Valuing the impact of spectrum use on the UK economy

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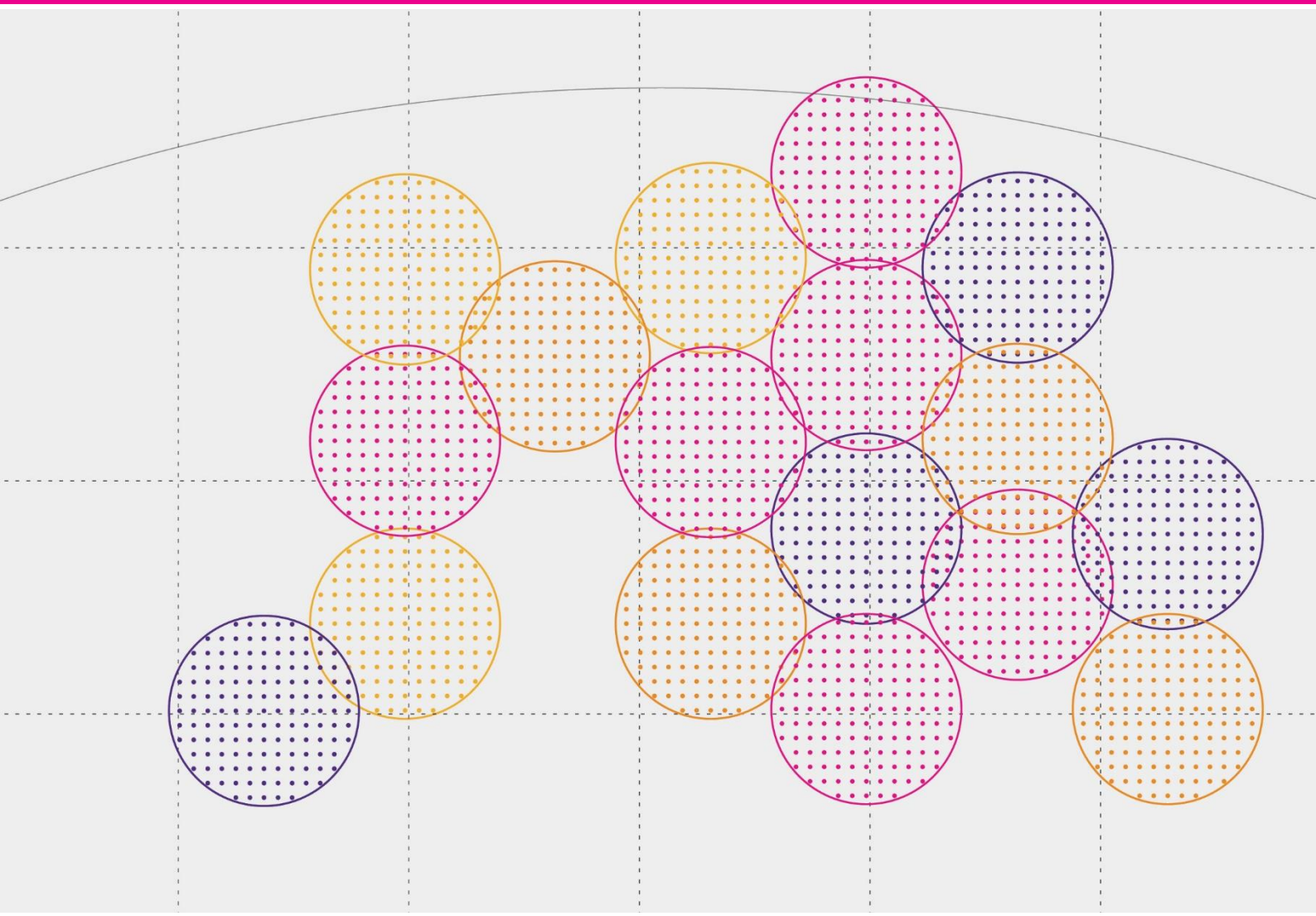

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About this study

This study for UK Spectrum Policy Forum provides recommendations to DCMS regarding updating the study on the contribution of spectrum on the UK economy to enable Government to continue to make robust spectrum allocation and assignment decisions.

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Contents

1 Introduction 4

2 DCMS 2012 report 5

2.1 Scope 5
2.2 Value 6
2.3 Matters arising 7

3 Workshops inputs and issues raised 8

3.1 Licence exempt 8
3.2 Space 8
3.3 Broadcasting 9
3.4 Defence 9
3.5 Utilities 10
3.6 Amateur radio 10
3.7 Commercial mobile services 10
3.8 Broader inputs 11

4 Conclusions 13

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1 Introduction

This report sets out contributions and conclusions from the Cluster 3 workshops held during 2018. It builds on the presentations made, the discussion that took place and input from individuals and companies throughout the course of the work. The output of this report is recommendations to DCMS regarding updating the study on the contribution of spectrum on the UK economy to enable Government to continue to make robust spectrum allocation and assignment decisions.

Cluster 3 has a remit to consider spectrum value and efficiency. The purpose of the 2018 workshops was to support the case for updating of the report published by DCMS in 2012 on the impact of radio spectrum on the UK economy,[1] and how the scope of a further study may require adapting in the light of developments with spectrum using services and approaches to assessment of value delivered by spectrum. The 2012 report concluded that in the period from 2006 to 2011, the value of spectrum to the UK had increased significantly from £35 billion to £52 billion per annum.[2]

Key to the terms of reference for a future report is the UK Spectrum strategy,[3] which set several actions and goals including:

- Developing a consistent methodology for assessing the full value of spectrum to the UK.
- Application of a consistent set of principles for valuing spectrum use across all sectors.
- Doubling the annual contribution to the economy of use of spectrum by 2025.
- Working with the UK Spectrum Policy Forum to keep the Spectrum Strategy focused on the key issues for delivering the best value for the UK from spectrum.

It is now approaching 5 years since the Spectrum Strategy was published and this is around half way to the 2025 goal. Government should assess progress toward the 2025 goal of doubling the annual contribution of spectrum to the UK: check what progress is being made, the future trajectory for value, and the range of likely outcomes. Based on this assessment, government could affirm progress, reconsider targets and / or make other adjustments as required.

The workshops were intended to gather input from spectrum using sectors that should be considered when assessing the scope of a future study. Details of workshop presentations can be found on the SPF website.[4]

This report has been produced for publication by the SPF. The report is structured as follows:

- Section 2 briefly sets out the findings of the 2012 report and relevant aspects of the Spectrum Strategy.
- Section 3 summarises workshop inputs and issues raised.
- Section 4 delivers conclusions and recommendations.

[1] Final report for the Department of Business, Innovation and Skills and Department for Culture, Media and Sport on the "Impact of radio spectrum on the UK economy and factors influencing future spectrum demand. Analysys Mason, 5th November 2012.
[2] Excluding public sector use of spectrum, which was out of scope for the 2012 report.
[3] Department for Culture, Media and Sport. The UK Spectrum Strategy: Delivering the best value from spectrum in the UK. March 2014
[4] https://www.techuk.org/insights/meeting-notes/item/14317-uk-spf-cluster-3-social-and-economic-value-3, https://www.techuk.org/insights/meeting-notes/item/13629-uk-spf-cluster-3-social-and-economic-value-2, https://www.techuk.org/insights/meeting-notes/item/12534-spf-cluster-3-economic-and-social-value-meeting-notes

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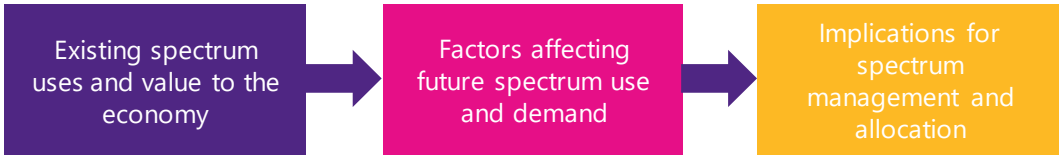
2 DCMS 2012 report

2.1 Scope

This section briefly covers the DCMS report published in 2012. The scope of the study is shown in Figure 2.1

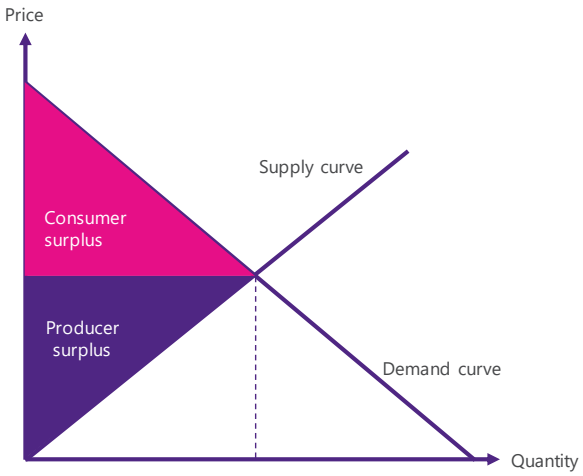
Figure 2.1: 2012 study scope



Existing spectrum uses and value to the economy

The study took an approach of estimating the historical and future economic benefit to consumers from having access to services using spectrum and the surplus producers earn from offering the services (i.e. an economic welfare approach – consumer surplus and producer surplus – see Figure 2.2). It also considered value and contribution to the economy of companies through the revenue and jobs created by spectrum.

Figure 2.2: Consumer and producer surplus



A key issue for the study was the lack of recent data on willingness to pay for spectrum using services. For some services (e.g. Wi-Fi) an approach of estimating savings achieved through offload by mobile broadband was used. For other services considered (which form a relatively small part of the overall value) existing models were updated.

Factors affecting future spectrum use and demand

This considered the changes observed and which were assessed to influence future spectrum demand and value. Examples are:

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- Growth in mobile data traffic.
- Growing use of licence exempt spectrum.
- Increasing efficiency of TV broadcasting (e.g. move to DVB-T2).
- Changes to the usage of fixed links (e.g. use of higher frequencies).
- Moves to higher frequency bands for services such as satellite communications and PMSE.
- The move to broadband services for PMR.
- Increase in sharing (e.g. white space / LSA).

The trends highlighted in the 2012 report have largely materialised in one way or another, with the notable exception of significant growth in sharing.

Implications for spectrum management and allocation

The 2012 report made recommendations on several areas including:

- Supporting growth of the public mobile sector (e.g. allocation of further spectrum).
- Action required to support growth driven by wireless data (e.g. spectrum for Wi-Fi).
- Technology upgrades to improve efficiency (e.g. DVB-T2).
- Better sharing (e.g. through use of DSA).
- Increasing spectrum supply (e.g. through release of public sector spectrum).

2.2 Value

Table 2.1 below summarises the key findings on value from the 2012 study.

Table 2.1: Value of spectrum use

Spectrum use	2006 (£ billion)	2011 (£ billion)	Real % change 2006–2011	10-year NPV 2012–2021 (£ billion)
Public mobile communications	21.8	30.2	16%	273
Wi-Fi	–	1.8	–	25.6
TV broadcasting	3.6	7.7	79%	86.0
Radio broadcasting	1.9	3.1	35%	28.6
Microwave links	3.9	3.3	-29%	22.1
Satellite links	2.8	3.6	7%	31.3

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Spectrum use	2006 (£ billion)	2011 (£ billion)	Real % change 2006–2011	10-year NPV 2012–2021 (£ billion)
Private mobile radio	1.2	2.3	55%	19.2
Total	35.2	52.0	25%	486

Source: DCMS, Analysys Mason

The results of the study reflect spectrum in commercial use. There was a real increase in value between 2006 and 2011 of 25%. The value of spectrum in public sector use was not considered.

2.3 Matters arising

Analysys Mason (Philip Bates) kindly provided input to the opening workshop and raised the following points for consideration for a future report:

- There has been considerable development in spectrum use since the 2012 report, but the trends identified therein remain broadly applicable.
- The 2012 study only considered private benefits and not wider external / social benefits accruing from use of spectrum.
- There was a lack of willingness to pay data and it would be highly desirable to gather new data to support consumer surplus calculations.
- Methods should be explored to consider the impact of public sector use of spectrum to the UK economy.
- The impact from some spectrum using areas was considered using models from previous studies and consideration should be given to whether these should be revised.

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3 Workshops inputs and issues raised

This section sets out the inputs to workshops from spectrum using sectors. It is recognised that not all sectors were able to contribute to the workshops and that there were many contributions from the floor to the overall discussion. Where possible, these views are captured in the text below.

3.1 Licence exempt

Licence exempt spectrum is used for many applications including Wi-Fi and Bluetooth. Although these two examples are important for the provision of many services, there are other licence exempt uses including many Short-Range Devices (SRDs), smart meters, vehicle radars, citizens band radio, cordless telephony, white spaces and others.

A key concern raised in the workshops was ensuring that the there is adequate spectrum available for the provision of licence exempt services and a key justification cited for this is the economic value delivered using licence exempt spectrum. For example, the value of carrying data originated on mobile and portable devices, which is offloaded to fixed networks – it is estimated that between 60-80% of traffic originated on these devices will use licence exempt spectrum. Also highlighted is the key role licence exempt spectrum can play in development of future M2M services and for applications such as smart vehicles.

A further aspect is the use of licence exempt spectrum in spectrum sharing scenarios (e.g. TV white space).[5] While this has not developed commercially to date in a significant way, there was a view that it would remain a key development area over the coming five years.

It is recognised that assessing the value delivered to the UK from the use of licence exempt spectrum requires some thought. While it is possible to assess producer aspects of these services, it is more challenging in the absence of a service transaction to assess how consumers and other users value them. Willingness to pay and other user research was highlighted as key to developing a better understanding of value for the sector.

3.2 Space

Several services were addressed under this heading including satellite communications, meteorological, science and passive services. Space services are key to many day to day applications, which are either directly used by consumers (e.g. provision of satellite TV content) or which provide key inputs to services that directly or indirectly impact consumers / citizens (e.g. earth observation). Also noted was the role played by space services in things like disaster relief where the ability to reach locations quickly in the absence of other infrastructure is vital. The latter, while contributing private value, also has a social component of value to consider.

The space sector is continuing to make considerable investments in new technologies, including medium and low earth orbiting satellites, and to address the need for an increasing level of broadband service provision. While the use of traditional satellite services may have declined as terrestrial solutions have become more widespread and cheaper, it is anticipated that volumes and revenues from new services will deliver significant value to the space sector.

Examples of current satellite use in the UK include distribution of TV signals to several million homes, M2M applications such as tracking and telemetry, provision of essential communications to remote locations,

[5] A similar example would be the GAA part of CBRS in the United States.

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provision of resilient back up solutions, information distribution for transport and other services, and delivery of security and defence capabilities.

In addition to the provision of communications and other services, the matter of manufacturing and export of satellite equipment was raised and whether this should be included when considering value delivered to the UK by spectrum.

3.3 Broadcasting

Broadcasting (both satellite and terrestrial) is still a vitally important means of providing audio visual content to a large part of the UK population. This position is forecast to continue well into the 2020s if not beyond. However, the use of spectrum in the sector is not confined to the final transmission to consumers. It is also used extensively for programme making and provision of content from special events (PMSE). Spectrum also plays a key role in inputs to broadcasting, like news gathering, where a high level of immediacy is required.

The difficulty of isolating the economic value of broadcasting was raised given the free to consume nature of some of the services provided. This was also seen as an issue for PMSE, where there may be some producer benefit, but the downstream consumer element is difficult to isolate, frame and measure.

There are wider benefits arising from broadcasting and again, how these might be captured and measured is a matter for debate. These benefits include externalities such as social inclusion, social cohesion, dissemination of public information, education, security and resilience and democracy. Key to assessing them is access to high quality research on how consumers / users value the service and the delivery element of it reliant on spectrum.[6]

3.4 Defence

Provision of defence is largely a public sector activity (although there are significant private sector elements, especially in areas like defence manufacturing). As with other public sector uses of spectrum, the 2012 study did not attempt to make an assessment of the impact of spectrum use by defence.

Defence is a significant input to the UK economy. The UK is the second largest defence exporter in the world. Provision of defence is worth £22bn a year to the UK economy and it makes a direct contribution to UK GDP through £7bn in high value exports.[7]

Spectrum plays a major role in provision of defence services and there are producer benefits that could be assessed for these. However, aspects of defence are a public good and this raises issues in terms of assessing value and the broader externalities and social benefits that may accrue. It is recognised that this is a complex area and it requires high quality data to understand the value citizens place on defence and to then isolate the proportion of value attributable to spectrum.

While there is a focus on defence to make more efficient use of its spectrum holdings (e.g. through release or sharing of spectrum),[8] this should be done with an understanding of the full value of the spectrum for both defence and alternative uses, to enable a proper impact assessment.

[6] This is a good example of where spectrum is an enabler but not the product consumed. Research does not automatically make the link between the value of the item consumed and enabling mechanisms.
[7] Source – presentation from MOD.
[8] The Public Sector Spectrum Release Programme (PSSRP). It should be noted that in addition to defence this applies across the public sector and is coordinated by the Central Management Unit (CMU) in UKGI.

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3.5 Utilities

Utilities make key inputs to the operation of the economy and spectrum plays a key role in the provision of utility services (e.g. electricity, gas, water). Many monitoring and control capabilities at remote sites would not be possible without access to reliable and resilient spectrum. These capabilities are provided through both terrestrial and satellite communication services (the terrestrial services being a mix of commercially provided services and dedicated networks provided by utility organisations and their suppliers). In addition to private value arising from use of these services, there are externalities and other social benefits that could be assessed.

Spectrum is necessary for business as usual operation for utilities, but it plays a key role at times of disruption. Without access to enough and adequate spectrum, it would be difficult for utility services to meet the restoration times required by government. Studies have been carried out into the cost of disruption and it was estimated in a report for EUTC[9] that disruption such as large area black outs can have a socio-economic impact of 50-150x the retail price of the electricity supplied. A key question is what proportion of this value is attributable to spectrum?

A further input highlighted is the relative amount of spectrum used by the utility industries compared to some other spectrum using sectors (e.g. commercial mobile) and how this is likely to change with the implementation of smart grids. Smart grids require the provision of many more monitoring and control points within the generation and distribution network (orders of magnitude) as the volume of renewables on the generation side and smart management and load control on the distribution side take effect.

3.6 Amateur radio

The UK has a vibrant amateur radio sector with over 70,000 licensees. It makes use of spectrum for both terrestrial and satellite communications on a primary and secondary basis. It is a sector that continues to innovate both technology and solutions. Radio amateurs sometimes provide lifesaving services through monitoring and relaying of information.

The sector provides some direct economic impact (e.g. through manufacture and sales of equipment). There are also externalities and social benefits arising from education, development of skills and social cohesion but as, with other spectrum using sectors, isolation and measurement of these can be hard to quantify. Each year some 2,800 Radio Amateurs take the Ofcom approved exams and this is an excellent way of encouraging STEM involvement.

The sector has a good future and it provides radio amateurs with a platform for and freedom to innovate wireless solutions.

3.7 Commercial mobile services

Although there was not a presentation on this area, it was discussed in the workshops. There has been a considerable amount of spectrum made available to mobile over the past 20 years, now mainly driven by the requirement to serve increasing amounts of mobile data. As was noted in the 2012 report, these services account for around two thirds of the value of spectrum to the economy.

The value of mobile was estimated using both welfare and by considering the contribution of companies and jobs. While major concerns were not raised with the approach, this is a good example of where the estimation

[9] European Utilities Telecom Council. Socio economic value of spectrum in providing utility services to support their operations. October 2013.

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of consumer surplus could be uncertain due to the data used. A future study should the requirement for up to date research to improve the quality of the reference data available.

Mobile is a good example of where there could be confusion with the use of the term value. The use of market mechanisms for assignment of mobile spectrum provides an insight to the private value of spectrum to an operator. This is not the same as the value a consumer may place on mobile services.

3.8 Broader inputs

Here are listed other inputs raised at the workshops and common themes from across the various presentations. It is recognised that not all sectors were able to formally present their inputs and that valuable contributions were made in discussion that cut across more than one sector.

- The point was made in several of the presentations and other contributions that high quality up to date research is required to assess the value of spectrum to the UK. This is critical for willingness to pay inputs to assess consumer surplus and for the evaluation of external and social value aspects. While the 2012 study did not include a primary research component, a future study should, given the age of some of existing research and in some areas the absence of useable data.

- There was some confusion at the workshops on the definition of value, which needs to be clear for a future study. The purpose of a future study (as was the case for the 2012 study) would be to assess the impact of spectrum use to the UK. This is likely to be based on the economic value attributed to spectrum (e.g. economic welfare). This is not the same as the value that a spectrum user may place on its spectrum as an asset or the fees paid for use of spectrum.

- The workshops highlighted that the spectrum world is dynamic rather than static. There is ongoing innovation in services and continuing changes to spectrum technologies, many of which allow more efficient use of the scarce resource. A key input to assessing future value is forecasts for spectrum use. For some spectrum using services these are readily available[10] while for others they are not so easily obtained. Some care will be required with forecasting, not only to ensure that the range of outcomes for specific services is plausible but also to ensure that relative effects are considered.

- Externalities and social value came up in several of the presentations and discussion. These points were not tackled in the 2012 study. There are many framing and measurement issues to consider when attempting to assess externalities and social value. In 2014, the DCMS commissioned an expert panel to look at social value.[11] This recommended use of multiple perspectives to provide several complementary measures and insights including:

  - Use of deliberative research and stated preference techniques.

  - Research based on subjective wellbeing.

- Several presenters and other participants raised the use of multiple models to assess value (e.g. there was not a single approach to assess the impact of spectrum for all services). The Spectrum Strategy set goals for Developing a consistent methodology for assessing the full value of spectrum to the UK and application of a consistent set of principles for valuing spectrum use across all sectors. The feasibility of this should be considered for a future study to deliver a consistent view. However, it is important not to neglect a key purpose of a future study, which is to carry out an assessment of progress since 2012,

[10] For example, the forecasts provided by vendors like Cisco and Ericsson for data service growth.
[11] Incorporating social value into spectrum allocation decisions. DCMS November 2015

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which requires some compatibility between new and existing methodologies (or at least an objective way of reconciling between results delivered by different methodologies).

- The presentation of defence issues raised questions around the wider public sector use of spectrum. This was not considered for the 2012 study. However, contributions at the workshops questioned whether a significant element of value was being missed by not including public sector use, especially with the heightened awareness of security and resilience issues being seen today. Bringing public sector into a future study would require at least:
  - Clear and accurate information on public sector spectrum usage.[12]
  - Information on how the public perceive the value of these services.

[12] Separating out what is commercial use from true public sector use.

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4 Conclusions

Spectrum users (the Spectrum Policy Forum) think it is important that Government has a clear understanding of the value of spectrum to the UK so that it can make robust decisions about spectrum allocation and assignment. Given the goals set out in the Spectrum Strategy it is important that Government acts on the recommendations set out below to provide a robust basis for Government, Ofcom and other agencies managing spectrum to deliver more effective allocation and spectrum management decisions. If enacted, the outcome will be a more holistic review of the impact of spectrum on the UK economy and better decision making.

Business recognises that value to the nation is not the same as value to different spectrum-using sectors, or to individual players within a sector. There is clearly economic value and it would be helpful to have an update of this using a methodology that allows for historic comparison but also best reflects what we now understand by economic value to the UK. Developing the ideas for social value would also help Government to be seen to have the tools for making robust decisions about allocation.

The UK Spectrum Strategy set out goals for spectrum in the UK including to double the contribution made by spectrum to the UK economy by 2025. It also set a goal for consistency of methodology for assessing the value of spectrum. Given the timing of the last study commissioned by DCMS in 2012, carrying out a follow up study in the near term (i.e. 2019) and reconsidering of methodological aspects would allow:

- Changes in the spectrum use landscape since the last report to be captured and the implications of these to be properly considered.

- An assessment of progress toward the goal of doubling the value to the UK economy to be carried out and any implications identified to be properly assessed and acted on.

The Cluster 3 workshops held in 2018 have highlighted several matters to consider when specifying further work in this area. These are set out below together with recommendations for action:

- It was clear that there is confusion regarding the term "value" among participants at the workshops. It is therefore recommended that the government clearly explain what it is seeking in the specification for a future study to avoid misunderstanding among stakeholders.

- The 2012 study did not consider externalities and social value aspects of spectrum use. The DCMS commissioned an expert panel to consider this, which reported in 2015. It is recommended that the DCMS review the findings and recommendations of the expert panel and consider incorporating at least a qualitative assessment of external and social value issues into a future study.

- The lack of robust willingness to pay data for spectrum using services is a concern for the accuracy and validity of a future study. The last available data commissioned by government was obtained more than 10 years ago. It is recommended that fresh primary research is undertaken as part of a future study to update this information.

- For the 2012 report, several methodologies were used to assess the value delivered by spectrum use, including the use of economic welfare (i.e. producer and consumer surplus). The Spectrum Strategy set a goal to use a single approach to value spectrum. While it is recognised that the application of a single approach to all spectrum uses may be challenging, it is recommended that the next study should consider this and move in this direction if possible.

- The 2012 study did not consider the value of public sector use of spectrum. The public sector continues to be an important user of spectrum, not least for defence and security purposes, and it delivers value in

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doing this. It is therefore recommended that the scope of a future study should include public sector spectrum use, not least to understand the scope for improving the efficiency of public sector use.

- The dynamic nature and continuing innovation with spectrum use are clear from contributions to the Cluster 3 workshops. A key function of the 2012 study was to identify factors influencing future spectrum demand. The SPF has recently updated its spectrum demand report[13] and it plans to carry out further work to assess demand by industry verticals. It is recommended that identification of trends and future use of spectrum should be retained in the scope of a future study, and potentially enhanced to allow appropriate scenarios for future use to be developed.

- Assessment of progress toward the 2025 goal is a key aspect of a future study. To do this a valid a comparison must be made with the outcome of the 2012 study. This requires that revisions undertaken to methodology still allow this comparison to happen. It is recommended that enabling valid comparisons with previous work is clearly specified as an aim of the study.

[13] UK spectrum usage and demand. Prepared by Analysys Mason for the UK Spectrum

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