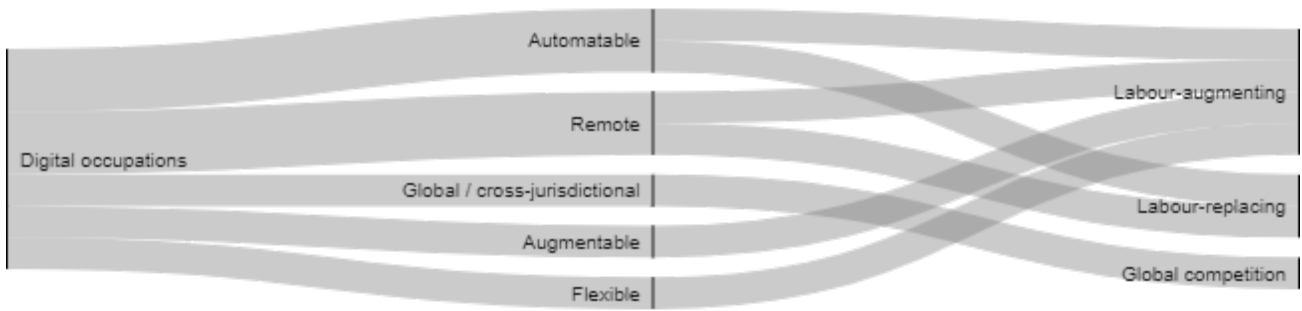
²¹ Mrass, Li and Peters (2017). *Towards a taxonomy of digital work*

²² Taylor for HM Government (2017). *Good work: the Taylor review of modern working practices*

- The distinction between labour-replacing digital technologies (where technology replaces the need for a human workers) and labour-augmenting digital technologies (where technology increases productivity of human workers) is significant as it impacts on the demand for labour;
- The structure of the labour market changes with a greater role for intermediaries (for example gig economy) which creates both flexibility for workers but potential for labour market issues; and
- New roles for labour (for example influencers), creating jobs and, therefore, economic value.

Figure 5: Key characteristics of digital occupations





Digital activities

Any definition of digital activities will need to incorporate new and established activities

Digital activities have become ubiquitous in the sense that much of what we do as consumers or producers is digital in some way. Daily routines feature thousands of such activities (e.g. posting on social media, reading digital content, shopping online, accessing services online) which are often completed remotely, instantaneously, anonymously, interconnectedly and globally.

Digital activities can be thought of as the new and established activities of businesses (producers), employees, consumers and government, often underpinned by data. A helpful distinction is between production activities (including data collection and processing) and those of consumption (including online purchasing and content generation, both underpinned by data).

Personal data is often volunteered, however new technologies allow data to be observed to a greater extent (for example browsing history or physical movements) and inferred (where for example analysis of volunteers and observed data from many people can be used to generate new insights).

Historically, activities have not been used as a way to define the perimeter of the economy. Any definition of digital activities would need to incorporate new and established activities.

One approach is to consider activities driven by the data value chain

Various academic studies have tried to develop taxonomies or typologies of these activities.²³ In addition, Ofcom has characterised online services as a set of activities in its paper on online market failures and harms.²⁴ Looking across these various sources suggests some important attributes of digital activities which are illustrated in Figure 6.

Figure 6: Categorisation of digital activities

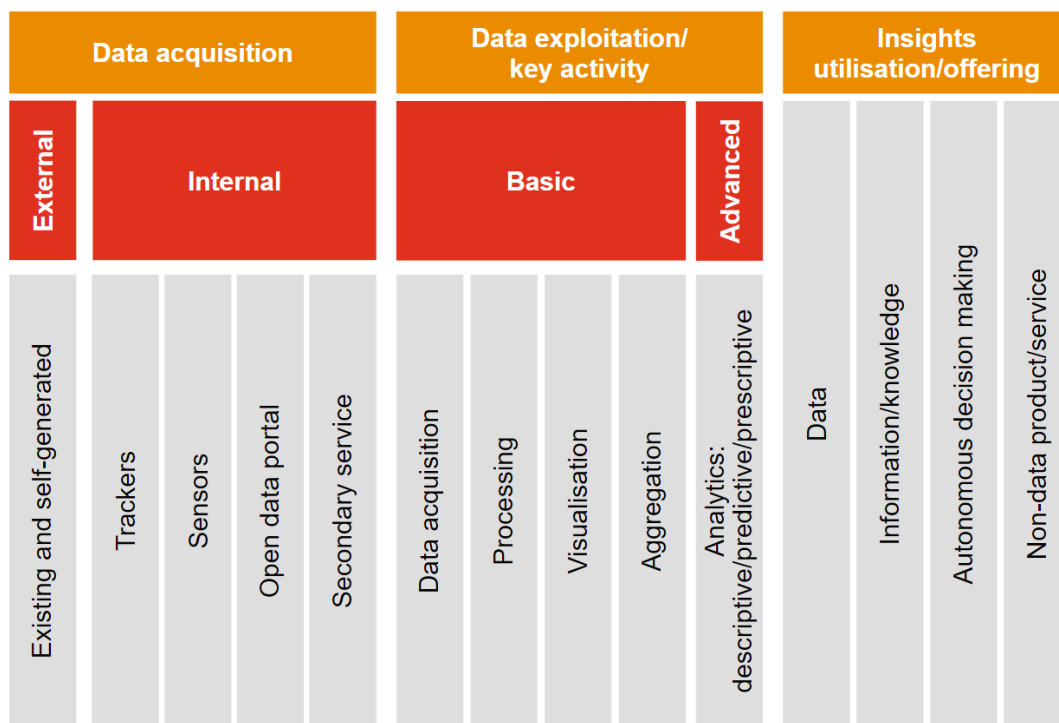


Figure 6 demonstrates the importance of data in digital activities – from data acquisition (the gathering (often between consumers and producers), filtering and cleaning of data) and data usage/exploitation (by producers) to visualisation or content sharing for a consumer. This taxonomy reveals the scale and complexity of the different digital activities which adds to the

²³ See, for example: Bock & Wiener (2018). *Towards a taxonomy of digital business models – conceptual dimensions and empirical illustrations*; Staykova and Damsgaard (2015). *A typology of multi-sided platforms: the core and the periphery*; Rizk, Bergvall-Kareborn and Elragal (2018). *Towards a taxonomy of data-driven digital services*; and Hartmann et al (2014). *Capturing value from big data – a taxonomy of data-driven business models used by start-up businesses*.

²⁴ Ofcom, *Online market failures and harms*, October 2019

challenges when analysing the potential implications for policy, governance and regulation of digital.

Digital activities are defined by a complex set of interacting characteristics

A complex set of characteristics can help to define digital activities. They are interconnected and significant from an economic perspective.

Many digital activities are performed actively, such as creating content online or posting on social media. They can either be done relatively anonymously and/or leave a permanent digital footprint.

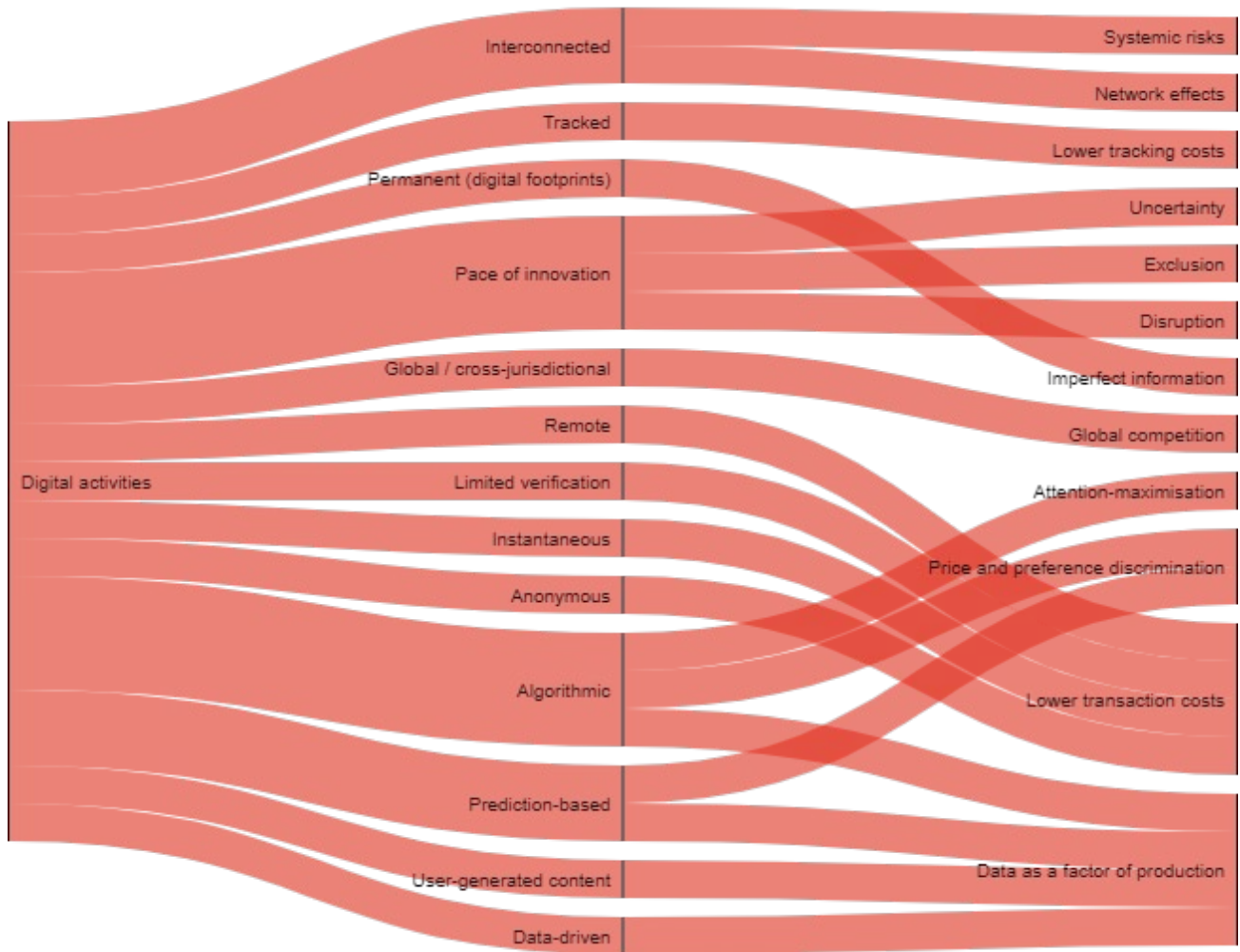
Some are more passive: for example, when using mobile phones, users may be unaware of the data they are generating which may be collected. This data can drive algorithms that can be used to predict consumer behaviours or track digital activities.

Digital activities can also be performed relatively anonymously, which creates challenges with verification of the content.

The characteristics of digital or digitalised activities are significant from an economic perspective (see Figure 7):

- Digital activities have lower transaction costs (e.g. tracking) than their physical equivalents: for example, shopping online provides consumers with a broader selection of goods and services than a physical shop could offer;
- Use of personal data enables price or preference personalisation which can create economic efficiencies but also has the potential to exploit consumers;
- Many digital activities depend on data as a factor of production;
- Digital activities are sometimes designed to maximise attention; and
- Can result in a permanent digital footprint: for example, if false content has been uploaded to the internet it can be downloaded and shared, so that even if it is removed from its source location the information may already have been replicated and passed on.

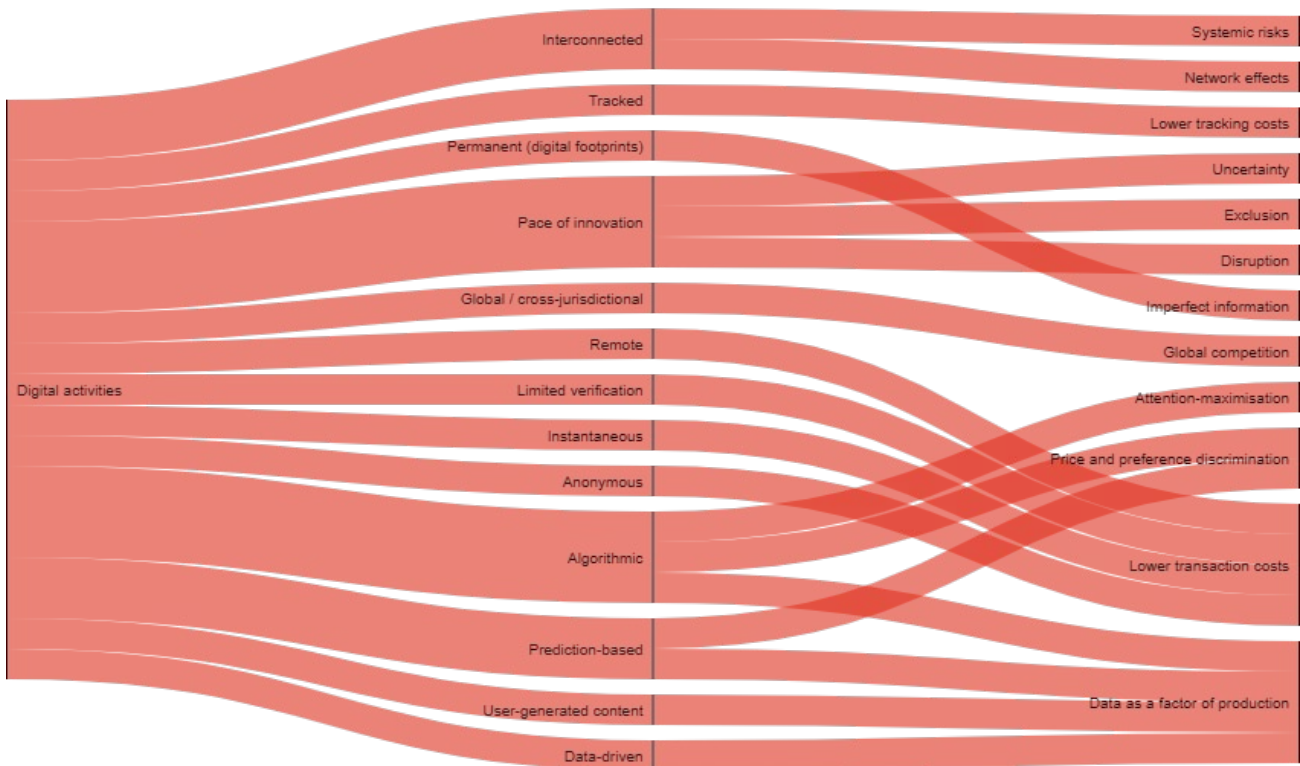
Figure 7: Characteristics of digital activities



Digital dimension

Characteristics

Economics of the characteristics



Digital business models

Different aspects of digital business models have been the focus of a number of policy reviews

A feature of digital is new forms of business models, notably digital platforms which connect distinct groups of users as a basis for generating value.²⁵

The fact that businesses can track choices and behaviour in real-time, for instance by monitoring user behaviour based on web page hits and click throughs, allows them to run algorithms constantly to optimise the products they provide with the long-term aim of maximising profit. In the case of advertising, for example, this often means prioritising traction and maximising attention.

Policymakers have already examined some specific types of business models as part of policy reviews. For example, the CMA²⁶ is currently undertaking a market study into online platforms and digital advertising and the Cairncross Review²⁷ looked at online advertising in the context of the media. Whilst these novel business models have brought significant efficiencies, they also pose challenges for policymakers. We have found no inclusive taxonomy (or typology) of the different models exists amongst policymakers.

Digital business models can be categorised by looking across the entire digital value chain

²⁵ OECD (2014). *Addressing the Tax Challenges of the Digital Economy*. (Link [here](#), accessed March 2020)

²⁶ CMA (2019). *Online platforms and digital advertising market study interim report*

²⁷ HM Government (2019). *The Cairncross review: a sustainable future for journalism*

Various academic studies have classified digital business models.²⁸ Building on the taxonomy for digital activities outlined in Figure 6, we consider the additional elements of digital business models to expand the taxonomy and make it more inclusive yet precise. These are illustrated in Figure 8.

Figure 8: Categorisation of digital business models

Data acquisition				Data exploitation/ key activity				Insights utilisation/offering				Service interaction			Target customer				Revenue model				Labour input						
External		Internal		Basic			Advanced																						
Existing and self-generated	Trackers	Sensors	Open data portal	Secondary service	Data acquisition	Processing	Visualisation	Aggregation	Analytics, descriptive/predictive/prescriptive	Data	Information/knowledge	Autonomous decision making	Non-data product/service	Application based	Product based	Embedded service	B2B	B2C	B2B2C	P2P	Asset sale	Lending/leasing	Licensing	Usage fee	Subscription fee	Advertising	Employee	Freelancer	Advisor

Whereas existing policy reviews have focused on specific aspects of digital business models, the framework in Figure 8 may provide a useful typology for defining the key elements of digital business models as it provides a holistic overview of the data value chain, to the customer segment, revenue model and labour model (which links to digital occupations).

A complex set of interacting characteristics can define digital business models focused on use of data

A complex set of digital characteristics allow digital businesses to scale quickly on a global basis. Several large technology companies are digital platforms which don't create content or provide other services themselves. Instead, they allow users to connect with each other to engage in social and/or economic exchange. They often create revenue through advertising.

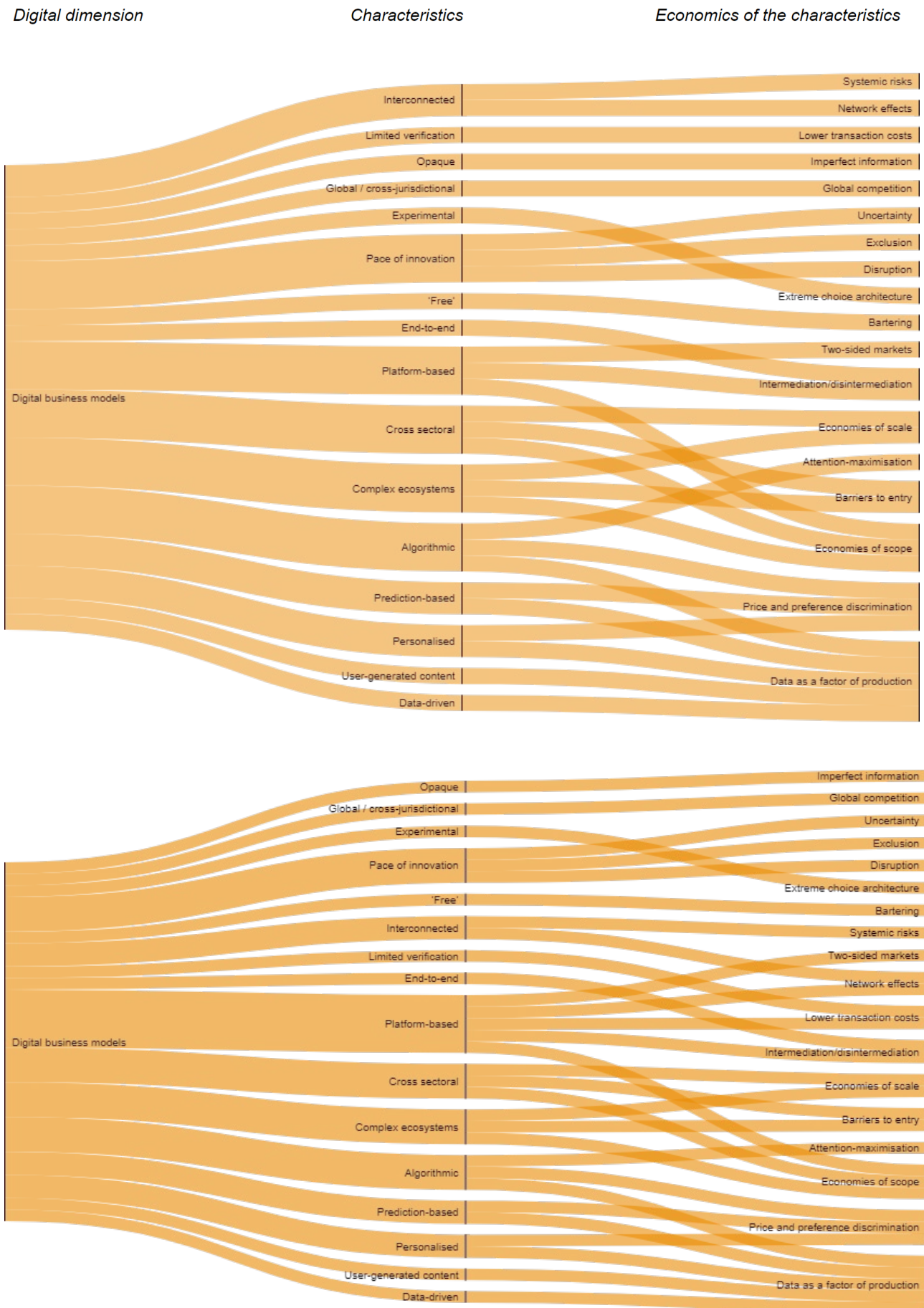
Digital business models are often data driven using prediction, algorithms and experiments to personalise services for consumers.

The characteristics of digital business models are significant from an economic perspective (see Figure 9):

- Data is a key input and could also be considered a factor of production;
- The marginal cost of online services is often effectively zero, which encourages businesses to scale without mass;
- Often business models are highly interconnected and create network effects; and
- Consumers generate value by sharing personal data and algorithms provide companies with the ability to predict consumer behaviour and undertake price and preference discrimination.

²⁸ See, for example: Bock & Wiener (2018). *Towards a taxonomy of digital business models – conceptual dimensions and empirical illustrations*; Staykova and Damsgaard (2015). *A typology of multi-sided platforms: the core and the periphery*; Rizk, Bergvall-Kareborn and Elragal (2018). *Towards a taxonomy of data-driven digital services*; and Hartmann et al (2014). *Capturing value from big data – a taxonomy of data-driven business models used by start-up businesses*.

Figure 9: Characteristics of digital business models



Digital technologies

It is challenging to define digital technologies as they are constantly evolving

It is challenging to define digital technologies as they are so varied. Some digital technologies, for example the internet and AI, are said to be general purpose technologies due to the breadth of their potential applications. This is why they are seen as drivers of growth in the digital economy. Many other technologies (e.g. drones, 3D printers) rely on general purpose technologies to function.

Policymakers have highlighted key digital technologies, however, this may not provide a comprehensive basis with which to define the perimeter of digital. For example, the UK Government set out 'eight great technologies' in 2013, which includes cross cutting digital technologies such as agri-science and advanced materials.²⁹ The Australian Government defines digital technologies as electronic tools, systems, devices and resources that generate, store or process data.³⁰

Other organisations have also produced lists of (key) digital technologies – for example, PwC's "Essential Eight" consists of AI, artificial reality, blockchain, drones, Internet of Things (IoT), robotics, virtual reality, 3D printing. These are, however, limited as they are very specific and not flexible to technological developments over time.

This highlights some important challenges in creating a useful definition for the scope of digital based on technologies:

- The constantly evolving nature of technology (quickly becomes outdated); and
- The need to take account of digital infrastructure (for example internet, 5G, cloud) which enable technology to be utilised.

One structured approach defines digital technologies based on underlying characteristics

Academic research has proposed a more structured approach to defining the parameters of digital technologies based on a hierarchical classification reflecting their underlying attributes (see Figure 10).³¹ This multi-layered taxonomy has been applied to around 50 technologies from Gartner's list of emerging technologies evidencing its effectiveness as a taxonomy of digital technologies.

²⁹ The Department for Business, Innovation and Skills (2013). *Speech: Eight great technologies*. (Link: [here](#), accessed March 2020)

³⁰ Australian Bureau of Statistics (2015). *Frameworks for Australian Social Statistics*. (Link [here](#), accessed March 2020)

³¹ Berger, Denner and Roeglinger (2018). *The nature of digital technologies – development of a multi-layered taxonomy*

Figure 10: Taxonomy of digital technologies

Service		Content						Network				Device							
Human involvement		Data treatment				Input		Output		Multiplicity			Direction		Role of technology		Scope		
Active usage	Passive usage	Collection	Aggregation	Analysis	Execution	Transmission	Digital	Physical	Digital	Physical	1 to 1	1 to many	Many to many	Multi-directional	Unidirectional	Application	Infrastructure	Cyber	Cyber-physical

A complex set of interacting characteristics can define digital technologies

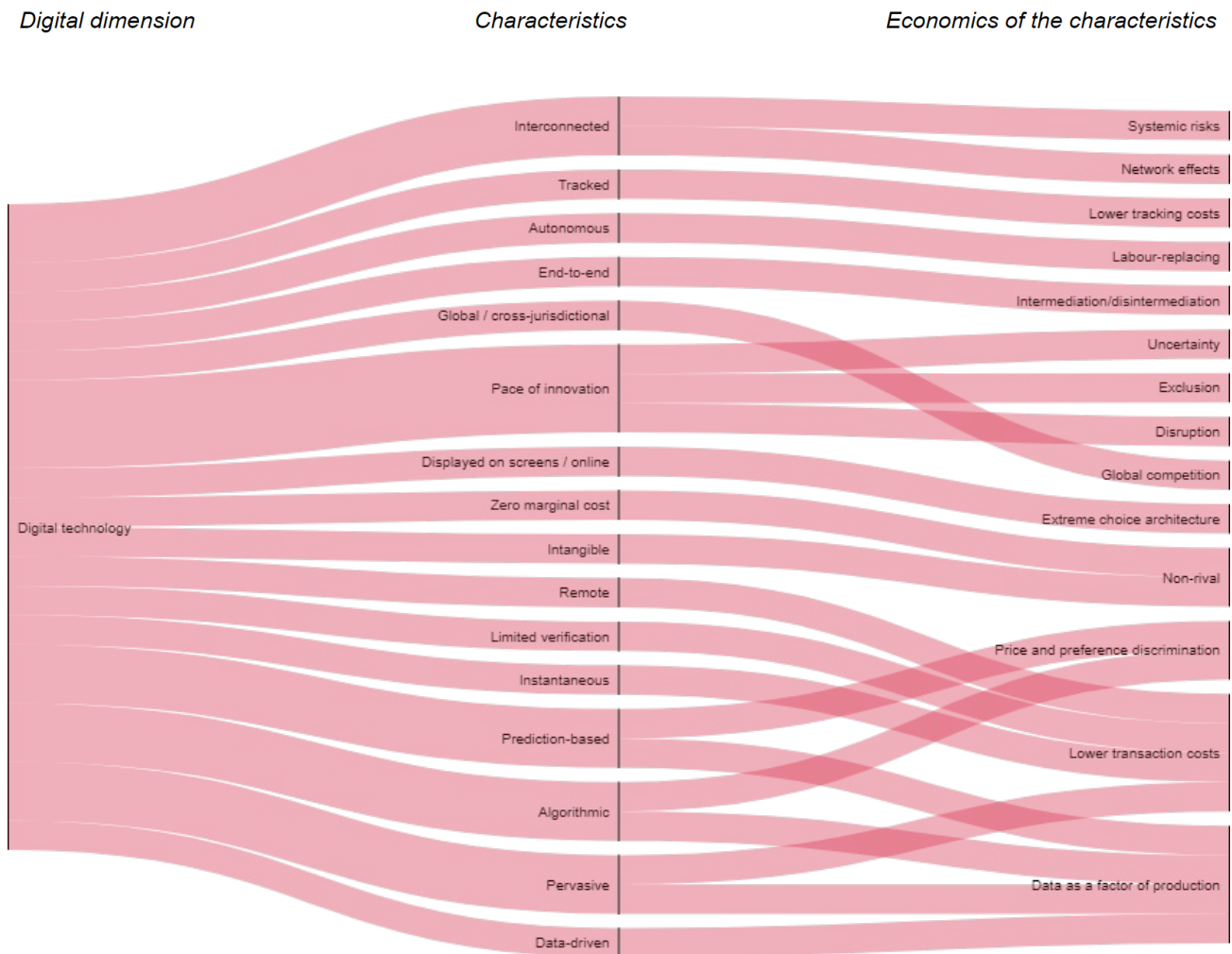
Digital technologies can be described as a complex set of interconnected characteristics. Over the last decade developments in AI have improved the extent to which algorithmic and autonomous systems can outperform humans on many specific but high-level tasks such as voice and image recognition. Since digital technologies can be encoded numerically, they can be scaled reliably, replicated and interconnected. These characteristics are closely reflected in the goods and services that they enable.

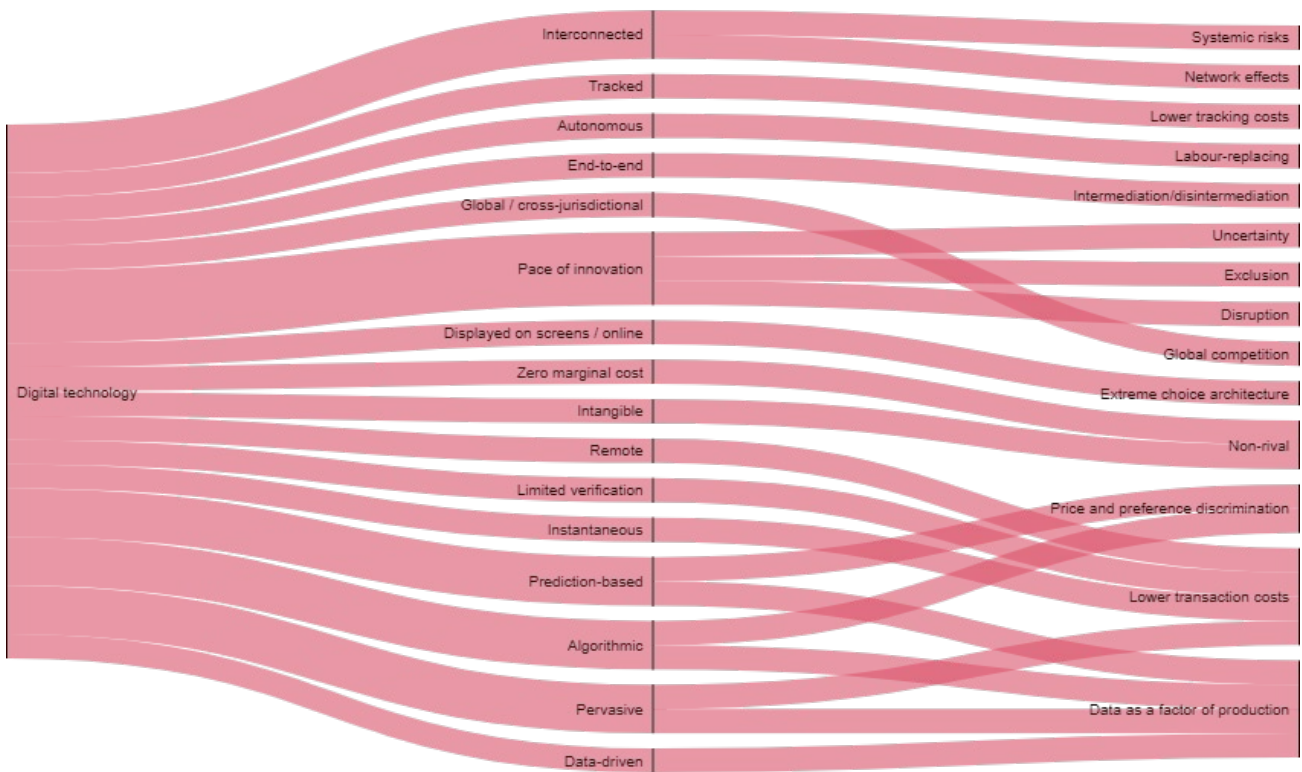
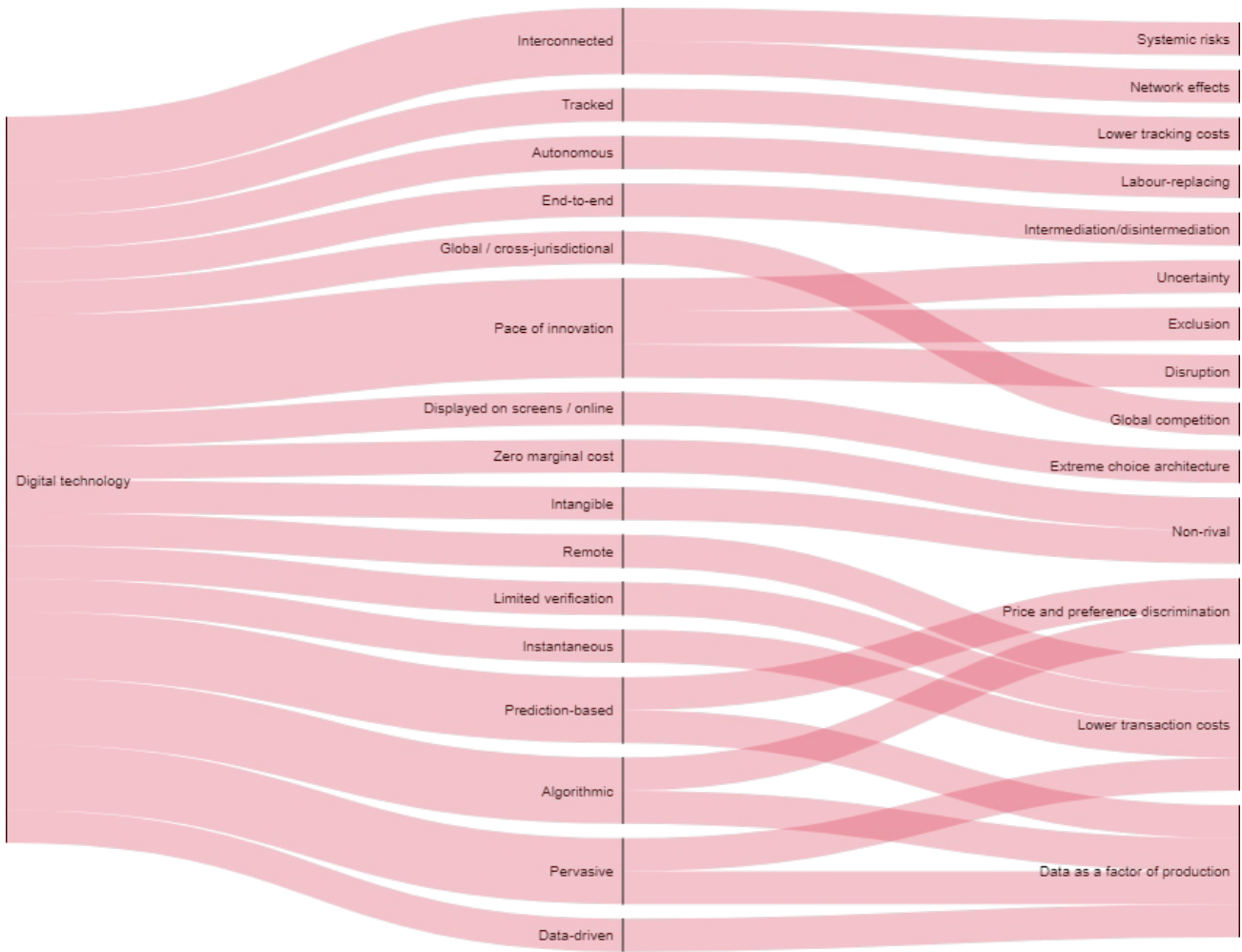
These characteristics of digital technologies are significant from an economic perspective (see Figure 11):

- They have lower costs of search, replication, transport, tracking and verification;³²
- The prediction and algorithmic characteristics enable price and preference personalisation of goods and services and activities;
- Data is a key input and could also be considered a factor of production; and
- There are network effects from the connectedness of digital technologies, which, in certain cases, can lead to systemic risks.

³² Goldfarb & Tucker (2017). *Digital economics*

Figure 11: Characteristics of digital technologies





Key findings

No one definition is sufficient to gain a complete view of the scope of digital, and a combination of dimensions may help

Multiple definitions of digital exist but none alone is sufficient to give an inclusive and precise definition of the perimeter of digital: various taxonomies, typologies and definitions have been created across UK policymakers and regulators, the European Commission, OECD and beyond. Although these definitions are helpful for specific policy purposes, such approaches do not capture all aspects of digital. Furthermore, the rapid pace of change in digital means that some definitions will need to be constantly reviewed and updated.

A robust definition and conceptualisation of digital which can be widely accepted and adopted by key stakeholders is a foundation for effective policy making. It is particularly important for data collection and comparison both in the UK and internationally.

There are many ways to conceptualise digital. We identify six dimensions that capture key elements and issues for policymakers.

To begin to understand the most helpful combination of definitions to define the scope of digital we assess the usefulness and feasibility of each dimension. Table 2 summarises our assessment of the usefulness and feasibility of defining the perimeter of digital by reference to:

- Intuitive appeal – how easily and readily understood the definition is by stakeholders;
- Comprehensiveness – can digital be defined in such a way that everything that needs to be is included;
- Future-proofed – the extent to which a definition will withstand technological developments over time;
- Non-trivial – a meaningful basis for categorising digital and non-digital; and
- Practicality – ease of use by policymakers, for example avoiding the need for constant updates or changes.

Our analysis shows that focusing on digital activities and how they shape business models is the most fruitful approach, especially if they can also be linked to the role of digital technologies.

We conclude:

- The dimensions of digital activities, goods and services and technologies are useful because they can be thought about intuitively, whereas digital occupations are conceptually difficult and limited to inputs. For example, is an IT manager working in the health sector part of a digital sector or not?
- A typology or taxonomy of digital activities can be comprehensive (in the sense that it can be broken down into distinct components that make up the entire set of digital activities). Other dimensions are much more challenging when considering a comprehensive taxonomy (for example, occupations and business models).
- It is difficult to think about ways to distinguish between a digital sector and a non-digital sector and a digital occupation and non-digital occupation. However, there are some non-trivial

taxonomies that have been developed to differentiate digital and non-digital goods and services and activities.

- In terms of practicality, traditional concepts such as sectors, business models and technologies may be more feasible compared with goods and services which are more challenging to group and create a hierarchy.

We find that digital activities are most useful (also in combination with other dimensions) in defining the scope of digital. And in this regard digital occupations and digital sectors are perhaps the least useful.

Table 2: Assessment of six digital dimensions in defining the scope of digital

	Goods and services	Sectors	Occupations	Activities	Business models	Technologies
Intuitive	Green	Amber	Red	Green	Amber	Green
Comprehensive	Green	Amber	Amber	Green	Amber	Green
Future proof	Green	Red	Red	Amber	Amber	Amber
Non-trivial	Green	Red	Red	Amber	Amber	Green
Practical	Red	Green	Amber	Amber	Green	Green

Key: Green: Likely to be useful and feasible; Amber; Potentially useful and feasible; Red: Unlikely to be useful and feasible.

Overall, we conclude that the digital ecosystem is complex and no single dimension is sufficient to define and describe the scope of digital. Instead, we find that considering combinations of the dimensions and understanding how they interact and their associated characteristics is more useful for defining the perimeter of digital. We consider the scope of digital to be the interconnections of all six dimensions.

3. Defining the distinctive characteristics

Introduction

In this section we consider four related questions:

- What potential harms or forgone benefits may arise from digital?
- What are the distinctively digital characteristics that give rise to these potential harms?
- Can these distinctively digital characteristics be grouped into thematic clusters?
- Which thematic clusters should be the focus of further analysis of the theories of harm?

Identifying and analysing the underlying drivers of potential harms (or forgone benefits) arising from digital are key to identifying if there is a need for a policy intervention and how it should be specified in an efficient and effective way. To respond appropriately to the new challenges and opportunities brought about by digital, a coherent and well-articulated understanding of how digital can drive beneficial and harmful outcomes is needed.

Our aim is to develop an understanding of the distinctive characteristics of digital and how they give rise to potential harms (or forgone benefits) for individuals, businesses and society. We identify what harms (or forgone benefits) may arise from digital. We also develop a conceptual basis from which to consider the nature, scale and severity of the potential harms (or forgone benefits) caused by digital. We then identify those characteristics which may cause or intensify these harms. In doing this, we build on our analysis of the characteristics associated with the six digital dimensions analysed in Section 2.

We find that these characteristics often appear in combinations that we term ‘thematic clusters’. These thematic clusters of distinctively digital characteristics are of concern because of their links to potential harms. The mechanism through which they cause or intensify harms is through market and, sometimes, policy failures. Their significance rests in the fact that the market, if left alone, will not provide the optimal outcome in terms of social welfare.³³ We identify six key thematic clusters of characteristics:

- Ownership and portability of personal data;
- Identity, verification and oversight of digital content;
- Transparency of digital technologies, data and algorithm;
- Digital scale, scope and network effects;
- The critical role of digital infrastructure and networks; and
- The global nature of data and digital.

³³ Note that market failures are efficiency concerns, but policy objectives may also fail to be achieved due to distributional impacts which this paper does not discuss in detail

Finally, in this section, we filter these six clusters down to four which we explore further in Section 4 where we develop theories of harm.

What potential harms or forgone benefits may arise from digital?

Potential harms (or forgone benefits) can arise where the economy and broader society incur costs and/or fail to capitalise on the opportunities presented by digital. Following the guidance in HM Treasury’s Green Book, we define these harms as either losses of social welfare (a harm) or the failure to realise full potential (a forgone benefit).³⁴

As a starting point we set out high level policy aims for digital so that we can identify the areas of potential harm (or forgone benefit) that could arise. Informed by our literature review, existing policy statements and workshop discussions, we consider three high level digital policy aims as shown in Table 3. For each aim, we indicate the issues that are relevant when considering the potential impacts of digital on individuals, businesses and society as a whole.

Table 3: High level digital aims

High level aims	Issues for consideration
Safety and security for all	<p>Ensuring that:</p> <ul style="list-style-type: none"> ● Individuals are protected from online harm ● Goods and services are safe to use ● Networks and infrastructure are secure
Prosperity and democracy within society	<p>Ensuring:</p> <ul style="list-style-type: none"> ● Media plurality ● Open debate with access to information ● Respect of privacy and ethics ● Promoting democracy and strong communities
Fairness and efficiency for consumers	<p>Promoting:</p> <ul style="list-style-type: none"> ● Fairness ● Efficiency ● Innovation ● Sustainability ● Competition ● Access and choice across markets

Based on our literature review, our workshops and our analysis, we identify six ‘families’ of potential harm as well as a cross-cutting one. These are summarised in Table 4.

³⁴ HM Treasury (March 2019). *The Green Book: appraisal and evaluation in central government*. (Link [here](#), accessed March 2020)

Table 4: Families of potential harms (or forgone benefits) of digital

Digital content	Digital interactions	Media and other services	Data abuse, loss of privacy and security	Consumers and workers	Competition abuse
<ul style="list-style-type: none"> • Illegal activities (for example terrorist, extremist and child abuse content) • Mental health impacts of viewing harmful/inappropriate content – viewed by children (and others) • Addiction (for example due to attention/information economy) • Distorted decision making (for example misleading content, fake reviews, biased recommendations) 	<ul style="list-style-type: none"> • Hate crime and terrorist activities • Harassment, cyberbullying and cyberstalking • Encouraging or assisting suicide • Incitement of violence • Discrimination and opacity (for example through lack of accountability of automated systems) • Sale of illegal goods/service (for example drugs and weapons) • Organised crime 	<ul style="list-style-type: none"> • Reduced media pluralism • Lower media quality • Disinformation • Polarisation, silos 	<ul style="list-style-type: none"> • Loss of privacy • Misuse/abuse of personal data • Fraud/identity theft • Cyber security attacks and breaches (for example digital infrastructure) • Lack of trust leading to lower digital usage (for example businesses' use and protection of data) 	<ul style="list-style-type: none"> • Unfair price personalisation • Distorted consumption decisions • Harmful business practices (for example misleading claims, pressure selling) • Poorer employment conditions 	<ul style="list-style-type: none"> • Excessive prices • Poor quality • Limited choice • Unfair tying and bundling • Lack of innovation • Exploitative T&Cs

Cross cutting harms: Society and environment

- Climate impact of digital (for example data servers)
- Wider societal impacts (for example loss of human agency)
- Welfare impacts of lower human interaction/empathy
 - Loss of opportunities for those without digital skill sets ('digital divide')

What are the distinctively digital characteristics that give rise to potential harms?

In this part of the section, we analyse which distinctively digital characteristics could drive the potential harms (or forgone benefits) identified above.

We define a distinctively digital characteristic as something which is both:

- **Distinctively digital**, meaning that the characteristic is unique to, or is amplified by, digital. It may be something which is unique to digital (i.e. a feature only made possible by digital technology), for example the use of algorithms to generate content or machine learning technologies to make predictions. It may also be something that is accentuated or intensified by the use of digital technology (i.e. its effect is substantially enhanced by digital technology), for example, price discrimination existed before and exists outside digital, but its impact may be amplified by the use of personal data in the digital value chain which makes individual ‘personalised’ pricing possible when it hasn’t been before.³⁵
- **Harmful**, meaning that the characteristic can be identified as a potential source of harm (or forgone benefit) which we define in terms of a loss of social welfare. The characteristic can cause harm or forgone benefits, or ‘intensify’ a harm, by which we mean increase its severity, magnify its scale, or raise its likelihood of occurring.

To identify the distinctive characteristics of digital that could give rise to potential harms (or forgone benefits), we build on our analysis of the six different digital dimensions in Section 2. We then identify those digital characteristics that make them distinctive and may be associated with causing or intensifying harms.

We identify a long-list of distinctively digital characteristics which have the potential to cause harms. Our long list consists of over 30 characteristics which can be mapped to the digital dimensions considered in Section 2.

Table 5: Distinctive characteristics of digital grouped by digital dimension

Digital goods and services	Digital sectors	Digital occupations	Digital technology	Digital business models	Digital activities
User-generated content	Cross sectoral	Global/ cross-jurisdictional	Pervasive	Algorithmic	User-generated content
Personalised			Interconnected	Personalised	Interconnected
‘Free’		Automatable	Tracked	Prediction-based	Algorithmic
Intangible		Remote	Pace of innovation	User-generated content	Pace of innovation
Interconnected		Flexible	Prediction-based	Interconnected	Permanent (digital footprints)
Instantaneous		Augmentable	Algorithmic	‘Free’	Prediction-based
Opaque			Intangible	Complex ecosystems	Tracked
Platform-based			Limited verification	Platform-based	Limited verification
Displayed on screen/online			Global/ cross-jurisdictional	Pace of innovation	Anonymous
Cross sectoral			Instantaneous	Experimental	Instantaneous
Global/ cross-jurisdictional			Remote	Limited verification	Global/ cross-jurisdictional
Tracked			Autonomous	Opaque	Data-driven
Limited verification			Displayed on screens/online	Cross sectoral	Remote
Zero marginal cost			Data-driven	Data-driven	
			End-to-end	End-of-end	
			Zero marginal cost	Global/ cross-jurisdictional	

³⁵ OECD (2018). *Personalised Pricing in the Digital Era*. (Link [here](#), accessed March 2020)

Can these distinctively digital characteristics be grouped into thematic clusters?

A digital characteristic can sometimes cause harm on its own, but often the characteristics work in combination with each other to cause or magnify harm. For example, several reports analyse how the combination of economies of scale and scope and the presence of network effects cause markets to ‘tip’ leading to abuse of dominance.^{36,37}

The interactions between the harms – either individually or in families – and the digital characteristics, in clusters or alone, are complex. They are often linked to market (and sometimes policy) failures.

Analysing the sources of market failure is helpful in understanding the relationship between potential harms and the distinctively digital characteristics and ensuring that the opportunities presented by digital are realised. Potential harms (or forgone benefits) arise from digital where markets fail and these failures are not adequately addressed by existing policy (i.e. there is concurrent policy failure). The key feature of market failures is that it means markets are not working as efficiently as they could.³⁸ Table 6 summarises the key sources of market failure.

Table 6: Sources of market failure³⁹

Source of market failure	Explanation	Example
Market power	When businesses have the ability to set prices above the competitive level, to sell products of an inferior quality or to reduce its rate of innovation below the level that would exist in a competitive market resulting in a loss of output and economic welfare.	Without effective competition a business can set the price of its goods rather than have to take the market price for it.
Barriers to switching	Costs that users face to switch between services can create barriers to switching.	Loss of personal data when switching between social media businesses or learning costs of swapping between interfaces.
Public goods	A public good is one where individuals cannot be excluded from using it for free and the use by one individual does not reduce availability to others (i.e. it can be used simultaneously by many).	National defence, public radio, street lighting.

³⁶ HM Government (Digital Competition Expert Panel) (2019). *Unlocking digital competition [The Furman Review]*

³⁷ Stigler Center (2019). Stigler Committee on Digital Platforms

³⁸ Therefore, where there is market failure social welfare is not being optimised. It is also important to recognise that digital may give rise to undesirable distributional outcomes and impacts, for example if certain groups of the population or particular sectors are disadvantaged at the expense of other groups and sectors, though we do not focus on this effect here.

³⁹ Adapted from Ofcom (2019). *Online market failures and harms*

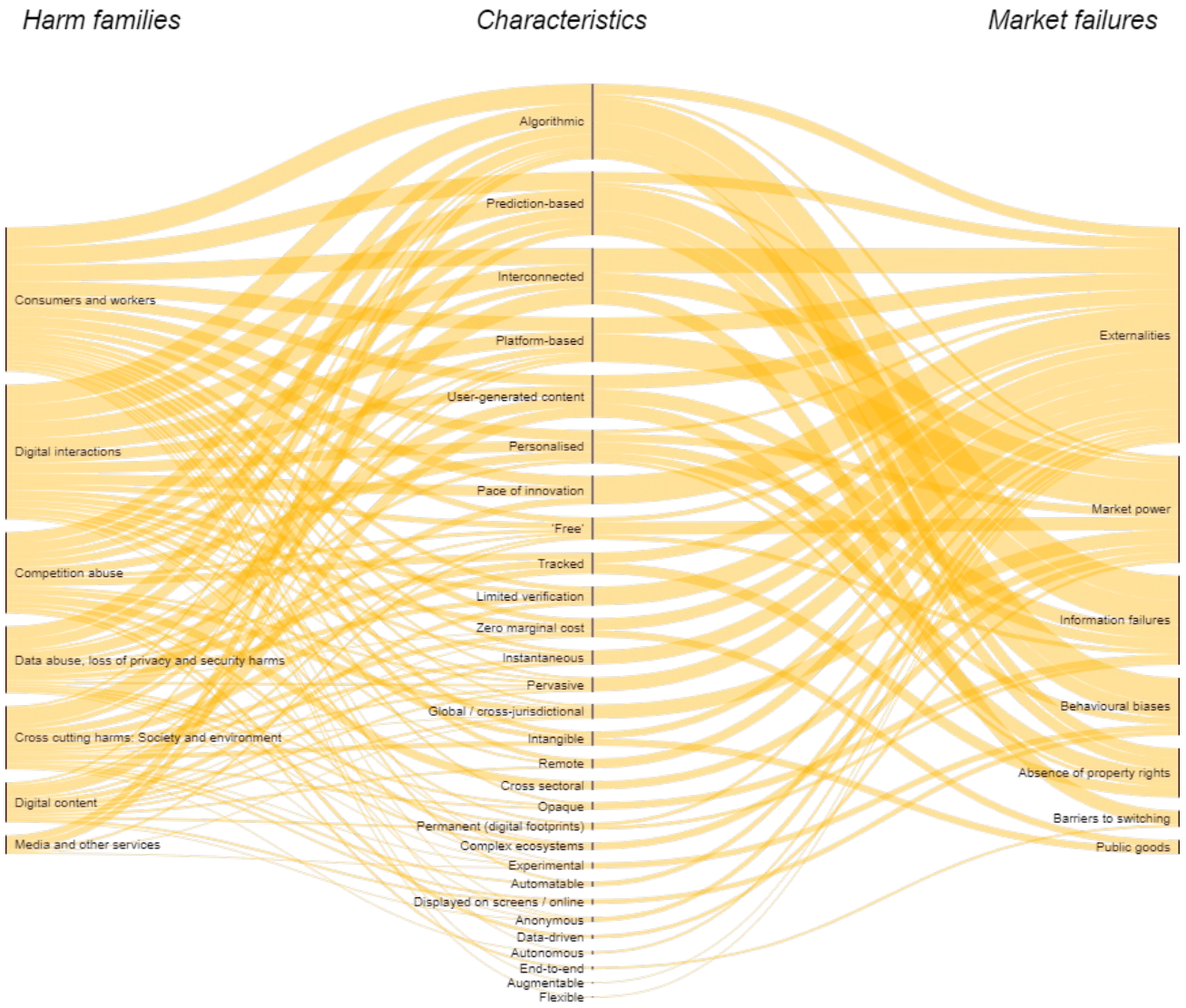
Absence of property rights	Lack of set legal owner in determining how a resource or economic good is used and owned.	A lack of explicit and well defined property rights over personal data.
Information failures	<p>'Imperfect information' is when it is too costly or difficult for a party to have all information relevant to their decision.</p> <p>'Asymmetric information' is when one party knows more than the other.</p>	A consumer not knowing how a company will use their data because the terms and conditions are too long and complicated.
Behavioural biases	Behavioural biases are the ways in which human choices are affected by biases which mean that their decisions are not purely rational.	Limited attention, inertia to change, being affected by framing (how things are presented).
Externalities	An individual's decision may not always consider the impact of their actions on the wider society. One party can affect another positively or negatively, but this effect on others is not a part of their decision-making process.	Algorithms may be designed to keep a user's attention on a site to generate revenue but it may choose to do this by promoting more 'extreme' harmful content to gain this attention.

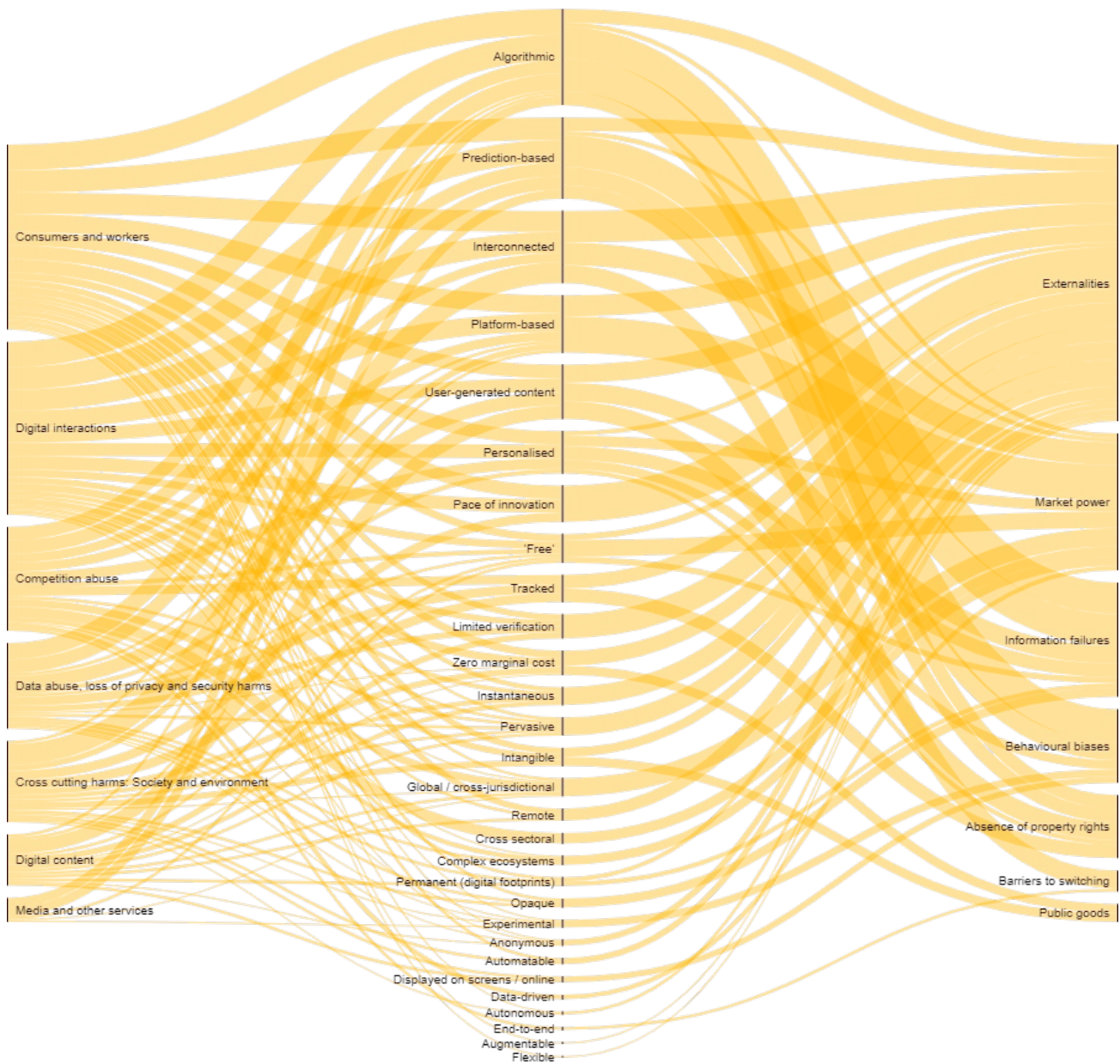
There are interconnected 'many to many' relationships between harms, digital characteristics and market failures. Multiple market failures can interact to generate specific harms and several characteristics may be necessary before harm arises.⁴⁰ In addition, some characteristics may lead or contribute to multiple harms.

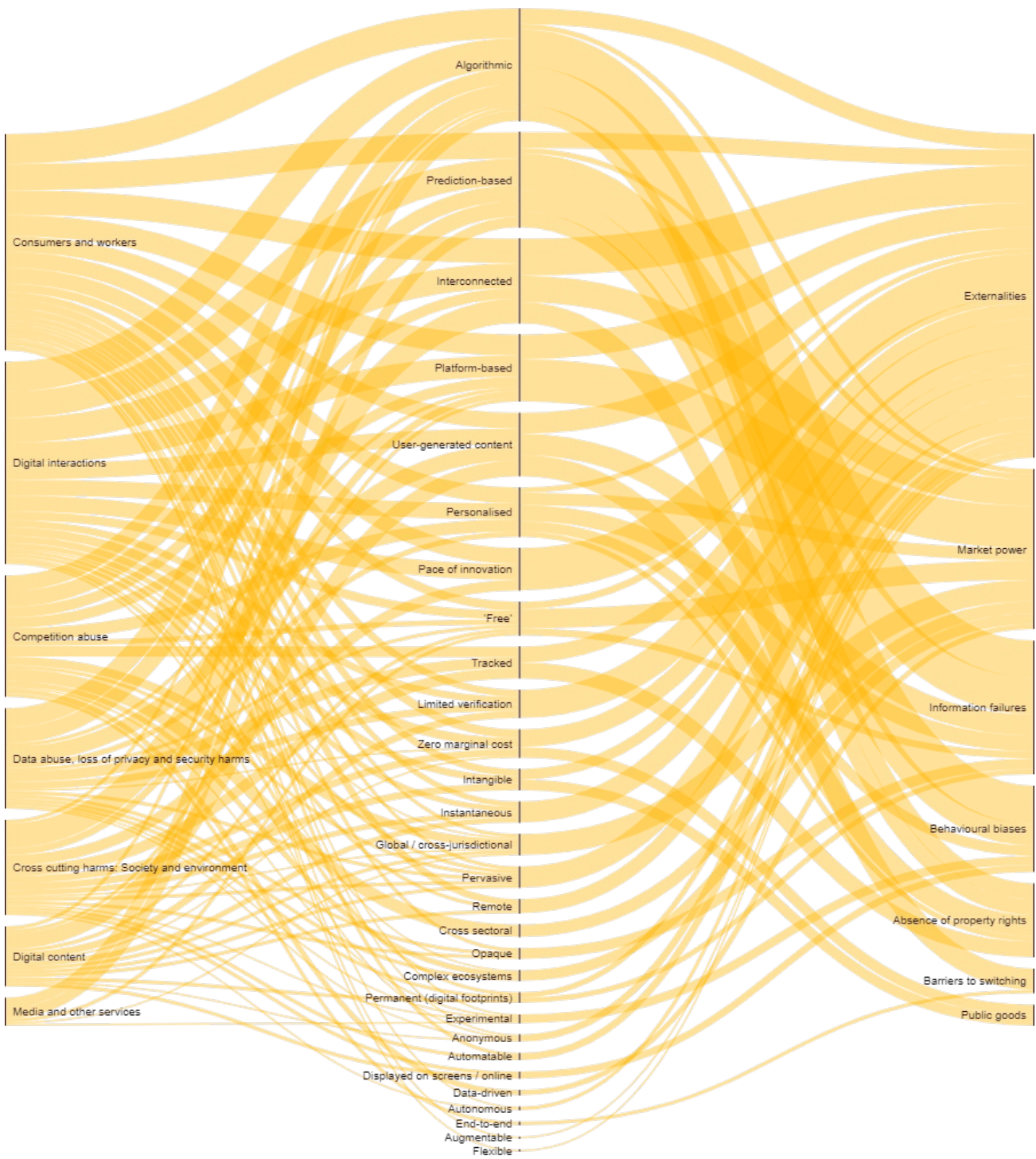
Figure 12 shows the complex relationship between these elements. The diagram has been developed through a review of the existing literature, a series of workshops with government policy teams and regulators and our own analysis.

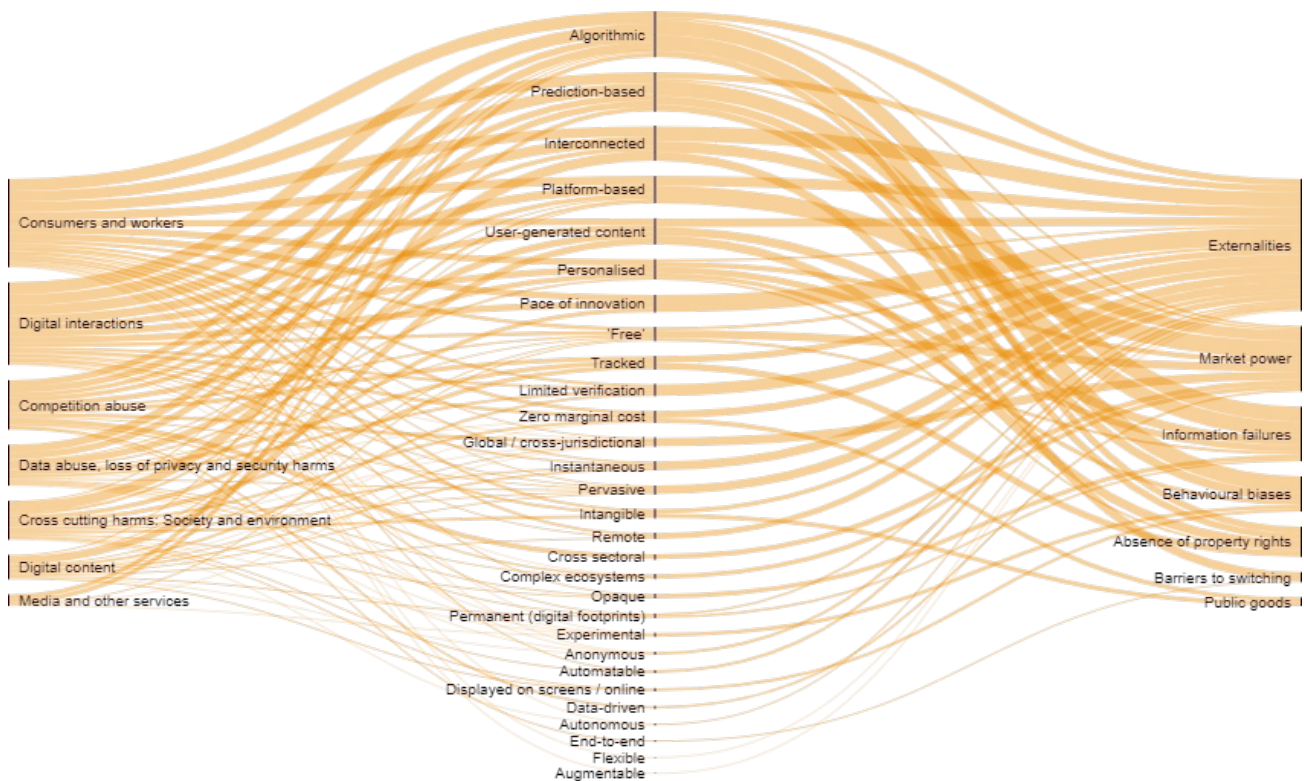
⁴⁰ Ofcom (2019). *Online market failures and harms*

Figure 12: The relationship between harm families, characteristics and market failures









Building on our work in Section 2 on the characteristics of digital and based on discussions during our workshops, our review of the existing literature (see Bibliography in appendix) and our own analysis, we have identified six key thematic clusters of characteristics. Below, we summarise their constituent distinctively digital characteristics and their links to the different digital dimensions.

Figure 13: The six thematic clusters of distinctively digital characteristics

#1 Ownership and portability of personal data	#2 Identity, verification and oversight of digital content	#3 Transparency of digital technologies, data and algorithms
#4 Digital scale, scope and network effects	#5 The global nature of data and digital	#6 The critical role of digital infrastructure and networks

Ownership and portability of personal data

Consumers regularly provide personal data to digital businesses, for example when they search, browse and buy/sell online. The use and value of this data is not always recognised by its owner but is an important, often critical, element in digital value chains, especially as it can be combined with other data to provide business insights. Consumers may not be aware of how their data is being used, manipulated and stored. This may lead to privacy concerns and violations as well as security breaches.

Digital business models notably rely on data. Whilst the data used across digital goes far beyond personal data, this is the focus of this cluster. Digital activities involve data gathering, analysis and use. Digital technologies make it possible to gather and process this data in ever larger

volumes. Data can be used to add value by enhancing digital goods or services or personalising them for individual users.

Key characteristics which shape the availability and value of personal data include:

- Services which are **'free'** at the point of use meaning the economic transaction is **bartering**;
- The **acquisition of data** – observed (Commercial surveillance: trackers, sensors etc.) vs. volunteered vs. inferred;
- The **pervasiveness of data** and **data as a factor of production**;
- The **volume of data** and **data processing power**;
- **Information asymmetry** and **ambiguous property rights**;
- (Algorithmic) **personalisation** (prices, ads, services, recommendations) which enables **price and preference discrimination**;
- **Attention maximising** behaviour to optimise the **choice architecture** (for example infinite feeds, testing through live experiments) which could also give rise to **addiction**; and
- The potential longevity or **permanency of digital footprints** which may deter provision of personal data.

Identity, verification and oversight of digital content

Digital is transforming the way that we generate and consume content and communicate with each other. The volume of content and communication has grown exponentially with content accessible across the globe at great speed. Whilst this creates considerable benefits, it also gives rise to the potential for harm or forgone benefits: for example, anonymous posting of content, without proper verification or oversight, may lead to consumer harms.

Digital technologies also create opportunities for individuals to engage in digital activities themselves such as content creation (for example blogs, memes) and sharing as well as generating content and targeting it through algorithms and machine learning. This gives rise to potential harms because the originator of the content may be hard to identify, and may even be **anonymous**, and it can be **hard to verify and authenticate content**. The harms are exacerbated by the **volume, speed** and **global** reach of content shared and the **pace of digital innovation**.

Transparency of digital technologies, data and algorithms

Data about individuals' choices and preferences can be and is frequently collected, for example as they search, browse and buy/sell online. This data can be used by companies to personalise advertising and pricing with a view to influencing consumer choice. If consumers lack adequate understanding of how their data is being used, how digital business models work and what trade-offs they are (implicitly) making when engaging in digital markets, this can result in distrust of digital.

The complexity of **digital business models** employing **advanced digital technologies** creates potential asymmetries of knowledge between consumers and producers. Consumers may want to use **digital goods and services** but are uneasy about being exploited by people and organisations using digital technologies. The resulting adverse impacts on consumption/use of data are influenced by:

- **Opaque** ‘black box’ data value chains and inaccessible terms and conditions drive **information asymmetries**;
- Difficulties identifying (and verifying) the origin of content (for example sponsored content, influencers) or identity of individuals (anonymity);
- **The role of algorithms** in facilitating **price and preference discrimination**; and
- The incentive in some business models to **maximise attention** driving the development of addictive content.

These potential harms are compounded by **lack of awareness/skills** of those online which creates digital vulnerabilities.

Digital scale, scope and network effects

Digital has enabled a few businesses to become large, interconnected businesses that span geographies across multiple categories of goods and services. In some cases, these multinational businesses that make up the ‘big tech’ companies have been able to build their position in some important digital markets to a point that potential harms could arise if they were to abuse their market power.

The evolution of digital technologies combined with the associated business models have driven the emergence of these ‘data based monopolies’ as the capability to gather and process large amounts of data has developed. The tendency for concentration in digital markets is linked to the economic features linked to some digital characteristics and their economic implications:

- **Economies of scale**;
- **Economies of scope** within complex ecosystems, leading to **vertical and horizontal integration**;
- **Network effects** (for example where a social media platform is more attractive to users when you have more of your friends on it and the platform is also more attractive to advertisers when there are more users)
- **Barriers to switching** (data mobility / interoperability / ownership);
- **Barriers to entry**; and
- The incentives in **two sided markets** reinforce the tipping effects, for example through intermediation of user-provided services (for example Airbnb lets).

The global nature of data and digital

As noted, digital permeates almost all parts of society and economy. It allows connectivity and communication across nations. Its nature means that businesses can scale quickly and with relative ease. The global nature of digital connects to all the other thematic clusters.

All dimensions of digital are global: digital activities can take place internationally supported by digital technologies. Digital business models can also be global, spanning sectors and countries to offer digital goods and services.

The key characteristics of digital that influence this are:

- The ability for business to **scale without mass**;
- **The cross-jurisdictional** nature of digital goods and services which are **remote** due to low transaction costs; and
- **The ease of communication at a distance.**

The critical role of digital infrastructure and networks

Digital infrastructure includes connectivity networks (e.g. payment systems and communication networks), enabling infrastructure (e.g. 5G network infrastructure and the cloud) and online services (e.g. search functions). The critical role of digital infrastructure is widely evident, not least during the current Covid-19 pandemic where a large part of the economy has moved to working from home and relying on digital infrastructure for video calling and collaborative working. It underpins both the economy and wider society by enabling us to pay for goods and services, communicate, work and socialise online. Increasingly, the infrastructure which underpins it is part of a global ecosystem: this creates risks and vulnerabilities.

Certain digital business models rely on large interconnected networks and ecosystems to operate. Understanding of the risks associated with these networks and how to mitigate them is not always as good as it needs to be with the result that appropriate risk management strategies are not always in place. Since digital activities and digital goods and services rely on these networks, their resilience is key.

The potential source of vulnerability is shaped by:

- The **scale, scope and cross jurisdictional nature** of critical infrastructure/networks;
- The interdependence of infrastructure, **networks** and **complex ecosystems**; and
- **Lack of awareness** of risks to business and consumers (from infrastructure/network failures).

Which thematic clusters should be the focus of further analysis?

Having identified these six key thematic clusters, we choose a subset to take forward to develop theories of harm. We filter them based on the likely impact of the potential harms (or forgone benefits) linked to the distinctively digital characteristics based on their:

- **Scale:** how many people or organisations across the economy and broader society would potentially be impacted by the thematic cluster;
- **Severity:** the intensity of the adverse impact (on social welfare) each time the harm is experienced ;
- **Longevity:** how long the harm could potential persist; and
- **Likelihood:** how likely the harm is to arise.

We select the following four thematic clusters for further analysis.

Ownership and portability of personal data

This thematic cluster causes a range of potential harms related to online safety and security and privacy based on the volume of personal data being collected, stored, shared and processed. These harms are linked to how well individuals understand their rights online and, specifically, whether the vulnerable are adequately protected. Specifically, we focus on the use of personal

data in digital value chains and explore issues arising from the absence of property rights and existence of externalities in relation to the use of personal data.

Identity, verification and oversight of digital content

This thematic cluster leads to potential harms including a lack of trust and distorted consumption decisions. The scale of this harm is potentially large: it affects people of all ages in different ways. The Online Harms White Paper consultation⁴¹ outlines a proposed approach to tackling some of the key issues. We focus on how identity and the lack of verification create and intensify *externalities* which can lead to potential harms because of lack of oversight of digital content.

Transparency of digital technologies, data and algorithms

This thematic cluster causes potential harm due to widespread distrust and unease relating to digital content and advertising and the potential negative impact of distorted consumption decisions. This set of harms may prevent ensuring safety and security online, such as ensuring products and services are safe to use and that the public is educated on rights and harms online. We focus on assessing how possible *behavioural biases* and *information failures* might prevent consumers from making informed and rational digital decisions.

Digital scale, scope and network effects

This thematic cluster is concerned with the tendency of digital markets to concentrate which gives rise to the risk of competition abuse and/or harmful business practices.⁴² The resulting harms may prevent fair and efficient markets including undermining competition, consumer access and choice and innovation, and may prevent the potential benefits of digital from being fully realised.

The significance of these potential harms is reflected in the attention that they have already received. For example, the Furman Review has examined how to promote digital competition and has recommended setting up a digital markets unit and other strategic recommendations which the Government has accepted. The Government has also announced a digital markets taskforce to consider the practical application of the potential pro-competitive measures.⁴³

We focus on the evidence already gathered in this area on market power and the additional evidence required to understand how this thematic cluster links to the other three thematic clusters we consider.

Conclusion

In this section we analyse the potential for digital to drive a range of potential harms (or forgone benefits) that reduce social welfare. We group these harms into seven 'families' reflecting a wide range of concerns for individuals, businesses, consumers and society.

We identify a set of distinctively digital characteristics which are distinctive because they are not present in their analogue equivalents or are accentuated or intensified by the use of digital technology and which can be identified as potential sources of harm (or forgone benefit).

⁴¹ HM Government (2019). *Online Harms White Paper*

⁴² Market concentration measures the extent to which the market shares of an industry are held by a small number of larger firms rather than dispersed across multiple smaller firms, and can be taken as a proxy for the intensity of competition. See OECD. *Competition: Market concentration* (Link [here](#), accessed March 2020)

⁴³ HM Government (2020). *Digital markets taskforce: terms of reference*. (Link [here](#), accessed March 2020)

We find that these characteristics tend to cause harm when they cluster together and/or when they are more intense in a digital setting. They are closely associated with market failures which provide the link between the characteristics and the harms. We find that this relationship is complicated: sometimes the interconnections are 'many to many' and sometimes more simple.

We identify six thematic clusters which drive groups of harms. We select four for further analysis in Section 4 on the basis that their likely impact is most significant:

1. Ownership and portability of personal data;
2. Identity, verification and oversight of digital content;
3. Transparency of digital technologies, data and algorithms; and
4. Digital scale, scope and network effects

In Section 4 we consider each of these thematic clusters in more detail to develop theories of harm, focusing on specific market failures and considering the existing and required evidence for the harms they drive.

Two other clusters are not investigated further because they are already addressed by policy or can only be addressed effectively on an international basis: the critical role of digital infrastructure and networks and the global nature of data and digital.

4. Developing theories of harm and their implications

Introduction

In this section we further develop and analyse the theories of harm associated with each of the four thematic clusters of distinctively digital characteristics identified in Section 3. The section is divided into two further parts:

- An overview of our approach to developing each theory of harm; the structure of the theory and the evidence needed to assess the scale and impact of the harms (or forgone benefits);
- Summaries of our theories of harm and evidence assessment based on applying our approach to each of the four clusters:
 - Thematic cluster #1 – Ownership and portability of personal data;
 - Thematic cluster #2 – Identity, verification and oversight of digital content;
 - Thematic cluster #3 – Transparency of digital technologies, data and algorithm; and
 - Thematic cluster #4 – Digital scale, scope and network effects.

Overview of approach

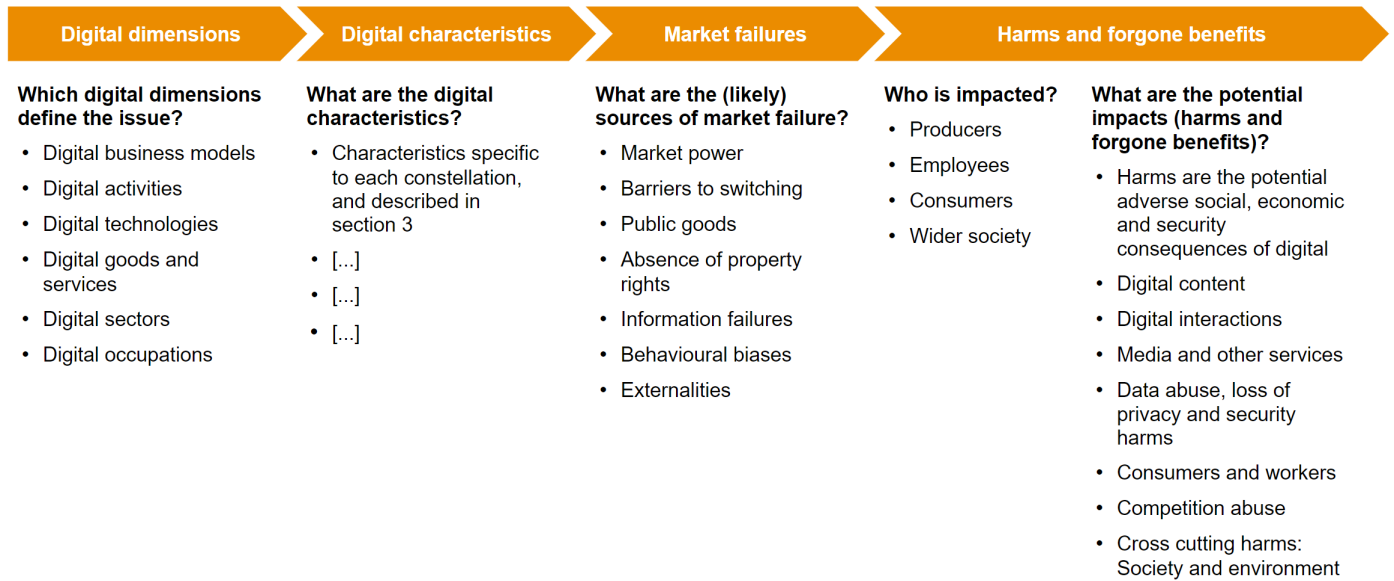
For each cluster, we build on our earlier analysis to develop a theory of harm as illustrated in Figure 14. We start by describing the cluster and some of the potential harms or forgone benefits related to it. We then summarise the relevant digital dimensions and characteristics for the cluster, the likely key sources of market failure and the potential harms (or forgone benefits) that may arise.

The figure for each cluster has a highlighted pathway across the four pillars of the theory of harm which the following narrative explores in more detail. This pathway has a focus on one or two key market failures associated with the cluster, noted at the end of Section 3. The pathway links these market failures to the potential harms or forgone benefits which may arise as a result of them. For each pathway we explore in more detail how the characteristics can lead to market failures, what harms may be associated with them and who they might impact. We also consider the evidence available or needed to assess the significance of these potential harms.

The pathway of harm which is explored is intended to demonstrate some of the key issues arising from each cluster of characteristics rather than provide an exhaustive analysis. It reflects where there are issues likely to be relevant for the consideration of policymakers and not necessarily the elements which may be the most important drivers or most significant sources of harm within the cluster.

Figure 14: Overview of structure of theories of harm

Thematic cluster



A next step (outside the scope of this work), there will be a need to consider areas for future policy, governance or regulatory intervention. We offer some considerations for this in Section 5.

Theories of harm and evidence assessment

Thematic cluster #1: Ownership and portability of personal data

Personal data has become an increasingly important part of the digital ecosystem and its associated value chains. As well as being a key input into the provision and delivery of services, including their personalisation, it is a quasi-currency; for example, some services are offered ‘free’ to customers in exchange for access to their personal data (such as social media and email accounts), which is used for value creation, such as online advertising. Individuals can also receive discounts on goods and services when providing personal data to sign up for an account.

The growth in the number of users of digital platforms and other digital services has fuelled the rise of the online advertising market which now represents half of total advert spending in the UK and is one of the key industries in which personal data is used, for example to target advertisements more effectively.⁴⁴

The acquisition and use of data (for example through processing, aggregation, analytics and visualisation)⁴⁵ are key activities within digital business models. The ways in which personal data are acquired can be grouped into three broad categories:

- **Volunteered** where personal data is actively provided by the individual to whom it relates;
- **Observed** where tracking technologies and sensors, for example, enable people’s behaviour to be monitored, for example their browsing history or their physical movements; and

⁴⁴ Plum for The Department for Digital, Culture, Media and Sport (2019). *Online advertising in the UK*

⁴⁵ Rizk, Bergvall-Kareborn and Elragal (2018). *Towards a taxonomy of data-driven digital services*

- **Inferred** where analysis of volunteered and/or observed data, often combined across many people, is used to generate new insights into people's revealed preferences and their likely behaviour – such data might for example be used to inform algorithms.⁴⁶

The important differences between these modes of data acquisition have a significant bearing on the nature of the risk of market failure and the resulting potential harms. For example, the issue of property rights and the resulting harms is more relevant where data is observed without consent. On the other hand, information failures and behavioural biases are relevant to understanding the significance of informed consent when data is volunteered and used to inform consumer targeting.

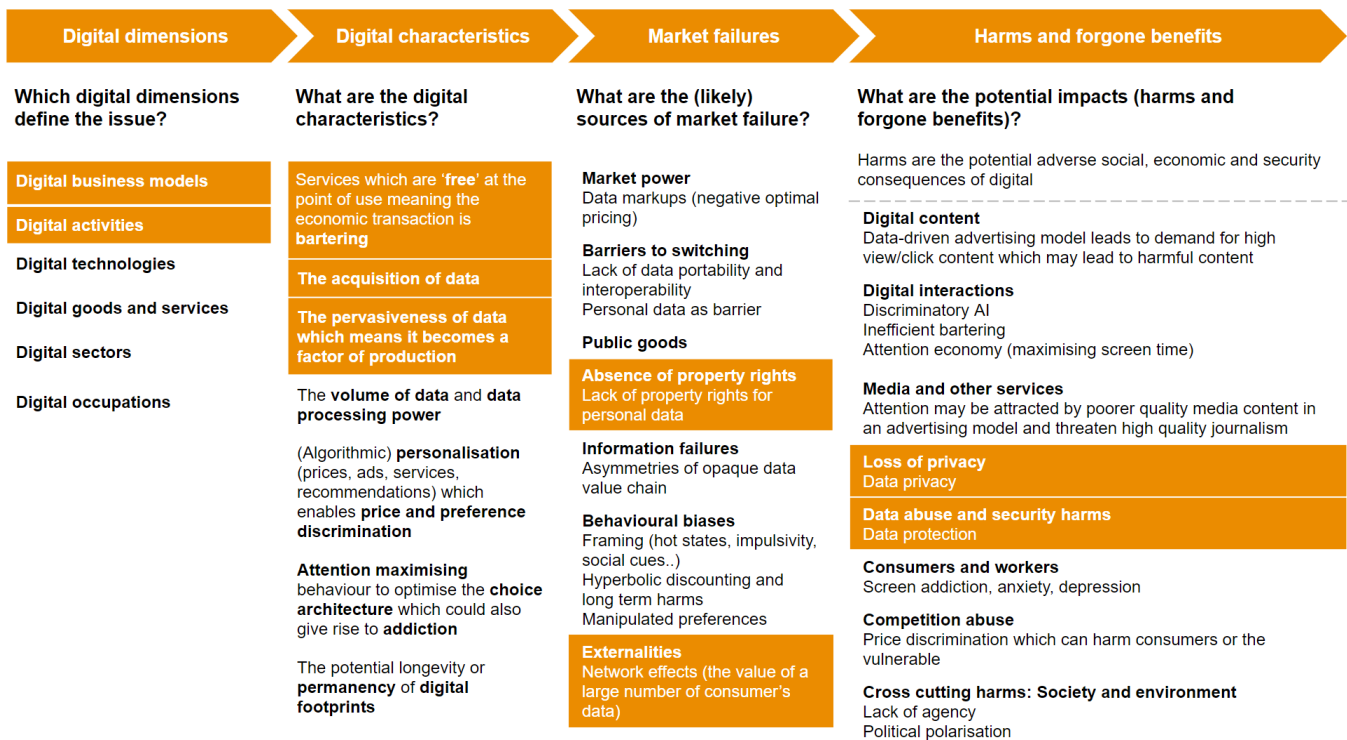
Whilst the demand for, and use of, personal data is extensive, the terms on which it is used, who uses it and how value is derived from it are sometimes unclear to those providing the data. The value of an individual's data is context dependent: for example, it is influenced by how 'big' the dataset is (how many data points relating to an individual are held and how many individuals are included)⁴⁷ and other factors such as a company's data processing power and the significance of data driven insights to their business model. Individuals cannot, therefore, always be sure of its market value. Many digital services are provided free at the point of use to consumers who 'pay' in kind by enabling data processors to extract value from their data. The value of the personal data to those who receive and use it is not always recognised by the data originators but plays a fundamental role in the value chain.

Figure 15 illustrates the theory of harm associated with the use of personal data. It highlights the distinctively digital characteristics that shape the harm, the associated digital dimensions and the resulting market failures and consequential harms (or forgone benefits). It shows the complexity of the picture with respect to the use of personal data. Many different combinations of digital dimensions underpin the distinctive characteristics that drive likely market failures and, then, potential harms (or forgone benefits). The range of harms extends from unfair business practices that exploit consumer data to a data-driven online advertising market which prioritises attention and can fuel the generation and spread of harmful content or poor media quality.

⁴⁶ OECD (2014). *Data-driven Innovation for Growth and Well-being*. (Link [here](#), accessed March 2020)

⁴⁷ Stigler Center (2019). Stigler Committee on Digital Platforms

Figure 15: Ownership and portability of personal data – theory of harm



Market failure focus and characteristics

To illustrate how this cluster of characteristics gives rise to potential harms, we focus on **those that are linked to the externalities and, in the extreme, the lack of property rights** (as described in Section 3). Both externalities and lack of property rights lead to potential harms and forgone benefits. This means that the benefits (and the costs) of the data do not always accrue to its owner and may not be factored appropriately into owners' decision-making. We focus on the selected associated harms highlighted in Figure 15. Three key characteristics drive potential harms which we discuss in turn below:

- **Lack of individual ownership of data:** Where data is volunteered, market failures are less likely (although consumers may not realise the value they are giving away and/or how their data will be used). In contrast, no explicit transactions occur when data is observed and inferred. This means that value and risk may not be transferred appropriately between the data owner (the individual) and the user or processor of that data.
- **Weak portability and interoperability:** Data portability reflects the right of individuals "to obtain and reuse their personal data for their own purposes across different services".⁴⁸ It gives power to the owner to control use of their data. Interoperability reflects the ability to share and understand data across different systems.⁴⁹ Interoperability has the potential to enable and incentivise competition between data processors.
- **An inefficient 'market' for personal data:** The challenges around data ownership, portability and interoperability mean that the market for personal data lacks transparency and openness, resulting in economic inefficiency. This raises questions around whether consumers are being fairly reimbursed for their data. Is gaining access to a service sufficient compensation for

⁴⁸ ICO. *Guide to the General Data Protection Regulation (GDPR)*. (Link [here](#), accessed March 2020)

⁴⁹ ICO. *Guide to the General Data Protection Regulation: right to data portability (GDPR)*. (Link [here](#), accessed March 2020)

providing personal data?

Whilst we focus on the absence of property rights here, we recognise that this is not the only relevant market failure for this set of harms driven by the cluster of characteristics. Decisions around personal data and for example privacy appear to also be affected by incomplete information, a bounded ability to process the available information and a large number of behavioural biases which deviate from theoretically rational decision making.⁵⁰

Harms and forgone benefits

Lack of property rights for personal data and externalities lead to forgone benefits as well as other potential harms that have adverse economic and social consequences. We focus on those that flow from loss of privacy and the risk of data abuse and security breaches below.

Loss of privacy

Although various degrees of informed consent are sought and received when personal data is acquired, potential harms can still arise from the **loss of privacy** individuals experience when it happens. These are potentially more significant when data is taken without the owner's permission and knowledge. These harms are exacerbated when businesses seek to gather large quantities of data, rather than narrowly targeted data, due to its importance in the value chain of their business models.

The different ways in which data is acquired matters: whilst some data is explicitly provided by consumers, much is also observed or inferred, and may be combined with other available data that is acquired. Even when data is volunteered, important questions arise as to how far data providers truly understand how their data will be used and the possible implications of its use (for example, that insights can be gathered from their data when used alongside data from other consumers).

In addition to corporate data gathering, privacy will also be impacted by the ability of government and the authorities to hold large volumes of personal data regardless of how it is collected: in the UK, for example, there are debates about the use of facial recognition software by police forces.⁵¹

Evidence required: Some evidence exists on the public's view of data privacy⁵², harms from data⁵³ and how behavioural bias and other market failures can distort consumer decision making.⁵⁴ A Doteveryone survey of the British public found that 42% would like to do more to change their privacy settings but don't know how and 25% feel there's no point in doing so as companies will get round them.⁵⁵ Further evidence is required to understand the value that people attach to the privacy of their data to assess the scale and severity of any adverse welfare impact arising from loss of privacy and to society more broadly. In addition there is an important piece of analysis to include in this area on the economics of privacy and the trade-offs which sharing personal data represents for individuals.^{56,57} There are also likely to be forgone benefits if loss of privacy means that individuals are less willing to make use of digital, for example to acquire digital

⁵⁰ OECD (2010). *The economics of personal data and the economics of privacy*. (Link [here](#) accessed March 2020)

⁵¹ Such as the Metropolitan Police using live facial recognition technology in public spaces in the UK. (Link [here](#), accessed March 2020)

⁵² The Direct Marketing Association (2018). *Data privacy: What the consumer really thinks*. (Link [here](#), accessed March 2020)

⁵³ Which? (2018). *Control, Alt or Delete: The future of consumer data*

⁵⁴ Oxera. *Too much information? The economics of privacy*. (Link [here](#), accessed March 2020)

⁵⁵ Doteveryone, *People, Power and Technology: Digital understanding* (2018). (Link [here](#), accessed March 2020)

⁵⁶ OECD (2010). *The economics of personal data and the economics of privacy*. (Link [here](#) accessed March 2020)

⁵⁷ Acquisti (2016). *The economics of privacy*. (Link [here](#), accessed March 2020)

goods or services, or data-driven innovations can't be developed due to individuals' fears of loss of privacy.

Data abuse and security breaches

Data abuse and security breaches can occur on an individual or larger societal scale. They happen when personal data is accessed or distributed in ways which have not been consented to (including if the security of data is breached).

A considerable volume of personal data is held on individuals by business and government. The sensitivity of this data varies considerably and is context dependent, from shoe size and marketing preferences to financial or medical information. What individuals feel is sensitive is also likely to be subjective although nine protected characteristics are defined in legislation⁵⁸.

Increasing volumes of sensitive personal data are held on large numbers of individuals within individual businesses as well as being shared across multiple interconnected businesses which can be linked together to generate insights on consumers. This means that when security breaches occur they can impact a larger number of consumers more severely due to the increasing volume of sensitive data held. The harms to individuals resulting from security breaches include financial loss, emotional distress and distrust of digital services. Businesses who suffer data security breaches may suffer financial loss and reputational damage. Benefits may also be forgone if the fear of these harms deters use of digital goods and services. In addition, broader issues may arise from data breaches that have implications for national security.

Evidence required: Further evidence is required to understand what the impacts are and then to measure and value these. Firstly the scale of financial loss due to personal data breaches of citizens or businesses and the scale and severity of the broader welfare impact of data abuse and breaches. In general, while there appear to be many studies which assess the direct and indirect costs to businesses, there is more evidence required on the wider impacts, including those on how individuals are affected.⁵⁹ Additional evidence is required to better understand:

- The likelihood of data abuse;
- The likelihood that data security breaches will impact individual data security or broader national security; and
- The forgone welfare benefit of those who do not use digital goods or services due to fear of data abuse and security breaches.

⁵⁸ The Equality Act 2010 defines nine protected characteristics, including age, race, gender and disability.

⁵⁹ IBM (2019). *Cost of a data breach report*. (Link [here](#), accessed March 2020)

Thematic cluster #2: Identity, verification and oversight of digital content

Digital content is generated in large volumes from an increasingly wide range of sources. Over half the global population uses the internet, over a third uses social media and the digital universe is growing 40% every year.⁶⁰ This brings important benefits as more information is shared on a global scale

Digital content is often generated by users who are not directly employed to produce it. This includes text, videos, images and audio that are shared with one or many other users. Users may be explicitly financially incentivised to create this content, notably if they attract a large following (for example “influencers”), reflecting the value that derives from drawing the attention of platform users. But there may be other implicit motivations such as social incentives, for example on social media, or user-experience incentives, such as receiving a more personalised service.⁶¹

Digital interactions are easy with contact between individuals and groups made possible through digital technology. Children often have a positive experience with digital content, accessing educational resources, information and entertainment and anonymity online has facilitated vulnerable and marginalised groups to communicate safely and freely with others online.⁶² However, the increase in user created content and the ease of digital interaction also create a risk of potential harms, in particular if it is hard to verify content or where the identity of digital actors is unclear.

This means it has become much harder for individuals to be held responsible for the consequences of their content, including potential harms. Digital technologies such as encryption enable content generators to protect their identities. This makes it difficult to attribute harms to the original content creator, be that an individual, company, state actor or other group. Similarly, communication and interactions online can be kept anonymous, whether that is social media interactions or online transactions on the ‘dark web’ for illegal goods such as drugs or weapons.

It is also difficult to verify or authenticate digital information when it is coming in large volumes from a wide range of sources and being transmitted through multiple means. Whilst there are clear cases where benefits flow from allowing anonymity online, for example enabling individuals to seek help or advice, protecting privacy and ensuring freedom of speech, there are trade-offs between these benefits and possible harms linked with digital anonymity.⁶³

Figure 16 illustrates the theory of harm associated with digital content which is generated by users who are hard to identify and/or where it is difficult to verify its veracity when it is exchanged on digital platforms. It highlights the key digital dimensions, the distinctively digital characteristics that shape the harm and the resulting market failures and consequential potential harms (or forgone benefits). Digital technologies, digital business models, digital goods and services and digital activities all drive distinctive characteristics that give rise to likely market failures and then potential harms. Whilst issues raised related to digital content are also explored in the Online Harms White Paper, we focus on a specific subset of these.⁶⁴

⁶⁰ MerlinOne. *The history of digital content*. (Link [here](#), accessed March 2020)

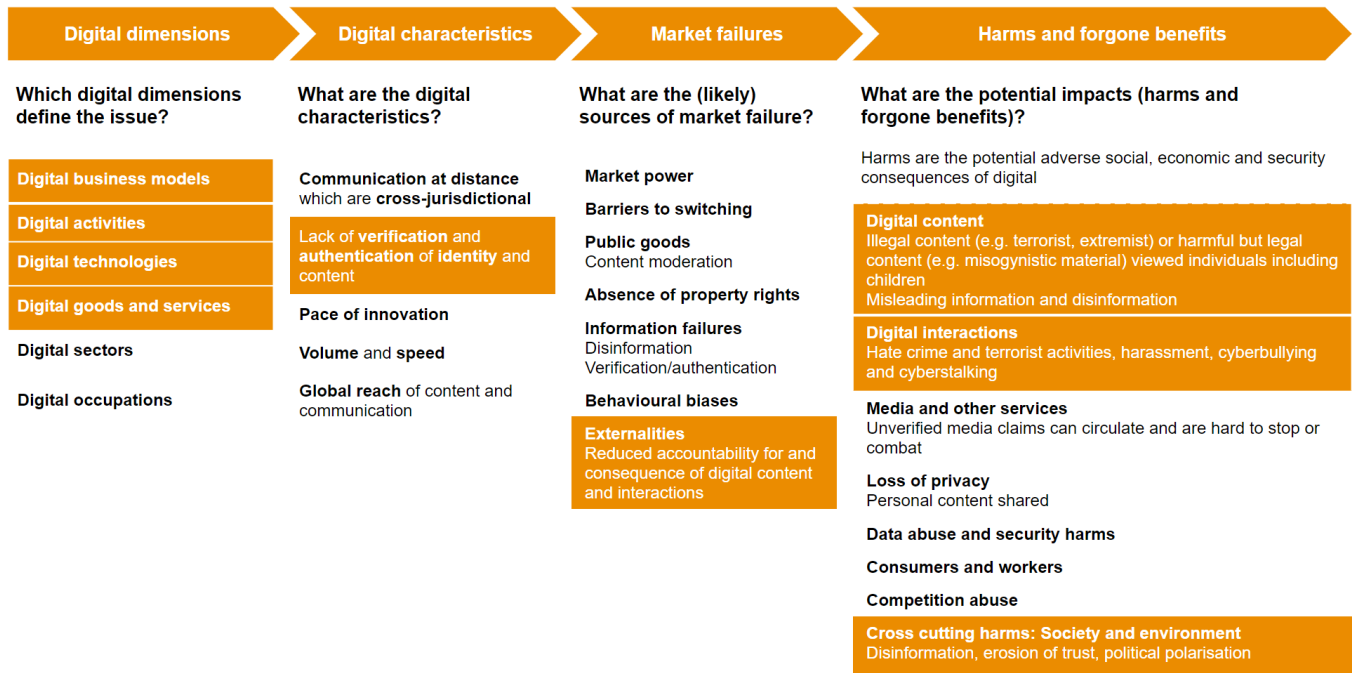
⁶¹ Toluna (2011). *Mixing Financial, Social and Fun Incentives for Social Voting*

⁶² HM Government (2019). *Online Harms White Paper*

⁶³ Childnet. *Response to the DCMS Internet Safety Strategy Green Paper*. (Link [here](#), accessed March 2020)

⁶⁴ HM Government (2019). *Online Harms White Paper*

Figure 16: Identity, verification and oversight of digital content – theory of harm



Market failure focus and characteristics

Our theory of harm framework focuses on the key market failures. We use it to identify the underlying causes of harmful content and activity which ultimately help to bound the scope of the problem and the applicability of any solution.

To illustrate this, we consider two **digital characteristics which create and/or increase the externalities** that drive potential harms (or forgone benefits):

- Identity** (of individuals/groups): Whilst many online interactions take place anonymously and are not harmful (as acknowledged above), some are linked to harmful behaviours such as cyberbullying, trolling, catfishing and scamming. Characteristics of digital user-generated content, such as anonymity, volume and speed of content generation and global reach, can exacerbate harms significantly because content generators do not feel fully accountable. This is because the ability to protect identity allows individuals or groups to cause harm to others without necessarily being held responsible for their actions. For example, someone shouting abuse at a person in the street risks being physically hurt and arrested whilst someone posting the abuse online is better placed to hide their identity. There are, however, many facets of anonymity. Even where an individual is not entirely anonymous, their identity can be obscured in ways which prevent effective accountability. For example, even if identified by part of their name or an image, the chance that they could be held accountable for their behaviour is reduced if the interaction is cross-jurisdictional or if their harmful actions or content is lost because of the volume of online activity.
- Lack of verification / authentication** (of content): When content is supplied online, it can sometimes be hard to verify or authenticate. Moreover, the ability of digital interactions or content to mislead is increasing: for example, AI enables people to modify voices and videos as well as images and text. It can also be difficult to know whether an interaction is with a person or with AI.

The significance of these characteristics is intensified by others, such as the **volume of data** and **ease with which users can generate content**. In addition, content is not just shared within

countries, it is **globally available in an instant**. This means that there are jurisdictional challenges over where content is generated and where it is consumed. These characteristics increase the risk of harm.

The reason why the ability to protect identity and the lack of verification/authentication matter is that people, including those responsible for potentially harmful content, typically respond to incentives. Their behaviours can be explained in terms of expected costs and benefits. Both characteristics lower the expected costs to the perpetrator of harmful behaviour (and externalise the consequences).

The Online Harms White Paper, for example, describes many of the harms associated with digital content and activity.⁶⁵ This Section focuses on a few of these related to externalities. However, this is not the only market failure which is relevant for this cluster of characteristics and its associated harms. Notably, information failures are also relevant when discussing identity and verification where users of digital lack information.

Owners and operators of digital platforms generally have an incentive to cultivate a trusted user base and keep interactions civil. In economic terms, this means that they bear some of the risk and, hence, the costs associated with sharing harmful content. This is why they already take steps to self-regulate their user-generated content and activity to some extent. Platforms that have failed to do so have faced an adverse response by users if they became known for disinformation or fraud.⁶⁶

The approaches that digital platforms have taken include content moderation, user-verified reviews and identity authentication. For example, Facebook sets out 'community standards' based on community feedback and expert advice and putting in place mechanisms to report potentially violating content enabling users to control their own experience by blocking or hiding people and posts.⁶⁷ Some platforms are experimenting with outsourcing self-regulation and/or creating independent bodies to make decisions and rulings. Indeed, Facebook is setting up an independent oversight board for content decisions.⁶⁸ As yet, it is unclear how effective these measures will be in addressing the potential harms identified.

Given the volume of content and activity, any solution has to be scalable and effective. This is why businesses are investing in technologies that may help with moderation, verification and authentication which are likely to be used in the future.⁶⁹ The key issue, however, is whether digital platforms and their users have the appropriate incentives to 'internalise' the externalities and work to remove them. There's also a question whether AI based oversight can be as good as human oversight.

Harms and forgone benefits

To illustrate this issue, we consider the potential harms in terms of adverse social and economic consequences of cyberbullying and disinformation:

⁶⁵ HM Government (2019). *Online Harms White Paper*

⁶⁶ Brown (2020). "Should I Stay or Should I Leave?": Exploring (Dis)continued Facebook Use After the Cambridge Analytica Scandal. (Link [here](#), accessed March 2020)

⁶⁷ Facebook. *Community standards*. (Link [here](#), accessed March 2020)

⁶⁸ Facebook. *Global Feedback and Input on the Facebook Oversight Board for Content Decisions*. (Link [here](#), accessed March 2020)

⁶⁹ Accenture (2017). *Content moderation: The future is bionic*. (Link [here](#), accessed March 2020)

Cyberbullying

Cyberbullying is an example of a digital activity which is of concern to policymakers because it can be harmful (see the Online Harms White Paper⁷⁰). It affects children and adults: for example, a YouGov poll suggested 23% of people in the UK had been targeted online and 55% of those in the 18-24 age group.⁷¹ The adverse impact on victims of cyberbullying is on their wellbeing – notably mental health and, in the extreme, suicide. It can also affect educational and workplace performance. Individuals and society will be harmed by both short term distress and longer term damage. It affects children and the more vulnerable in society more intensely.⁷² The Annual Bullying Survey on the experiences of young people in UK high schools and colleges found that over one third (37%) who had been cyberbullied developed depression and 26% had suicidal thoughts.⁷³ In comparison, the corresponding statistics for ‘offline’ bullying were lower suggesting an increased potential for harm through digital interactions.⁷⁴ There is a closely related set of activities including online harassment and stalking which are likely to cause some similar harms.

Evidence required: Robust evidence is needed to test whether differences exist in prevalence rates between bullying online and offline. Such evidence would help understand the distinctively digital element. A body of research exists into the impact of cyberbullying on adolescents, see for example the UK Council For Child Internet Safety’s literature review.⁷⁵ There is, however, a noted lack of systematic evidence on adult cyberbullying, ‘trolling’ and online harassment, though initial evidence suggests there are severe harms such as mental health issues and low job satisfaction.⁷⁶ Further evidence is, therefore, required to understand the scale and severity of the harm caused by cyberbullying across age groups, in particular understanding its short and long term welfare consequences (for example, on mental health or earning potential over an individual’s life). There is also a need to understand how cyberbullying may affect vulnerable groups as there are some initial findings that the prevalence of cyberbullying may be higher for some groups, such as women, religious minorities, and disabled people.⁷⁷

Disinformation

Lack of verification means that the source of digital content cannot always be easily ascertained making it difficult to authenticate. The rise of disinformation⁷⁸ has been facilitated by this characteristic of digital technology, although it is not a harm which is new to digital.⁷⁹

The ease and speed with which content can be created and distributed online allows information to be shared rapidly on a global basis. For example, software can be used to fabricate content or automated bots used to amplify messages.

Whilst automation and AI can bring large benefits, they can also lead to potential harms to society and democracy. Content may be deliberately created or shared to deceive citizens.⁸⁰ It can be

⁷⁰ HM Government (2019). *Online Harms White Paper*

⁷¹ YouGov (2019). *Cyberbullying afflicts quarter of brits*. (Link [here](#), accessed March 2020)

⁷² Nixon (2014). *Current perspectives: the impact of cyberbullying on adolescent health*

⁷³ Ditch the Label (2017). *The Annual Bullying Survey 2017*. (Link [here](#), accessed March 2020)

⁷⁴ HM Government (2020). *Online Harms White Paper: Initial consultation response*

⁷⁵ UK Council for Child Internet Safety (2017). *Children’s online activities, risks and safety: A literature review*. (Link [here](#), accessed March 2020)

⁷⁶ UK Council for Internet Safety (2019). *Adult Online Hate, Harassment and Abuse*

⁷⁷ Ditch the Label (2017). *The Annual Bullying Survey 2017*. (Link [here](#), accessed March 2020)

⁷⁸ And misinformation - while both are types of inaccurate information, disinformation is intentionally designed to deceive.

⁷⁹ Ryan et al. (2019). *Monetizing disinformation in the attention economy*. (Link [here](#), accessed March 2020)

⁸⁰ HM Government (2019). *Online Harms White Paper*

shared online and quickly spread, either with malicious intent or by those unaware of its source or impact. It has the potential to lead to national security threats as well as giving rise to risks to public safety and public health. It may also shape political polarisation. It can affect wide audiences or be targeted at groups which may include the vulnerable.⁸¹ There are also economic implications and consumer harms from misleading information such as fake product reviews and sponsored endorsements. These may distort consumption decisions, a harm we look into in more detail in thematic cluster #3.

Evidence required: Although some research exists, there is limited evidence on the impacts of the potential harms (and the forgone benefits) of disinformation. A report for the European Commission has highlighted the need to build on existing research to better understand the impacts of disinformation, for example in the areas of transparency of online news and empowering users and journalists.⁸² Better evidence is required to understand the scale and severity of the harm from disinformation, in particular understanding its long and short term welfare consequences. This includes further evidence on the impact on national security, public safety (including response to crises), public health or public discourse and democracy (such as free and fair elections and political polarisation). Evidence is also needed on the role of advertising and the attention economy in ‘monetising’ disinformation so that its reach and drivers are better understood.⁸³

Thematic cluster #3: Transparency of digital technologies, data and algorithms

Users of digital can often feel confused and disempowered by the lack of transparency in the provision of digital goods and services: 89% of the British public surveyed by Doteveryone want clearer terms and conditions and half would like to know how their data is used but can’t find out.⁸⁴ Recent research has identified five digital ‘blind spots’ which are particularly poorly understood by online users:

- How adverts target people;
- How personal information is collected;
- How prices can vary;
- Where news comes from; and
- How products and services are paid for.⁸⁵

Consumers’ choices often depend on the information they have available when they make their choices, for example their knowledge of the options available to them and the possible consequences of each choice. This choice environment – reflecting the actual choices available and how they are presented – is important because individuals typically have bounded rationality, heuristics and bias which influence their decision-making.

The increasingly complicated use of choice architecture to influence decision-making has been accelerated by developments in the application of digital technologies. These developments allow

⁸¹ Government Communication Service (2019). *Resist: Counter-disinformation toolkit*

⁸² European Commission (2018). A multi-dimensional approach to disinformation. (Link [here](#), accessed March 2020)

⁸³ Ryan et al. (2019). *Monetizing disinformation in the attention economy*. (Link [here](#), accessed March 2020)

⁸⁴ Doteveryone (2018). *People, Power and Technology: Digital attitudes*. (Link [here](#), accessed March 2020)

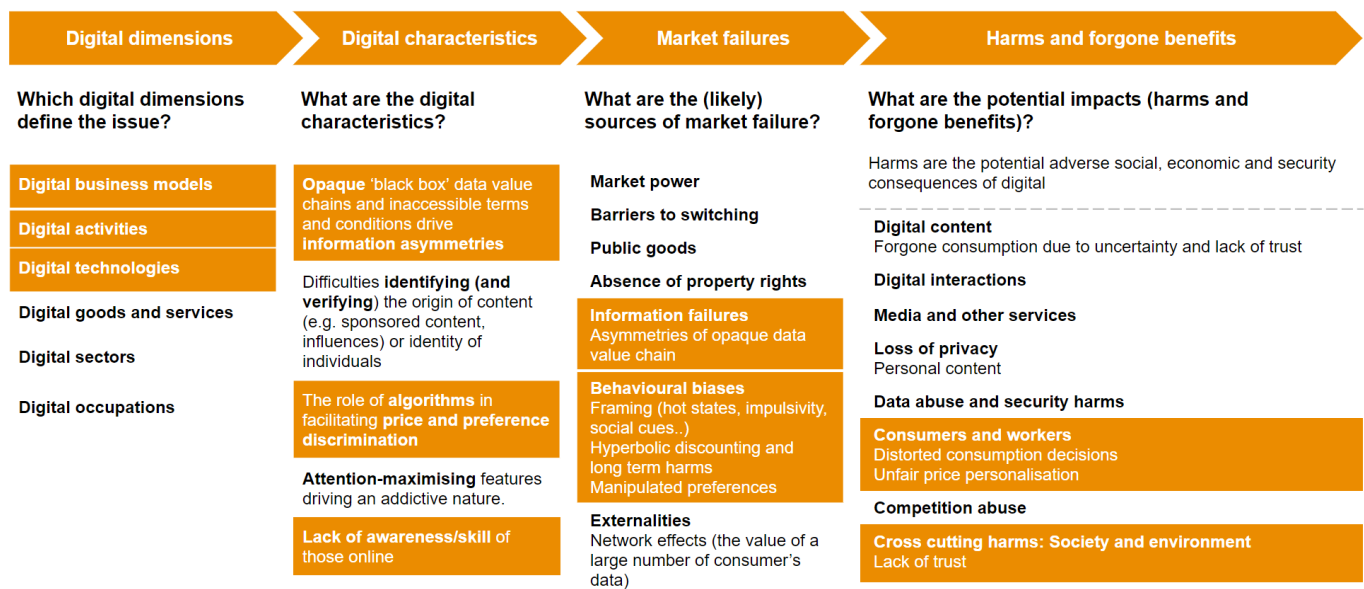
⁸⁵ Doteveryone (2018). *People, Power and Technology: Digital understanding*. (Link [here](#), accessed March 2020)

digital businesses to identify and exploit the mental shortcuts that people often take to simplify their thought processes. Businesses can also run real-time experiments on actual and potential customers to understand how they make decisions so that they can exploit biases in a way which may be harmful. For example, consumers can be ‘nudged’ into making choices which are not the best options for them. Where businesses hold large sets of personal data, they can identify groups of different ‘types’ of users who behave in particular ways and employ targeted strategies for each of them to influence their decision making.

Realising the full benefits of digital, however, requires individuals to understand and trust how businesses make recommendations, set prices, provide content, use their personal data and so on. Without this, individuals may be reluctant to take full advantage of digital so that they can realise its potential benefits. Furthermore, where understanding is weak, digital users can be exploited, thereby making it even less likely that they will benefit from digital in the future. On the other hand, some parts of the population, for example younger people, may be overconfident about their abilities to make use of digital to the point where they ‘overconsume’.

Figure 17 illustrates the theory of harm associated with the transparency of digital technologies, data and algorithms and its influence on consumer decision making. It highlights the distinctive digital characteristics that shape the harm, the associated digital dimensions and the resulting market failures and consequential harms (or forgone benefits).

Figure 17: Transparency of digital technologies, data and algorithms – theory of harm



Market failure focus and characteristics

To illustrate the potential for this cluster of characteristics to drive harms, we focus on how they might do this through **information failures (imperfect or asymmetric information)** and **behavioural biases** (as described in Section 3). We describe how the key digital characteristics linked to information failure drive potential harms (or forgone benefits) as highlighted in Figure 17.

Characteristics

Three key characteristics drive potential harms through information failure and behavioural biases:

- **Opacity (complex technologies and value chains):** Complex digital business models and technologies contribute to a lack of transparency among many users. For example, their awareness of how services make money from data is low: of British adults surveyed by Doteveryone 70% are unaware that free-to-use apps can make money from data, 62% for social media and 57% for search engines.⁸⁶ The value chain of data is, therefore, somewhat of a 'black box' for consumers. Even when users consent to terms which set out technically what data is collected and for what purposes, for instance under GDPR rules, there remains a very real lack of understanding as to how data is used in the value chain and the possible consequences of this.
- The role of **algorithms:** An algorithm is a sequence of instructions or set of rules designed to complete a task or solve a problem.⁸⁷ It can be used to conduct a range of digital activities such as data processing, visualisation or prediction. Algorithms play a valuable role in the creation and distribution of digital goods and services. They are likely to be designed to distribute or promote goods and services based on the purpose and function of the digital business model. For example, where there is an advertising model, the algorithm's design will reflect the incentive to keep people's attention. This may influence the nature of the content shown. Therefore, whilst algorithms can introduce efficiencies, they also raise concerns because of their potential to facilitate discrimination or exploitation.
- **Lack of awareness and skills:** Users may be unaware and ill-equipped to make decisions such as those related to their personal data. For example, there is a large amount of evidence that most digital terms and conditions go unread as these are hard for consumers to assess due to their length, complexity and legalistic language, where 89% of the British public surveyed by Doteveryone want clearer terms and conditions.⁸⁸ This lack of skill can create vulnerability if individuals agree to things which are not in their best interests.

Harms and forgone benefits

Information failure and behavioural biases can lead to potential harms as a result of distorted consumption decisions, where consumers do not have the welfare maximising level of services:

- User lack of trust, skills and confidence in digital can result in forgone benefits (if digital services are underconsumed): the uncertainty driven by lack of trust means that some consumers may not be willing to buy or use certain services with the result that they miss out on the benefits they could have derived if there had not been this distrust and uncertainty⁸⁹; and
- Business choice manipulation can influence consumer behaviour in a suboptimal way.

We consider each potential harm in turn.

Lack of trust of businesses' use and protection of data

Where consumers do not trust how their personal data will be used and whether its confidentiality will be respected this can give rise to potential harm (or forgone benefits). Consumers often do not know what they consent to when they give up their data, are not well placed to assess the likely effectiveness of the data security systems being used by recipients of their data and do not

⁸⁶ Doteveryone (2018). *People, Power and Technology: Digital understanding*. (Link [here](#), accessed March 2020)

⁸⁷ ICO. *Guide to the General Data Protection Regulation (GDPR): automated decision making and profiling*. (Link [here](#), accessed March 2020)

⁸⁸ Doteveryone (2018). *People, Power and Technology: Digital attitudes*. (Link [here](#), accessed March 2020)

⁸⁹ There is also the potential for overconsumption due to lack of skills, for example where users think they are better equipped than they are to deal with harmful content exposure

understand whom it may be shared with (or sold to).⁹⁰ It is likely that this information asymmetry is significant and that consent to personal data is being given which is not sufficiently informed. For example, in one experimental survey of users joining a fictitious social media site 98% of people accepted terms and conditions that included providing a first-born child as payment, demonstrating consumers are not engaging with these contracts.⁹¹ Where consumers do not know or cannot appreciate the nature and extent of the possible harms which could arise if they give over data, there is likely to be a 'present bias' at play, where the immediate gratification of accepting conditions to be able to access a service or purchase a good outweighs the potentially serious, but far off, and hard to calculate potential harms. This links to the additional implications for privacy and data abuse that have been discussed in thematic cluster #1.

Consumers may not understand how their data is used or trust companies to use it appropriately and fairly. One example of this is price personalisation where the price set varies by individual. The information held by digital businesses could enable 'personalised pricing' in a way that was not possible previously. In particular, personal data could be used to achieve or approximate 'first degree price discrimination' where the price of the good or service is unique to the individual being offered it.⁹² This may increase welfare by opening up a market where some consumers were originally priced out – where only one price was previously offered, now it can be offered to some individuals for less who can now afford it. It can enable pricing which is more consistent with the outcome of a competitive (and efficient) market. Personalised pricing can, however, be harmful if it allows businesses to extract more consumer surplus for the business, especially if vulnerable customers are left worse off.

This is also a concern for digital trust and choices for two reasons:

- Many users don't understand that their data is used for this purpose: only 21% of British adults surveyed by Doteveryone are aware that data may be collected so that companies can determine the price they are charged for a product or service;⁹³ and
- Where consumers are aware of this practice they may not believe that the prices or other offers they received are 'fair' if their personal data has been used to generate them. While they may have technically consented to such a use of their data, often consumers do not have a clear understanding of the terms and conditions which they accept, or what they have consented to their data being used for and are not likely to think this is justifiable, particularly if it results in higher prices for them.

Evidence required: Although evidence exists of distrust and uncertainty, additional evidence is needed to assess how individuals' behaviour is impacted by lack of trust in how companies use and protect their data. This is particularly relevant when providing data is a condition of accessing a digital good or service. Firstly additional evidence could help to understand how the transparency of algorithms changes/shapes behaviour. That research may not have been undertaken yet because algorithmic transparency is relatively new. Secondly, there is a broader question for individuals and society which needs to be addressed: what is the impact on autonomy and choice posed by personalised service offerings? Thirdly, additional information can help to assess how the cost benefit analysis of personalised offerings may interact with unfair price discrimination and harms to privacy. There are implications for efficiency and distributional outcomes which are also

⁹⁰ Doteveryone (2018). *People, Power and Technology: Digital attitudes*. (Link [here](#), accessed March 2020)

⁹¹ Obar and Oeldorf-Hirsch (2018). *The Biggest Lie on the Internet: Ignoring the Privacy Policies and Terms of Service Policies of Social Networking Services*

⁹² OECD (2018). *Personalised Pricing in the Digital Era*. (Link [here](#), accessed March 2020)

⁹³ Doteveryone (2018). *People, Power and Technology: Digital understanding*. (Link [here](#), accessed March 2020)

complicated by evidence that personalised pricing is perceived as unfair.⁹⁴ There is also concern around the potential for personalised pricing to harm consumers by leading to a loss of trust in online markets and consequently reducing digital engagement.⁹⁵

Choice manipulation of digital recommendations

Where consumers have imperfect information about digital goods or services, they may seek additional information to verify product quality. To do this, they may seek reviews and recommendations in order to bridge the gap but there is a potential informational asymmetry between them and the seller of the good or service. If customers are unable to distinguish trusted reviews and recommendations from those that may have been motivated by other incentives, they may decide to trust none of them when making their decisions. Several studies have analysed aspects of this phenomenon.⁹⁶

Additionally, consumers can be behaviourally ‘nudged’ into making certain decisions with the digital choice architecture set up by businesses. For example, if a company gives prominence to its own goods or services consumers could be influenced to choose these over other, possibly better, alternatives. An example of this is the 2017 case at the European Commission where Google was fined for abusing dominance as a search engine by giving illegal advantage to its own comparison shopping service.⁹⁷ This may erode trust in goods and services consumed online because an information gap and uncertainty remains. This may then distort consumption decisions with a resulting adverse impact on welfare.

Evidence required: Evidence is required to understand the value that people attach to digital businesses providing trustworthy recommendations based on the consumers interest. A *Which?* survey showed that 97% of adult shoppers rely on online customer reviews to help make a purchase, and the CMA estimates that £23 billion a year on UK consumer spending may be influenced by online reviews.⁹⁸ Where these reviews are not genuine, or it is not clear that those promoting products have been paid to do so, this can have a negative impact on consumer decision making. Additional evidence is also required to understand if consumers will reduce their consumption when they do not trust recommendations.

Thematic cluster #4: Digital scale, scope and network effects

The fourth cluster of characteristics highlights the tendency of digital markets to concentrate. Unlike the previous three characteristics clusters, this is relatively well addressed by existing research and evidence. In particular, there is a body of research in both the UK and internationally that explores the tendency of digital markets to concentrate and the implications for market power and, through it, to the competition family of harms. For example, in the UK, the Furman review assesses the benefits and challenges of digital markets with respect to competition, focusing on areas of e-commerce, social media, search and online advertising where a small number of large

⁹⁴ OECD (2018). *Personalised Pricing in the Digital Era*. (Link [here](#), accessed March 2020)

⁹⁵ Office of Fair Trading (2013). *Personalised Pricing - Increasing Transparency to Improve Trust*. (Link [here](#), accessed March 2020)

⁹⁶ See, for example, CMA (2015) *Online reviews and endorsements* and Lappas, Sabnis & Valkanas (2016) *The Impact of Fake Reviews on Online Visibility: A Vulnerability Assessment of the Hotel Industry*

⁹⁷ European Commission (2017). *Press release: Commission fines Google €2.42 billion*. (Link [here](#), accessed March 2020)

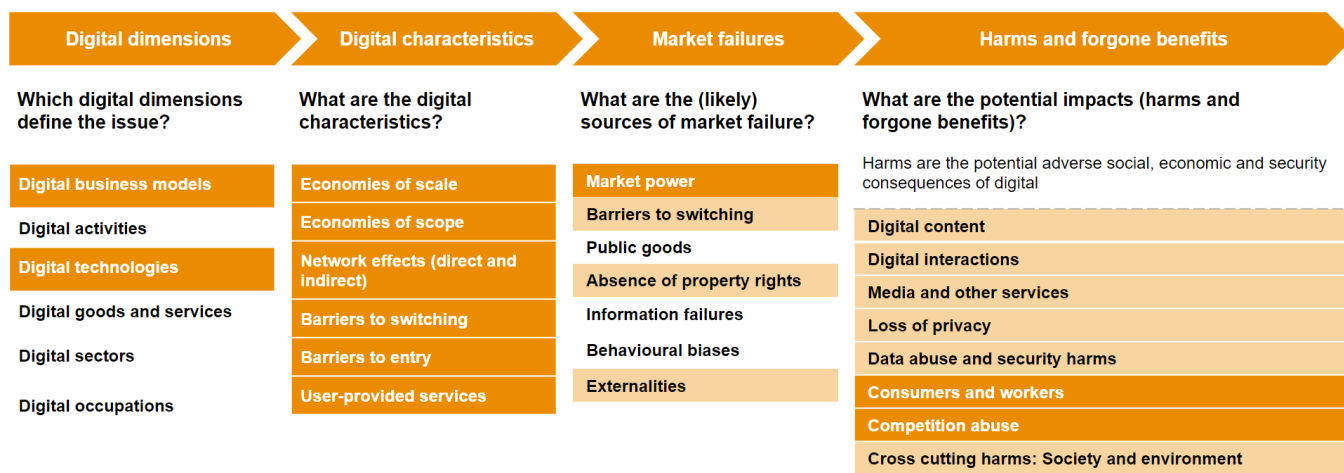
⁹⁸ Which? (2019) *Investigation into ‘fake’ customer reviews*. (Link [here](#), accessed March 2020)

players are active.⁹⁹ This section, therefore, focuses on how this cluster of characteristics may exacerbate other families of harms as market power combined with other forms of market failure.

The tendency of digital markets to concentrate means that a few dominant businesses may gain extensive market power and this can lead to potential competition harms. Concentration in many digital markets, including online search, mobile operating systems, social media and digital advertising, is high with a small number of ‘big tech’ companies now having large shares of the relevant markets.¹⁰⁰ Where competition exists in these markets, it is often between these companies. There is a question as to whether incumbents can be constrained by competition ‘for’ the market rather than ‘in’ the market.¹⁰¹ However, there is scepticism of this due to persistent dominance of large businesses, their established scale, the value of the data they already hold and their use of connected ecosystem business models.¹⁰² As a result competition for the market alone cannot be counted on to solve this problem in digital markets.

Figure 18 outlines the theory of harm linked to this cluster. It shows that whilst the focus in concentrated markets is the risk of competition abuse, it is also important to consider the wider impacts on other harm families, especially the possibility that these harms may be exacerbated in concentrated digital markets.

Figure 18: Digital scale, scope and network effects – theory of harm



Market failure focus and characteristics

This cluster of characteristics is driven by characteristics of digital technologies and the nature and shape of digital business models, especially digital platforms. Existing evidence suggests that no single characteristic causes concentration in digital markets.¹⁰³ Instead, the tendency of markets to tip is linked to:

- **Economies of scale and scope** which provide cost advantages to businesses with bigger market shares, incentivising growth and expansion, and creating the opportunity for vertical and horizontal integration. Advantages to scale arising from **very low marginal costs of production of digital services** where digital goods and services can be infinitely reproducible

⁹⁹ HM Government (Digital Competition Expert Panel) (2019). *Unlocking digital competition [The Furman Review]*

¹⁰⁰ HM Government (Digital Competition Expert Panel) (2019). *Unlocking digital competition [The Furman Review]*

¹⁰¹ In this case, rather than competition of multiple players ‘within’ a market sequential competition takes place to unseat a dominant incumbent

¹⁰² HM Government (Digital Competition Expert Panel) (2019). *Unlocking digital competition [The Furman Review]*

¹⁰³ Stigler Center (2019). Stigler Committee on Digital Platforms

and mean that companies which have sunk the (high) fixed costs such as setting up networks or infrastructure may be able to prevent or deter entry and exercise their market power;

- **Direct and indirect network externalities** compound the impact of economies of scale and scope: they reflect the incremental benefit gained by an existing user every time a new user joins the network and create potential rewards directly for a business able to attract users, for example to digital platforms (for example the benefits of using a social media platform increase the more like-minded people also use it) and indirectly (for example benefits to advertisers on a platform when more users join); and
- **Markets built around instantaneous global reach** which enables high numbers of customers or users, rapid growth and access to all global markets.

Several of these characteristics can bring advantages to consumers, such as the productive efficiencies from large players operating where there are strong economies of scale and scope which can be passed on to consumers. However, there are potential harms here too. When these characteristics are present, digital markets can be left with a small number of powerful players especially as barriers to switching between suppliers can mean that incumbents are at an advantage over potential rivals.

Whereas economists have formulated a very precise definition of the conditions under which natural monopoly occurs in terms of the structure of the costs and benefits, no equivalent definition has been developed in the area of digital. Although some progress has been made, for example, Carrière-Swallow and Haksar argue that data should be treated as a factor of production having the key economic characteristics of being nonrivalrous, generating privacy externalities and being partially excludable.¹⁰⁴ The Stigler Center has also developed some interesting examples which explain why data has increasing marginal returns.¹⁰⁵ Developing and adopting more formal economic explanations of market power will be critical to understanding the characteristics that drive market outcomes.

Tipping effects may be lessened organically by the existence of other characteristics which can allow multiple businesses in the same area to coexist, though these won't necessarily occur. In the case of digital platforms, for example, multiple platforms could be sustained where individuals have different preferences for goods or services to each other, where there are 'differentiated' digital offerings which satisfy these distinct consumer needs, and where consumers can simultaneously use multiple platforms to fulfil their needs.¹⁰⁶

As has been noted, the key market failure which drives potential harm is market power and several studies have explored how it can lead to competition abuses. This is, however, not the only market failure which is relevant. The harms associated with competition abuse may be exacerbated by the concurrent presence of other market failures. For example, barriers to switching can strengthen an incumbent's dominant position by making market entry by rivals harder. Where consumers could lose data in moving to a different service or it would take time to learn how to use it, they may be reluctant to switch. This barrier can reduce the competitive pressure on already dominant businesses with the result that they are less innovative.

¹⁰⁴ Carrière-Swallow and Haksar (2019). *The economics and implications of data*

¹⁰⁵ Stigler Center (2019). Stigler Committee on Digital Platforms

¹⁰⁶ Lear for CMA (2019). *Ex-post Assessment of Merger Control Decisions in Digital Markets*

Secondly, the absence of effective property rights may make users' data more vulnerable to dominant businesses when there is not pressure from rivals to compete over data security and privacy as an element of quality.

Finally, the presence of network effects means that the value of an individual's data is small on its own, but much greater when combined with the data of others. This creates an externality where the actions of an individual to give up their data have an impact on the wider users of a service, for example by contributing to a big data set which allows complex analytics and predictions of consumer behaviour. Additional evidence on how this thematic cluster interacts with other market failures which may occur alongside market power would be valuable.

Harms and forgone benefits

Markets which are concentrated tend to lead to poorer outcomes for consumers including:

- **Excessive prices:** Whilst many digital services are offered for 'free', personal data has such a key role in the value chain of digital business models that it may be that users should be compensated for providing this data. Even 'free' services may be too expensive if digital businesses are not forced to pay for data. Personal data is also linked to harms to privacy, data abuse and fraud, threats which consumers are not adequately compensated for when the price of data is nothing.
- **Poor quality:** Lack of competition can also affect the quality of digital goods and services available to users. For example, the quality of digital content on platforms may be lower in digital markets where market power is present. If businesses are not exposed to competition, they have less incentive to protect their customers with the result that they are more vulnerable to illegal, harmful, false or addictive content. There are also concerns around media quality and plurality if the digital platforms through which we consume media have no incentive to compete on the quality of their journalism, which could exacerbate concerns about the sustainability of producing high-quality journalism in the digital age.¹⁰⁷ Similarly, without competition dominant firms may be less motivated to address issues such as the prevalence of bullying or harassment on platforms.
- **Limited choice:** Consumers may face less choice in concentrated markets. Owners of platforms with ecosystems can promote their own products (at the expense of others) and this can limit consumer choice and/or manipulate their decision making process. The effect is to distort consumer decisions and/or erode their trust in digital ultimately leading to less use of digital than would be desirable.
- **Lack of innovation:** Limited competition may also have adverse dynamic effects over time which also detract from consumer and societal welfare as the benefits of innovation (better products at a lower price) are either missed completely or delayed. For example, the practice of 'killer acquisitions' where incumbents can acquire innovative targets such as new start-ups to pre-empt future competition from them.¹⁰⁸ This may prevent rivals from disrupting the market by introducing innovative new or improved goods and services. To the extent that this is likely, it represents a potentially significant forgone benefit. Whilst there is some evidence that dominant players in digital markets face incentives to innovate due to the threat of new entry, there is less evidence of the long term threat to innovation if these businesses enjoy market power and this gives them the capacity for strategic investments to defend their incumbency

¹⁰⁷ HM Government (2019). *The Cairncross review: a sustainable future for journalism*

¹⁰⁸ Cunningham et al (2019). *Killer Acquisitions*

advantages.

Overall, the implications of digital markets' tendency to concentrate are to give rise to potential economic harms and also to exacerbate social harms. Further evidence is needed to understand how the economic and social impacts interact and to consider whether or not existing policies and regulation are adequate to deal efficiently and effectively with these potential harms.

Conclusions

In developing theories of harm for four thematic clusters of digital characteristics, we highlight the complex relationships that exist between the digital dimensions, the digital characteristics, market failures and potential harms. Multiple many-to-many connections exist between digital characteristics and the market failures rather than simple one-to-one relationships. Several market failures often interact to generate harms, potentially amplifying the harm and raising additional challenges for policymakers seeking to address them. For example, even where information asymmetries can be overcome or property rights effectively assigned, behavioural biases may prevent policies from working as planned. There is also the risk of unintended consequences. These complexities will need to be assessed on a case by case basis.

Across the four clusters we focus on a small number of harms to illustrate the potential impacts of each thematic cluster. Even within this small number there is a real diversity of potential harms which policymakers need to be aware of, and even the same cluster of characteristics can lead to an array of harms, some of which may have similar responses but others will not.

We examine both harms and forgone benefits in this section. The latter impact must not be understated and is an area where there is particular need for evidence to identify where the opportunities and benefits to social welfare of digital are not being fully realised. This can be difficult to evidence because it requires careful construction of a counterfactual to determine the benefits which have been forgone, but it is crucial to understanding these issues.

There are challenges in gathering relevant evidence needed to define and understand the impact of harms. Measuring the potential impacts on individuals' wellbeing, both positive and negative, across digital is an incredibly large task. Our high level analysis of the evidence available compared to that required to properly inform policy decisions indicates a significant evidential gap. There is often some evidence available on harms but it can be patchy and incomplete. Where 'analogue' equivalents of harm exist there is often a need to update them for the digital version of the harm, for example in the case of exploring how the impacts of cyberbullying may differ from bullying not online. There is also value in a range of different types of research for understanding harms, from formal economic assessments to surveys of the users of digital which can shed different lights on these issues.

5. Key findings and next steps

Key findings

Our conclusions are set out in the Executive Summary and the conclusion of each chapter. Below, we summarise our key findings in relation to the two key questions that our work has addressed.

1. What is in scope of 'digital'?

Digital now plays an increasingly prominent role, in our daily lives and for businesses across all sectors. This has led to multiple, often competing, definitions of digital each of which may vary in scope. A new definition and conceptualisation of digital which can be widely accepted and adopted by key stakeholders is a foundation for effective policy making.

There are many ways to conceptualise digital. We identify six dimensions that capture the key elements and issues for policymakers (digital goods and services; digital sectors; digital occupations; digital activities; digital business models; and digital technologies).

We conclude that the digital ecosystem is complex and no single dimension is sufficient to define the scope of digital. Instead, we find that considering combinations of the dimensions and understanding how they interact and their associated characteristics are more useful for defining the perimeter of digital. We consider the scope of digital to be the interconnections of all six dimensions.

2. What are the distinctive characteristics of digital that cause potential harms (or forgone benefits) which could require new policy, governance or regulation?

Identifying and analysing the underlying drivers of harms and benefits arising from digital is key to targeting policy interventions in a streamlined and efficient way. We examine the *distinctive* characteristics of digital – characteristics that are unique to, or exacerbated by, digital – and how they may give rise to potential harms (or forgone benefits) for individuals or organisations, businesses and society. In doing this, we incorporate our analysis of the characteristics associated with the six digital dimensions.

We find that these characteristics often appear in combinations that we term 'thematic clusters'. These thematic clusters of distinctively digital characteristics are of concern because they correlate to potential harms (or forgone benefits). We identify six thematic clusters which appear to drive related groups of harms. We select four for further analysis on the basis that their likely impact is significant and: the pace of digital developments may indicate a need for new policy, governance or regulation:

1. Ownership and portability of personal data;
2. Identity, verification and oversight of digital content;
3. Transparency of digital technologies, data and algorithms; and
4. Digital scale, scope and network effects.

For the four thematic clusters, we develop a theory of harm. This theory of harm links the relevant digital dimensions to the distinctive characteristics to the resulting market (and policy) failures and, finally, to the potential harms (or forgone benefits).

In all cases, we find that the relationships between characteristics, market failures and harms are complex with multiple, interconnected factors interacting. To illustrate this, for each of the four thematic clusters we focus our assessment around a particular subset of the characteristics, resulting market failures and the potential harms (or forgone benefits) which arise from it. Therefore, the theories of harm developed here are not intended to be exhaustive. Instead, their purpose is to demonstrate the key issues arising from selected thematic clusters.

We also note the empirical evidence that may be required to quantify the impact of harms and how the harm comes about as a result of characteristics and market failures. In most cases, significantly more evidence is required to understand the harms and how they are caused by digital characteristics.

Next steps

The second part of this section considers possible next steps. Specifically, we analyse how our work could be developed. We identify three broad areas:

- Conducting further analysis and evidence gathering;
- Broadening the analysis to include other distinctive characteristics and market failures; and
- Considering the potential implications of this work on governance, policy and regulation.

Each of these areas will require further analysis and we consider each in turn.

Conducting further analysis and evidence gathering

As part of our analysis of each distinctive thematic cluster, we discuss the qualitative evidence relating to specific harms (or forgone benefits). We suggest what additional analysis could be useful in building the evidence base to enable the findings to be tested and refined. This includes: quantification of the scale of the welfare impacts of distorted consumption driven by information asymmetries or bias manipulation; analysis of the forgone benefits of reduced consumption of digital content from lack of trust; and, whether and how assigning property rights and developing a stronger market for personal data could reduce this potential welfare loss.

Broadening the analysis to include other aspects of the thematic clusters

Our analysis is intended to inform development of a framework which can be used to shape a strategic approach to digital policy, governance and regulation based on understanding how the distinctive characteristics of digital link to the potential for harms (or forgone benefits). It has, however, been limited in its scope. Specifically, we examine the role of selected market failures in developing theories of harm. This means that further aspects need to be examined if a comprehensive assessment of the theories of harm is required across the clusters we analysed (see Figures 15, 16, 17, 18).

A further avenue of work could also involve a deeper exploration of the complex interactions within a thematic cluster to develop a robust understanding of the connections between characteristics and the causal mechanisms through which the drive market failures and ultimately harms.

Furthermore, we do not consider the theories of harm associated with two of the six distinctive characteristics of digital we identified in Section 3: additional work is needed to consider the implications of the critical role of digital infrastructure and networks and the global nature of data and digital.

Potential implications for governance, policy or regulation

The scope of our work does not extend to assessing the appropriate policy, regulatory or governance responses to particular market failures and their associated harms. However, we anticipate that the findings in this report may be used to consider a number of different aspects of future policy development. We consider each briefly below.

Scope of digital governance and regulation

Our work proposes a multi-dimensional framework for considering digital on the basis that a single 'dimension' approach (e.g. a sectoral, occupational or goods and services approach) is insufficient in capturing the cross-cutting impact of digital on the economy and society. Our work has shown that to understand the range of potential opportunities and harms brought about by digital, an inclusive approach to the scope of digital is necessary.

Going forward, there may be a case for policymakers working in traditionally disparate policy areas to work closer than before, in order to address harms stemming from common underlying drivers. Cross-sectoral teams have a shared interest in ensuring the coherent governance of digital for beneficial outcomes. For example, businesses deriving insights from large consumer data sets play an increasingly prominent role in digital business models, regardless of sector; policy teams across all sectors may need to collaborate to ensure governance around these practices will realise the opportunities and mitigate the risks.

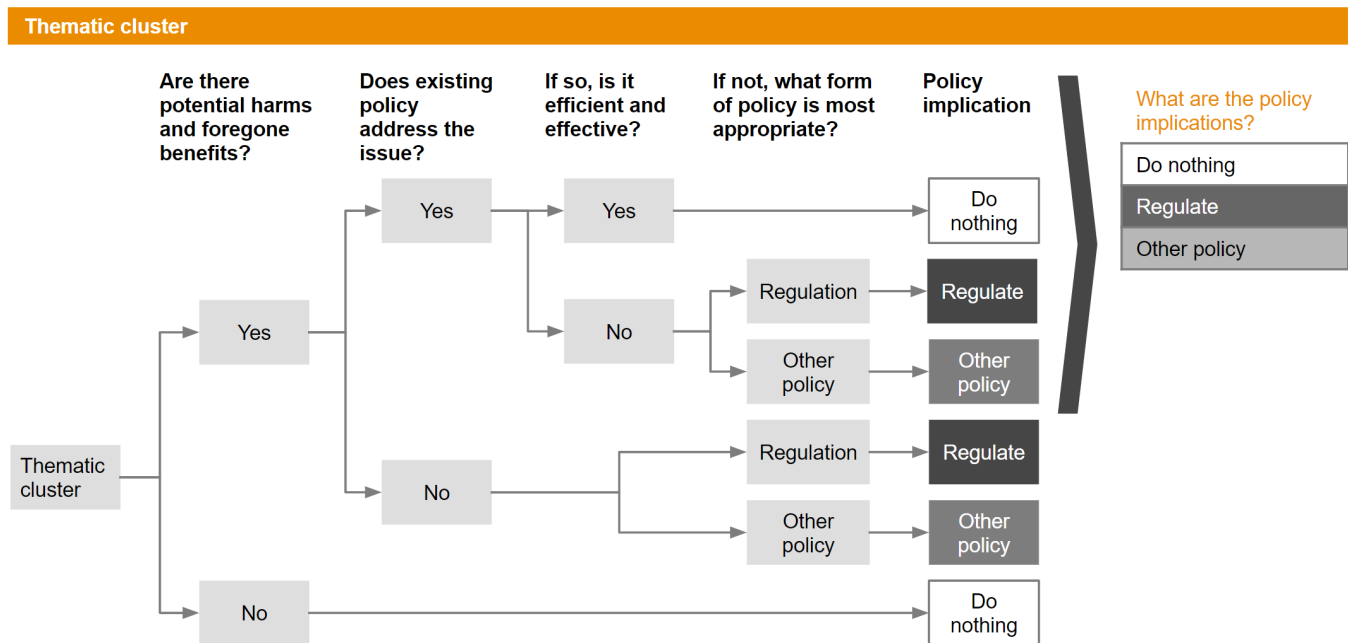
Approach to designing interventions

A new approach may be required for future design of policy interventions seeking to unlock the benefits or tackle the harms arising from digital. Our report identifies thematic clusters of characteristics that, when appearing together, can lead to potential harms (or forgone benefits). This may present an opportunity for policymakers to develop interventions in a streamlined, targeted way by identifying synergies where harms can be traced back to common underlying causes.

Figure 19 illustrates how policymakers may need to consider our work as a basis when deciding whether and how to respond to potential harms.

Given the interdependencies which exist between the digital dimensions and their associated characteristics, it will be important to consider the potential for interventions to have unintended consequences, both positive and negative.

Figure 19: Illustrative decision making process for digital policy, governance and regulation



For policymakers designing digital policy interventions, there may be synergies where multiple harms may be addressed by addressing a single thematic cluster of characteristics. This may result in greater coordination among policymakers in design of regulatory or enforcement measures. A clear next step would be to develop a more robust evidence base to show the extent of these relationships through empirical evidence – we suggest focus areas for this further work in Section 4 of this report.

Horizon scanning

A common theme throughout our evidence gathering phase has been the rapid pace of change in digital meant that definitions of digital were often out of date or failed to keep up with new innovations in digital. This was particularly true when conceptualising digital through the ‘digital technologies’ or ‘digital goods and services’ approach. Our multidimensional approach mitigates this to some extent, for example by identifying the underlying activities that operate new digital technologies.

In order to future-proof our definitions of digital further, policymakers using this work should consider horizon scanning processes and an iterative approach to defining digital. We anticipate that bodies such as the Regulatory Horizons Council and the Centre for Data Ethics and Innovation will be important contributors to this debate.

International governance

The global nature of many distinctive characteristics means that coordinated international responses may be a central component of addressing some key policy challenges. The resultant harms often affect consumers and businesses operating across disparate jurisdictions (for example, harmful content may be created outside the UK but impact on UK citizens and data centres outside the UK may hold personal data on users in the UK). Furthermore, unilateral interventions in the UK may have implications for its international competitiveness, balance of

trade and inward investment. This means that governance of digital will require some level of international cooperation, like information sharing arrangements or enforcement agreements, in order to be effective. This is a clear area which will benefit from further evidence. In particular, it will be important to establish the limitations to governance for digital businesses operating across multiple jurisdictions.

The regulatory regime

The scope of our analysis does not examine the institutional implications for UK regulators that might flow from our policy-related findings. The institutional arrangements arising from potential future policy development will, however, be a key consideration for addressing some of the harms identified in this report.

It may be the case that digital requires a novel approach to regulation. To determine this, there are a number of questions that need consideration:

- Where should responsibility for monitoring and/or enforcement sit from a regulatory perspective?
- Which, if any, digital policy responsibilities can be allocated on a traditional vertical 'sector' basis, or structured horizontally?
- Where might cross-cutting harms arise from shared distinctively digital characteristics and what powers might a regulator (or multiple regulators) need to address them?

Finally, a supplementary consideration will be to ensure that if existing regulatory institutions are affected by digital policymaking, they have the right capability and capacity to be effective now and in the future. In the future there may be a need for stronger regulatory coordination and stronger efforts to share information and build a robust evidence base.

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Workshop attendees

During this project we ran two workshops with representatives from DCMS, Whitehall and UK regulators.

Department for Digital, Culture, Media and Sport	Other government departments	Regulators
<ul style="list-style-type: none">• Digital regulation and markets• Online harms• Cyber security• Digital standards• Central analysis• Domestic data protection	<ul style="list-style-type: none">• HM Treasury• The Home Office• The Cabinet Office<ul style="list-style-type: none">• Internet policy team• The Department for Business, Energy and Industrial Strategy (BEIS)<ul style="list-style-type: none">• Better regulation executive• Consumer and competition	<ul style="list-style-type: none">• Competition and Markets Authority (CMA)• Ofcom
