The Digital Dividend in Serbia

Report by Europe Economics

(incorporating changes agreed at the Digital Dividend Workshop held in Belgrade June 16/17 2010)

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1 EXECUTIVE SUMMARY

This report is closely similar to the final draft completed on June 10 but incorporates minor changes agreed at the Digital Dividend Workshop held in Belgrade on June 16 and 17 2010.

1 This report estimates the potential value of the "digital dividend" that will become available to Serbia when it ceases the transmission of analogue TV signals, replaces them with digital, and releases some of the radio spectrum previously used by TV. The term "dividend", implying benefit, arises because, as the released spectrum becomes available, more, and more varied, forms of electronic communications through the air become possible.

2 In Serbia, Digital Switch Over (DSO) will take place over a period starting in 2012 and concluding in 2015.

3 The digital dividend cannot be precisely valued in advance, in any country, for at least four reasons:

- it may not be clear at the outset how much of the released spectrum is required by operators (and unwanted spectrum has no value);
- the uses to which the released spectrum will be put may not be known at the time it is made available;
- national ambitions for uses of the released spectrum may be constrained by policies or decisions imposed externally (for example frequency harmonisation decisions aimed at preventing signal interference close to national borders); and
- there is no single, commonly accepted method of valuation.

4 In order to attempt a *potential* valuation of the *potential* digital dividend for Serbia, we first went through the following preparatory steps:

- we considered the current state of the electronic communications market in Serbia (broadcasting, fixed and mobile telephony, and internet) in order to assess Serbia's preparedness to make use of the digital dividend;
- we then (as requested) briefly reviewed the situation in jurisdictions close to Serbia, and in certain EU and non-EU countries;
- next we considered any policies and decisions already adopted in Serbia in relation to spectrum use;
- finally we took into account the known external constraints that Serbia has to deal with.

5 We then applied two methods of valuation, namely the "total welfare" approach and the "Gross Domestic Product impact" approach (both explained below) and have calculated a range of possible values. Both these techniques by nature produce approximate results: a precise valuation is infeasible.

6 To place a value on the digital dividend in Serbia we needed first to assess how much spectrum would be available for release, and at what frequencies. Here harmonisation comes into play. The European Commission is effectively identifying a harmonised element of the digital dividend from channels 61 to 69, covering 790-862 MHz, and is strongly encouraging Member States to take advantage of it. This part of the spectrum is regarded as presenting the best opportunity for a Europe-wide harmonised allocation to mobile broadband.

7 It is in our view beneficial to Serbia to align its use of the digital dividend with the emerging harmonisation in Europe, and we therefore make the key assumption that Serbia and its neighbours will follow suit. This does not, however, preclude additional spectrum being assigned to the digital dividend from the remaining TV bands. For analytical purposes we assume that the amount of spectrum to be released in Serbia will be 72 MHz (channels 61 to 69), while acknowledging that the digital dividend could be larger if the government chose to release further spectrum in the 470 MHz to 790 MHz range.

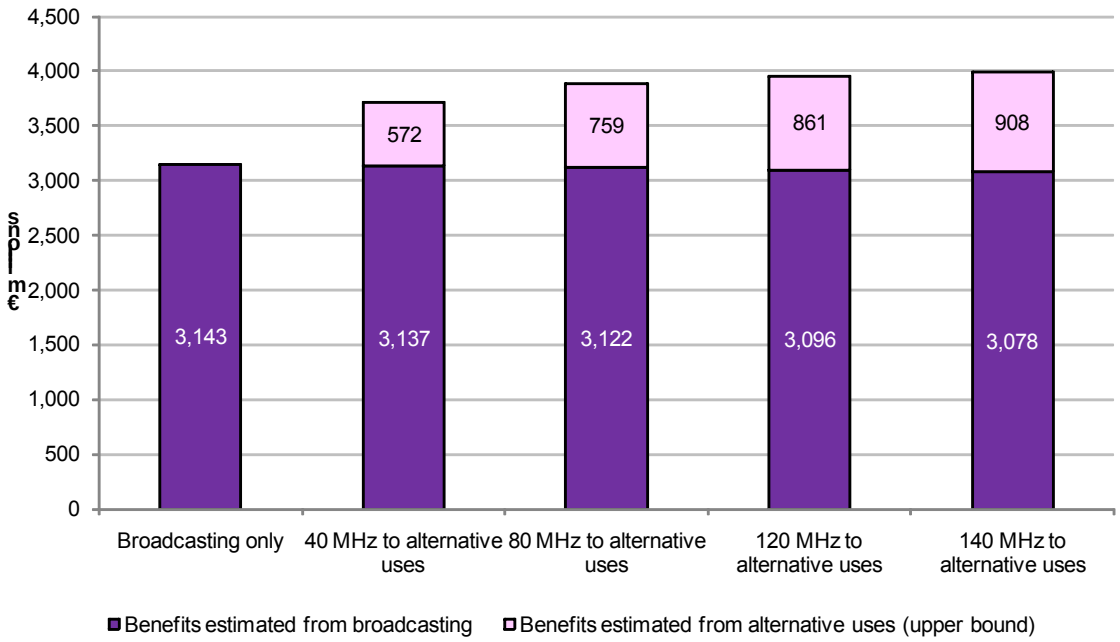
8 Allocating channels 61 to 69 to the digital dividend is unlikely to constrain the output of broadcasters for the foreseeable future. At the same time it seems to us that other users, among which mobile operators are already prominent, should be able to achieve from this additional spectrum a substantial increase in capacity, for new services and for improved coverage.

9 The "total welfare" approach to valuation calculates the benefits to consumers and producers of spectrum-using goods and services. Total welfare is made up of "consumer surplus" (the benefits that consumers receive over and above the price they have paid for such goods and services) and "producer surplus" (the benefit that producers receive over and above the prices they would have accepted for such goods and services). Characteristically, in a competitive market consumer surplus far exceeds producer surplus.

10 We have calculated that mixed use of the digital dividend – i.e. the allocation of some spectrum to non-broadcasting uses – produces a higher total welfare value than if the whole of the dividend is allocated to broadcasting and all other users merely keep the spectrum they have now. We estimate that, if the whole digital dividend were allocated to broadcasting, the digital dividend in Serbia would have a net present value over the period 2012 to 2027 of €3.1 billion. If spectrum is allocated to other uses, the net present

value would increase (depending on the allocation) by between roughly €572 million and €908 million.[1] Figure 1 below illustrates this.

Figure 1: Value of broadcasting and mobile broadband based on medium demand (upper bound)



Source: Europe Economics estimate

11 It is clear that the allocation of spectrum away from broadcasting to other uses presents a very small decrease in the value of broadcasting.

12 In reality, three factors are likely to increase the value of non-broadcasting applications relative to broadcasting:

- first, the value of externalities in the Serbian context is likely to be higher with non-broadcasting applications than with broadcasting (we explain the concept of externalities in the detail of our report);
- second, questions arise about the quality of broadcasting that could be sustained if a huge increase in the quantity of broadcast output takes place; and
- thirdly, we have not taken into account the possibility of re-farming in the 900 MHz band.

[1] Note that these values represent an upper bound, which is discussed in further detail in Section 6.

13 Thus the real value of alternative uses could be – and we believe is likely to be – higher than we have estimated, and the real value of broadcasting lower.

14 Furthermore – and this is a vital point – the estimated values in this report are based on historical information. Other experience tells us that the value of the digital dividend, and the value of mobile broadband relative to broadcasting, increases over time. There is no reason why this consideration should not apply to Serbia, but we have no basis on which to make longer-range forecasts.

15 Our use of the term "alternative uses" merits comment. We use it mainly to signify uses alternative to broadcasting. In practice, alternative uses are likely to be overwhelmingly mobile communications, and specifically mobile broadband. Our valuations of alternative services are based on valuations of mobile broadband. For this reason we use the term "mobile broadband" except where a wider definition of "alternative uses" is required.

16 The impact of the digital dividend upon Serbia's Gross Domestic Product (GDP) is harder to quantify. We can say with reasonable certainty that the present impact of spectrum-using services amounts to approximately 3 per cent of GDP. This takes into account the direct impacts of spectrum-using organisations, the indirect impacts that these organisations create among immediate suppliers and customers, and the further multiplier (or "ripple") effects that take place throughout the economy.

17 We can express the GDP impacts in employment terms too. The spectrum-using industry in Serbia currently employs just under 39,000 people – just over 8,000 in direct employing organisations, 24,000 in indirect organisations, and about 7,000 from multiplier effects. At least 50 per cent of such employment arises in mobile networks and downstream businesses. These employment figures are gross estimates, not adjusted for the so-called "re-absorption effect", which we explain in Section 6 of our report. On this basis, employment arising from spectrum-using organisations is equivalent to about 1.3 per cent of the Serbian workforce.

18 Estimating future GDP impacts, whether in revenue or employment terms, is fraught with difficulty because we do not know:

- how much spectrum will be released to what operators;
- the extent to which operators will make use of their allocated spectrum, and what services they will provide;
- what the consumer response will be; and
- what additional employment and expenditure will arise.

19 However, experience from other countries tells us that the total welfare effects of spectrum-using industries increase over time, and it is inconceivable that the GDP impact would not increase too. We have some evidence which suggests that greater growth emerges from mobile technologies than from broadcasting, even where consumers are willing to pay for broadcasting.

20 If one aim of spectrum policy in Serbia is to add to GDP, policy makers need to strike a balance between awarding too much spectrum too early (thus possibly constraining future uses) and awarding too little too late (making it difficult for the spectrum-using industries to plan long-term).

21 Finally, we emphasise that our methods and calculations are conservative. The conclusions we reach are based on verifiable facts where possible and on reasoned argument elsewhere. We do not exaggerate and we do not speculate. It is certainly the case that the uptake of new technology often outstrips forecasts, and it may well be that the values we have calculated are exceeded in practice.

2 INTRODUCTION

2.1 This report estimates the value of the digital dividend that could arise in Serbia and makes broad comparisons with the value of the dividend that is likely to arise in other south-east European jurisdictions. To do this we have developed our earlier work on spectrum policy conducted for Ofcom in the UK (2006) and ComReg in Ireland (2008), using factual information about Serbia and applying the analytical techniques used previously.

2.2 The digital dividend is defined as the benefit that becomes available when analogue broadcasting signals are switched off in favour of digital, and radio spectrum is thereby released. Because of its propagation characteristics, the spectrum released from television broadcasting is valuable for a variety of services, and the providers of such services may therefore find themselves competing for such spectrum as becomes available. A more detailed description of the digital dividend, as well as of the technical and regulatory issues that arise, appears in Appendices 1 and 2 respectively.

Europe Economics

2.3 Europe Economics (in this report "we" or "us") is an independent economics consultancy, with substantial experience of economic regulation, competition policy and the application of economics to public policy and business issues. The firm advises a wide range of clients, including government departments, regulators, supra-national bodies such as the European Commission and the European Parliament, leading law firms and major private sector companies and (as here) their representative bodies.

Quotient Associates

2.4 Quotient Associates is a strategy, technology and economics consultancy to the radio communications industry. It specialises in wireless communications, broadband, broadcasting, and spectrum regulation and management. Its clients include network operators, equipment vendors, regulatory authorities, and government and financial institutions from around the world. Quotient Associates and Europe Economics have worked collaboratively on a number of spectrum-related projects in the recent past.

The structure of this report

2.5 In Section 3, we set out the basic factual information about Serbia that we have applied in this study, and in Section 4 we summarise comparisons (in relation to spectrum usage) between Serbia and other jurisdictions in south-east Europe and beyond, and describe the digital dividend in Serbia. Country summaries are contained in Volume 2 of this report.

2.6 In Section 5 we describe ways in which the digital dividend can be valued. In Section 6 we apply these techniques to Serbia itself and out the valuations we have calculated – one set of valuations based on the values that consumers and producers place on spectrum-using services, the other on the overall impact of such services on the Serbian economy.

Section 7 explains the conclusions we have reached.

2.7 Finally, three Appendices contain detail matters relevant to the main study.

3 THE SERBIAN CONTEXT

3.1 This section of our report summarises the factual information on which we base subsequent analysis. Full details can be found in Appendix 1. We include information on two main areas:

(a) the demographic and geographic features of Serbia that condition what is feasible in relation to spectrum usage; and

(b) the principal features of the communications sector in Serbia, dividing it into fixed and mobile telephony, internet and broadcasting.

3.2 In general terms we give prominence to Serbia, though in the Appendix, wherever possible, we draw comparisons with a number of other jurisdictions in south-east Europe and with the European Union.

Demographic and geographic profile

3.3 Serbia has a population (in 2008) of 7.35 million people, comparable to Bulgaria.[2] The population is split nearly equally between urban and rural. The labour force is estimated at 3.1 million, with an unemployment rate of 16.1 per cent – substantially higher than the EU27 average for 2009, which was 9.4 per cent.

3.4 GDP in 2008 (at the official exchange rate against the euro) was €33.42 billion. Growth had been 5.5 per cent in 2008 but it fell to minus 3 per cent in 2009. GDP per capita in 2008 was €4,547, about 20 per cent of the EU27 average. In respect of GDP per capita, according to the IMF's projections for 2009, Serbia ranks no. 74 in the world.

3.5 Serbia's land mass is just over 77,000 sq km, and its population density is 94 per sq km.[3] Its terrain is extremely varied, and the largest part of the country is mountainous. In respect of size and topography, Serbia is comparable with Austria.

3.6 Serbia borders Hungary to the north, Romania to the north-east, Bulgaria to the south-east, Kosovo, Macedonia and Albania to the south, Montenegro to the south-west, Bosnia & Herzegovina to the west and Croatia to the north-west. Specific spectrum-related problems arise for land-locked countries which have a relatively large number of surrounding jurisdictions.

Electronic communications

3.7 The electronic communications market in Serbia is well established, and represented

[2] Figure taken from the Statistical Office of the Republic of Serbia and excludes Kosovo and Metohija
[3] Again, figures exclude Kosovo and Metohija

almost 5 per cent of GDP in 2008. Mobile telephony revenues dominate, at 62 per cent of the total. Internet and cable revenue are much smaller, at 7 and 4 per cent respectively.

3.8 Mobile penetration far exceeds fixed-line penetration, at 128 per cent compared with 41 per cent. Price comparisons between fixed and mobile have proved to be difficult, although we have established that mobile tariffs in Serbia are low compared with other countries, irrespective of usage level. Low prices imply that the revenue benefit obtainable from freeing up spectrum for mobile services is potentially lower for Serbia than for higher-priced countries in the region.

3.9 Projections for fixed line and mobile services are quite dissimilar. While the number of fixed-line subscribers is estimated to increase somewhat there are differing forecasts about the growth of mobile. One suggests that penetration rate will slow, as it has since 2007, given that it has already reached over 120 per cent. However, another estimate projects a penetration rate above 175 per cent. Our view is that the penetration rate may well not increase by very much, but that average revenue per user (ARPU) is likely to grow more significantly. Our reasoning here is that as the mobile sector becomes more competitive, users may not continue to use multiple SIM cards, and that as 3G services develop, customers will simply switch to them rather than carry multiple devices.

3.10 As regards internet connections, Serbia has acquired a taste for broadband (490,000 connections) but so far has had little experience of mobile broadband (no connections in 2007 and 25,000 in 2008).

3.11 Against this general backdrop it is unsurprising that communications revenues from the internet have increased more than five-fold, from €20.1 million in 2005 to €111.5 million in 2008.

3.12 As regards broadband monthly prices, Serbian users pay roughly the same as the average EU consumer for slower (1 Mbps) lines, and approximately 25 per cent less for faster (2Mbps) lines. This may be ascribed either to competitive prices offered by alternative operators or to lower levels of willingness to pay in Serbia. Only 41 per cent of the Serbian population owns a computer.[4]

Broadcasting

3.13 Serbian consumers have become accustomed to watching a variety of TV channels, and are prepared to pay for them. This is generally helpful background to policy decisions about the allocation of spectrum to TV broadcasters. On the one hand, there appears to be little justification for allocating a large amount of spectrum to the incumbent national broadcaster, when its primary channel attracts only 26 per cent of viewing hours and its

[4] Mirjana Milošević & Tanja Petrović (2008) "The Late Beginning of Digital Television in Serbia" in Sükösd Miklós and Adla Isanović (eds.) *Public Service Television in the Digital Age: Strategies and Opportunities in Five South- East European Countries*.

second channel only 8 per cent. If television capacity is substantially increased, the potential impact on quality deserves close consideration.

3.14 Around 30 per cent of households have some form of multi-channel television access, mostly analogue cable television. This may serve to reduce the demand for digital terrestrial television. There are a number of other issues that may negatively influence the take up of digital terrestrial television which are presented in Appendix 1.

Revenue and employment in the spectrum-using sector

3.15 Total revenues from Serbian telecom services amount to €1.61bn, equivalent to 4.87 per cent of GDP.

3.16 Employment figures of Serbian telecom services are substantial. According to a Deloitte study[5] there were in 2007 close to 34,000 people employed in the communications sector, as shown in Table 3.1.

Table 3.1: Employment in the mobile and fixed telecommunications sector, 2006 and 2007

	2006	2007
Mobile network operators	2,680	2,860
Fixed telecommunications operators	620	630
Network equipment suppliers	175	180
Network support suppliers	780	785
Handset importers	200	270
Other suppliers of capital items	115	115
Suppliers of non-network support services	930	960
Airtime/ SIM sellers and mobile phone sellers	18,500	20,750
Multiplier	6,400	7,110
Total domestic employment	**30,400**	**33,660**

Source: Deloitte analysis based on data provided by key industry players in interviews, analysis of company accounts and industry reports, and data provided by Telenor.

3.17 Deloitte caution that they regard their figures as conservative (especially as a guide to the future) since the market is undergoing change. For example, new retail chains are opening in urban and rural areas. They estimate that there were over 20,000 non-mobile-specific points of sale for mobile airtime in Serbia in 2007, including small groceries, kiosks, tobacconists, petrol stations, banks and post offices. In addition, top-up services

Mediacentar Sarajevo, 2008

5 Deloitte, Economic Impact of Mobile Communications in Serbia, Ukraine, Malaysia, Thailand, Bangladesh and Pakistan, January 2008.

are available from those locations where Nokia e-load terminals are present.[6] In addition to non-mobile-specific points of sale, Deloitte estimated that in September 2007 120 mobile dedicated retail shops existed, and the MNOs have begun to develop their own retail shops. We have more to say on employment in Section 6 of this report.

[6] Deloitte's employment figures do not include all employees working within each point of sale, but include only the full time equivalents (FTEs) attributable to mobile services.

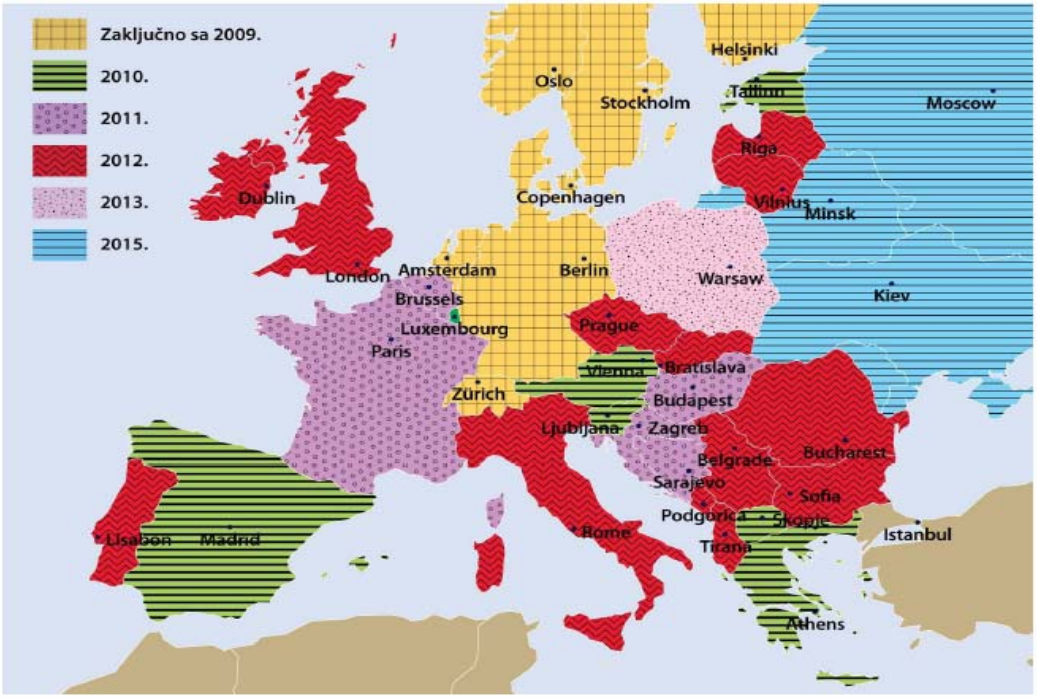
4 THE DIGITAL DIVIDEND IN SERBIA

4.1 In this section we review what has already been said officially about the digital dividend in Serbia, and we go on to identify possible options for the use of the digital dividend. We take into account the national (and SEE-8) situations described in Section 3, as well as a technical appraisal of spectrum availability in Serbia and the opportunities and constraints that Serbia faces.

National strategy for digitalisation

4.2 Serbia has decided upon 2012, and specifically April 4th as the year for analogue switch-off, and digital broadcasting is currently underway. This is consistent with a much earlier recommendation of the European Commission to EU Member States – COM (2005) 204, and in line with many other counties in Europe as shown in Figure 4.1 below.

Figure 4.1: Dates for analogue switch-off in Europe



Source: Serbian Consultation Document 2009

4.3 With 2012 in mind, the Serbian Ministry of Telecommunications and Information Society has drafted an Action Plan specifying milestones, and the competence of different institutions, for the process of digitalization.

4.4 The government has in mind a few high-level possibilities for new services that will be available within the digital dividend. These include:

(a) Communication services

- Wireless broadband services
- Transmitting of multimedia and video applications to mobile or fixed devices
- Public safety services, such as wireless emergency services.

(b) Information services

- Better choice of program content in specialized areas (politics, history, children programs, sports).
- Upgraded Electronic Program Guide (EPG), faster and more interactive than the regular teletext guide. Electronic Program Guide ensures access to all digital television services and it will be the main instrument for the citizens to navigate through the whole service offer.

(c) Interactive services

Interactive television is two way information flow that enables the communication among the viewer and broadcaster as well as following digital services:

- E-commerce and e-banking
- Interactive games and quizzes
- Information and video on demand
- E-mail
- Betting and voting.

Other jurisdictions

4.5 Serbia has expressed interest in the experiences and policies of other countries in relation to the digital dividend, not least due to its expressed interest to join the EU, which, at present is predicted for 2014. To respond, and in order to avoid the time and cost required for original research, we have drawn on two principal published sources.

4.6 First, we used a series of country summaries taken from the Cullen Report already referred to. These summaries, however, are taken from the Cullen Report published in June 2009, rather than the more recently published one in March 2010. The countries are the same nonetheless, covering Croatia, FYROM, Turkey, Albania, Bosnia and Herzegovina, Montenegro and Kosovo.

4.7 Secondly, in our 2008 report for the Irish communications regulator, ComReg, we covered – again in brief – twelve EU and non-EU jurisdictions.

4.8 Summaries for all these countries are reproduced in a separate volume to this report. Here we provide only a brief summary of findings.

The Cullen report

4.9 The Cullen summaries show that most of the changes taking place in the electronic and communications markets in the SEE-8 relate to the structure of the market, legislative proposals promoting competitiveness, and the independence (or lack thereof) of the national regulatory authorities.

4.10 Generally speaking, state involvement in ownership and control of the incumbents is decreasing in the SEE-8, albeit at varying paces. Incumbents largely still monopolise the fixed line telecommunication services, with Turkey (and Kosovo) being at one extreme where the incumbent remains the only authorised provider and Croatia and Macedonia at the other end, having fully liberalized this market.

4.11 Mobile services enjoy greater competitive characteristics, with approximately three competing operators in each country. However, even in this sector operators still face problems as regulators have not enforced regulation to the extent necessary to secure competitive safeguards for alternative operators.

4.12 In terms of the alignment of the national communication laws with the *acquis communautaire* the picture still remains mixed.

4.13 Regarding the date for analogue switch-off most all countries, with the exception of Turkey, are expecting to complete this step by the end of 2012 at the latest. While in the majority of countries no official decisions have been taken yet as to the allocation of the released spectrum, the intentions uttered by governments is to share it between broadcasters and mobile operators, which is likely then to provoke a contest between the two stakeholders. The exception here is Croatia who, according to Frontier's 2010 study, has announced plans for the use of the digital dividend for mobile services, with a spectrum auction scheduled for 2011.[7]

Our report for ComReg

4.14 Our summaries for ComReg showed that the biggest single issue arising for governments and regulators in relation to the digital dividend is determining an appropriate balance between the claims of broadcasters and the claims of mobile network operators. It is clear that in some jurisdictions, governments accepted at a very early stage that broadcaster would keep, roughly speaking, the volume of spectrum that they already had, effectively giving television a very substantial potential increase in the volume of broadcasting that could be achieved. Some commentators have doubts as to whether

[7] Frontier (2010) ' The impact of broadband in Eastern and Southeast Europe' Report for Telekom Austria Group

broadcasters can fill – and indeed can afford to fill – the *quantity* increase with sufficient *quality* of programming.

4.15 In general, governments did not take decisions in favour of broadcasting on the basis of up-to-date economic valuation. We have seen, for example, no serious study of the value that consumers might place on High Definition Television (HDTV), or on a substantial increase in local or regional broadcasting.

Background considerations

4.16 The Serbian government has not yet announced formal plans for the allocation of the digital dividend. Its guiding principle, however, seems to be one of maximising societal benefit, as emphasised in the 2009 consultation document:

> "Frequency spectrum does not belong to the broadcasters, nor the mobile phone operators or the spectrum regulators or the state. As a public domain, it belongs to citizens, therefore, planning of the network has to be guided by this principle, so the digital dividend would not turn to digital deficit."

4.17 As we read it, therefore, no existing spectrum user should assume that the amount of spectrum he has now, or the frequencies he is using, will be carried over into the all-digital era. The government has indicated, however, that potential growth in television services will have to be considered in the allocation of spectrum; it also originally assumed the whole TV band (channels 21-69) would be available to be shared by future potential broadcasting use.[8] This implies that broadcasting is unlikely to see a reduction in available spectrum from its current allocation, and may well receive a higher allocation after DSO which will correspondingly reduce the spectrum available for other uses.

4.18 That said, objectives stated by the Serbian government in other contexts give due weight to the allocation of spectrum to other uses (for example, mobile broadband). In 2006 it prepared a five-year strategy for the development of Telecommunications in Serbia, and among the key objectives were:

(a) Widespread availability of the internet

(b) The promotion of the Web economy

4.19 Furthermore, the government has stated that, because mobile broadband communication services can connect people in remote areas with more developed regions, it considers a key benefit of the digital dividend the stimulation of equal and sustainable regional development.

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[8] Strategy for Switchover from Analogue to Digital Broadcasting of Radio and Television Programs in the Republic of Serbia, July 2009

International considerations

4.20 Whilst a purist definition of the digital dividend implies that once analogue broadcasting signals have been switched off the entire spectrum thereby released could in theory be released for any other service that is technically suited to those frequencies, the reality is different. National governments and regulators within and beyond the EU have found it necessary to guarantee a certain amount – and often a large amount – of spectrum to broadcasters.

4.21 In no jurisdiction that we have considered have we found a published quantitative assessment of future demand for broadcasting, especially terrestrial broadcasting, supplied either by publicly-funded or commercial broadcasters; nor any assessment of what public service broadcasting ought to look like once DTT becomes widely available.

4.22 Nevertheless, the priority accorded to the preservation of broadcasting is sufficiently widespread for the European Commission to have defined the digital dividend thus:

> "Digital dividend is the spectrum over and above the frequencies required to support existing [analogue] broadcasting services in a fully digital environment, including current public service obligations".[9]

4.23 While the Commission's definition refers to *existing* broadcasting, a number of governments have reserved broadcasting spectrum sufficient not merely to allow broadcasters to sustain current output but to expand it considerably, facilitating a dividend of sorts for broadcasters.

Harmonisation

4.24 Harmonisation is key to the value of the digital dividend. Spectrum harmonisation will greatly enhance the creation of a single market in digital electronic communications, particularly relevant within the EU (and thus for Serbia with the prospect of accession). A harmonised approach will be important for some of the potential uses of the digital dividend where economies of scale are required. Benefits in terms of economies of scale are also likely to extend to equipment manufacturers, for example, who will be able to benefit from opportunities to develop goods and services for a wider market rather than for separate national markets. Harmonisation will also enhance the efficient use of the digital dividend and avoid cross-border signal interference. Furthermore, harmonisation will increase the potential for neighbouring countries to agree on policies regarding, for example, less onerous emission limits or on lower levels of interference than are specified by the GE06 Plan. It is therefore important for Serbia to harmonise its allocation plans

[9] COM (2007) 700. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: *Reaping the full benefits of the digital dividend in Europe: A common approach to the use of the spectrum released by the digital switchover* (November 2007)

with its neighbours, both within and outside of the EU.

4.25 To reflect this, the European Commission has emphasised the importance of Member States coordinating spectrum usage in the EU, and has also highlighted that Member States should release the digital dividend as soon as possible after analogue switch off (i.e. beginning in 2012). [10]

4.26 Harmonisation, however, may be more challenging to achieve in Serbia than in the EU, particularly in a timely manner. Serbia will have to harmonise with its neighbours, who in turn will have to coordinate with their own neighbours. As many of these immediate and secondary neighbours are not within the EU (Russia, as by far the largest, being the most important example) such coordination may not happen as quickly as under EC encouragement. The Regional Agreement developed at the ITU conference in 2006 stipulates that by 2015 all countries must allow co-primary use of the 800MHz harmonised band, and it is therefore likely that this will be the earliest opportunity for Serbia to fully allocate its digital dividend in coordination with its non-EU neighbours.

4.27 Therefore, any benefits arising from allocation of the digital dividend in Serbia are likely to be held back by this delay in allocating spectrum to 2015 as opposed to 2012. This is highlighted in our evaluation in Section 6.

Technical issues

Background

4.28 The UHF spectrum used for terrestrial TV broadcasting in Europe extends from 470 to 862 MHz. It is divided into 49 contiguous RF channels each being 8 MHz wide and numbered from 21 to 69. The transmission of a single analogue TV programme service (often referred to as a channel) occupies one 8 MHz RF channel, hence one analogue TV channel is equivalent to one RF channel. Several transmitter stations are required to provide coverage across the whole of a country, and different RF channels are used at different transmitter sites in order to avoid interference between them. Serbia's allocations are split across 15 zones, with Belgrade city also having six additional channels.

4.29 A digital TV transmission also occupies one 8 MHz RF channel but it carries several TV programme services and is referred to as a multiplex. A multiplex can carry 6 to 8 programme services at standard definition[11] (SD) or 4 at high definition (HD).[12] As with

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[10] "Reaping the full benefits of the Digital Dividend in Europe: A common approach to the use of the spectrum released by the digital switchover" – Council of Ministers, 12 June 2008

[11] Using MPEG4 compression, on which Serbia has already decided. These numbers are representative: the actual number can be varied depending upon the video quality required.

[12] Based on developments in the DVB-T2 and H.264/AVC standards.

analogue TV, multiple transmitters are required to provide national coverage and different RF channels are used at different sites to avoid interference[13].

4.30 The GE06 Plan agreed at the ITU Regional Radio Conference in 2006 provides an integrated frequency plan for the broadcasting of DTT across Europe. Under this plan Serbia has been allotted seven national multiplexes or "layers" of spectrum.

4.31 Serbia's allotment of 7 layers will support 7 national multiplexes, equivalent to around 42 to 56 SD or 28 HD national TV programme services. At present there are eight national broadcasters in Serbia. Thus, even with a significant increase in the number of programme services it is probable that some of the UHF TV band will remain unused after the switch to DTT, providing a digital dividend that could be used for other purposes.[14]

Constraints on identifying a suitable digital dividend

4.32 Serbia is a landlocked country and hence Serbia and its neighbours need to align their uses of spectrum, in order to avoid interference. The most convenient way to do this would be if all countries concerned could have a harmonised approach to the digital dividend. This is discussed below.

4.33 In some countries, Programme Making and Special Events[15] (PMSE) services have shared the TV spectrum with the broadcasters by operating at low power, such that they do not interfere with TV reception. An example of a PMSE device is a radio microphone. The spectrum which is used in this way is often termed interleaved spectrum. Users of interleaved spectrum have had to be considered in other counties when moving to digital TV transmission and when planning a digital dividend.

4.34 In some countries, some TV channels within the band are not available for use by TV. In the UK, this applied to channel 69, which was for PMSE use. It also applied to channels 36 and 38 which were used for airport radars and radio astronomy observations respectively. These channels have had to be cleared in the UK.

4.35 The latter two constraints do not apply here, since in Serbia the TV bands are not shared with other services. PMSE has an 8 MHz allocation in a short range devices (SRD) band. This is shown in Figure 4.2. Nonetheless, PMSE is a potential future user of the digital dividend in Serbia.

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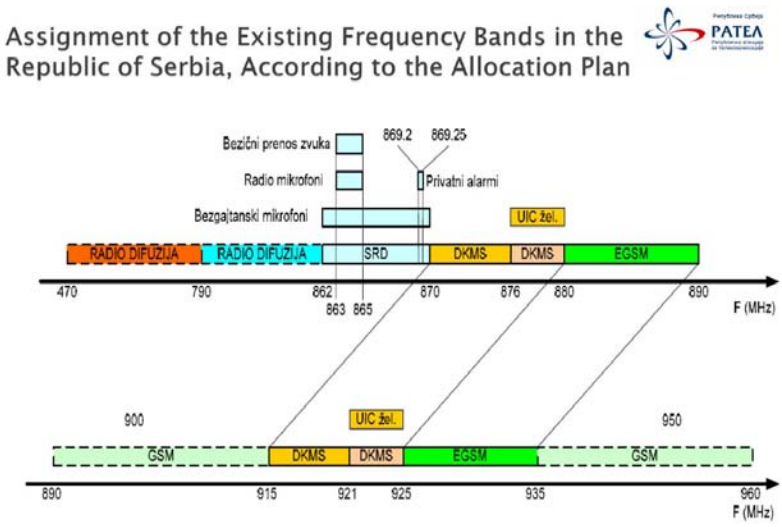
[13] It is also possible to transmit a multiplex using the same RF channel at each transmitter site by careful planning and synchronisation between the transmitters. Such a network is referred to as a single frequency network (SFN). Serbia plans to use a multi-frequency network (MFN) for its digital terrestrial TV network supplemented, in some instances, with SFNs.

[14] It is possible that the Ministry of Telecommunications and Information Society will allocate fewer multiplexes to DTT (minimum of four), which will substantially increase the spectrum available for uses other than broadcasting.

[15] Programme Making and Special Events (PMSE) covers a wide range of wireless applications used primarily in support of programme making and broadcasting (SAP and SAB services) such as outside broadcasting and news gathering. It can also include the making of film, radio, advertisement and corporate material as well as the production of plays, concerts and shows and events of all sorts.

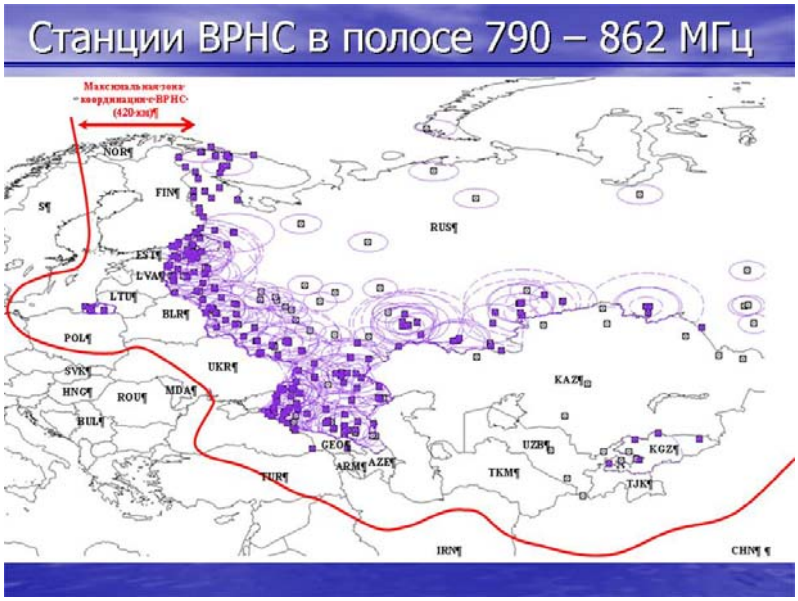
Figure 4.2: PMSE use in SRD band in Serbia



Source: RATEL 2010

4.36 As regards constraints on the use of the digital dividend, there also exists a need to avoid interference into aeronautical services in European countries and bordering non-European countries. Specifically, Russia is known to operate Aeronautical Radio Navigation Services (ARNS) devices in the TV bands. This is not a direct concern for Serbia, since it is outside the Russian 420 km interference zone. However, there is an indirect effect, since if Europe is to harmonise a portion of the digital dividend, then neighbouring countries must do the same, as must the next level of neighbouring countries, which ultimately includes Russia. Russia will allow co-primary use of mobile broadband in the 800 MHz band by 2015 as required by the ITU. This may cause a problem for those countries in Europe which desire a quicker move to the use of the 800 MHz band.

Figure 4.3: Russian ARNS interference zone



Source: Russian Ministry of Defence 2009[16]

Harmonisation of the digital dividend

4.37 The European Commission is strongly encouraging member states to take advantage of the digital dividend, and CEPT originally identified channels 62 to 69 inclusive for mobile broadband, which was expanded to channels 61 to 69 following WRC-07. Channels 61-69 cover 790-862 MHz. This had been identified as the best opportunity for a Europe wide, non-mandatory, non-exclusive sub-band for a harmonised allocation to mobile broadband. A harmonised approach is important for some of the potential uses of the digital dividend where economies of scale are required. It may, therefore, be beneficial to the Serbian consumer and the Serbian economy to align the digital dividend in Serbia with the emerging harmonisation in Europe.

4.38 We make the key assumption that if Serbia is to set aside a digital dividend for mobile broadband use, then it will indeed use the proposed harmonised channels 61-69, and that its neighbours will do likewise. Complete harmonisation is a key feature; for this reason we do not consider taking only a portion of channels 61-69 for a digital dividend. This does not preclude additional spectrum being assigned to the digital dividend from the remaining TV bands, including interleaved spectrum.[17]

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16 Dmitri Zholtikov, Russian Ministry of Defence, GSMA Moscow Summit: Opportunities Provided by the Digital Dividend, May 2009.

17 However, feedback from Serbian mobile operators suggests that the use of interleaved spectrum will very limited, if at all.

4.39 Calculation of the total amount of digital dividend in Serbia is not possible without a detailed investigation, which we have not done. Instead we have estimated the potential for a digital dividend particularly in channels 61-69. Our approach is based on estimating the spectrum required for TV transmission in Serbia in the future. In doing so we have had to make many simplifying assumptions.

Estimating the potential digital dividend

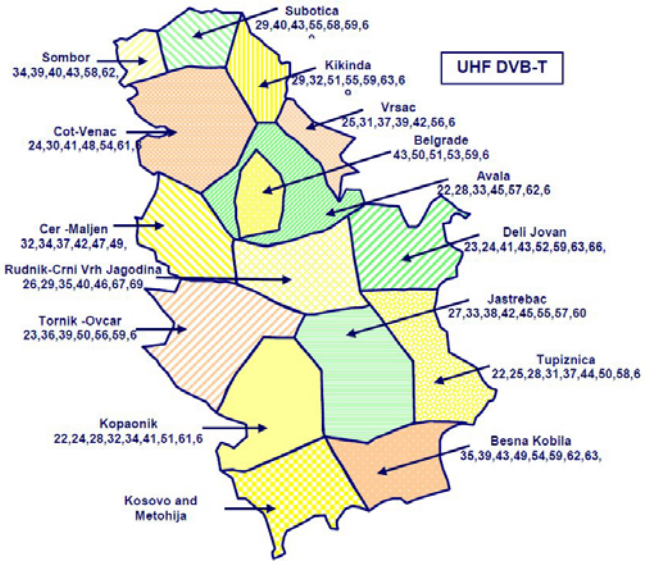
4.40 In order to estimate the extent of Serbia's digital dividend we need to estimate what the future requirements of TV broadcasting in Serbia are likely to be.

4.41 We assume that the smallest digital dividend available to Serbia will be 72MHz, i.e. the spectrum available from the proposed harmonised channels 61-69, also referred to as the 800MHz band.

4.42 In order to estimate what the largest digital dividend might be we need to estimate the likely future requirements of TV broadcasting in Serbia.

4.43 Originally, Serbia assumed the whole TV band (channels 21-69) would be available to be shared by future potential broadcasting use, [18] as shown in Figure 4.4.

Figure 4.4: Distribution zones in the UHF TV band in Serbia



Source: "Case studies on migration from Analogue to DTTB of Serbia", March 2009, downloaded from www.itu.int

[18] Strategy for Switchover from Analogue to Digital Broadcasting of Radio and Television Programs in the Republic of Serbia, July 2009

4.44 Channels 61 – 69 are already in use by broadcasting in Serbia, and experience some presence from the Army.[19]

4.45 The ITU has clarified that all 15 allocations in Serbia would lose some spectrum if bands 61 to 69 were set aside for the harmonised digital dividend, as shown in Figure 4.5. Even without a reorganisation of the channel plan to take into account the absence of channels 61-69, it can be seen that each zone has at least 5 channels still available when channels 61-69 are given to the digital dividend.

Figure 4.5: Harmonised Digital Dividend channels highlighted

Serial number	Distribution zone	Channels
1.	Avala	22,28,33,45,57,62,64
2.	Belgrade	43,50,51,53,59,68
3.	Besna Kobila	35,39,43,49,54,59,62,63,69
4.	Vrsac	25,31,37,39,42,56,60
5.	Deli Jovan	23,24,41,43,52,59,63,66,68
6.	Jastrebac	27,33,38,42,45,55,57,60,64
7.	Kikinda	29,32,51,55,59,63,69
8.	Kopaonik	22,24,28,32,34,41,51,61,66
9.	Kosovo and Metohija	21,31,44,46,48,58,67
10.	Tornik-Ovcar	23,36,39,50,56,59,63
11.	Rudnik-Crni Vrh Jagodina	26,29,35,40,46,67,69
12.	Sombor	34,39,40,43,58,62,64
13.	Subotica	29,40,43,55,58,59,69
14.	Tupiznica	22,25,28,31,37,44,50,58,65
15.	Cer-Maljen	32,34,37,42,47,49,52
16.	Cot –Venac	24,30,41,48,54,61,66

Source: "Case studies on migration from Analogue to DTTB of Serbia", March 2009, downloaded from www.itu.int

4.46 In order to estimate the amount of spectrum needed for TV transmission in Serbia, we consider the number of TV channels available today and map this onto a likely corresponding future spectrum requirement. This will have two outcomes. It will confirm whether Serbia is likely to be capable of supporting channels 61-69 as a harmonised digital dividend, and if so, what degree of additional spectrum is potentially available beyond this 72MHz.

4.47 We note firstly that Serbia has chosen MPEG-4 compression and DVB-T2 transmission, which each represent efficiency improvements over the earlier MPEG-2 and DVB-T standards.

4.48 Earlier in the report, we noted that Serbia currently has eight national broadcasters. We further note that up to 40 regional and 160 local broadcasters have been anticipated.[20] Local broadcasters are likely to be low power and are thus likely to be able to be

[19] Feedback from mobile operators

accommodated within the existing allocations. We make this assumption in order to simplify the estimation process. If we further assume that regional broadcasters are evenly distributed among the 15 zones, then we can estimate that each zone will have three regional broadcasters. The total number of broadcasters per zone is then 11, made up from 3 regional broadcasters, plus the 8 national broadcasters.

4.49 With four HD services per multiplex and seven national multiplexes, 28 program services are available per zone. This is greater than the 11 broadcasters per zone. Based on the assumptions we have made, this suggests that Serbia may not need all the TV bands in order to run its anticipated TV services. This confirms the potential for a digital dividend.

4.50 When channels 61-69 are given to the harmonised digital dividend, each zone retains at least five channels as described above. With five national multiplexes, 20 HD program services are available per zone. This is greater than the 11 broadcasters per zone. This estimate suggests that Serbia has enough potential digital dividend spectrum to support a harmonised dividend in channels 61-69, and potentially more. The caveat is that some broadcasters may require more than one program service we have assumed.

4.51 Of course, if each broadcaster per zone required two programme services per multiplex, then this would require 22 HD program services in total, which would need six national channels. With the harmonised digital dividend already served by channels 61-69 as shown, this would not be possible in Serbia, without re-planning the channels.

4.52 The harmonised approach in channels 61-69 releases nationally available spectrum for high power use, using different frequencies per zone in line with GE06. It is possible to release further spectrum outside this harmonised approach, but still in accordance with GE06. Such unused frequencies could be released across Serbia, leading to a larger digital dividend. The constraints on the use of this spectrum could be minimised via co-ordination with neighbours. Some use of interleaved spectrum for the digital dividend is likely to be limited to only low power devices and we consider interleaved spectrum separately below.

4.53 Based on the assumptions above, we think it likely that Serbia could provide channels 61-69 to a harmonised digital dividend comprising 72MHz of spectrum. We think it unlikely that significantly more spectrum will be available. This conclusion is based on our assumption that, in future, broadcasters are likely to require, on average, more than one programme service each. If so it is unlikely that significantly more spectrum will become available beyond channels 61-69. Our assumption that all local broadcasters can be fitted within the existing allocations may not hold good, and in practice some local broadcasters may require their own channels.

[20] Serbia's Broadcasting Development Strategy to 2013 (Official Gazette of Republic of Serbia, No 115/05).

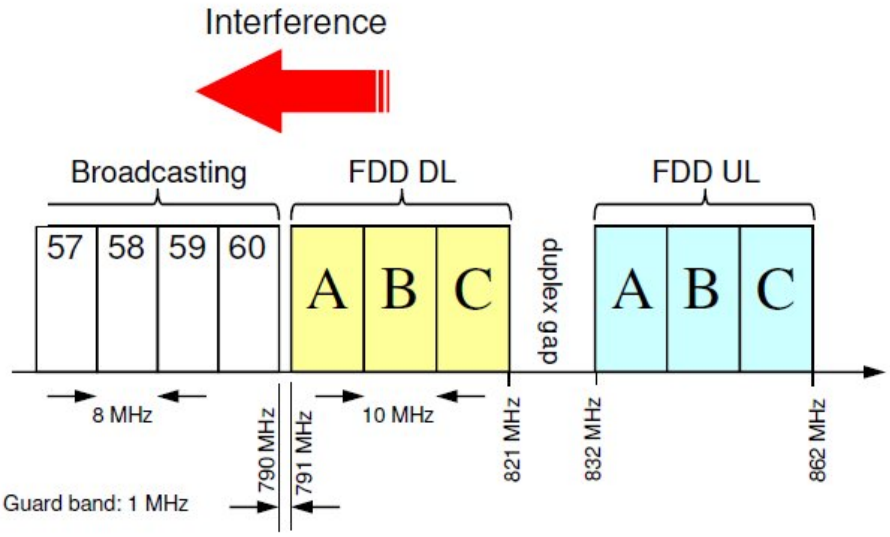
4.54 We emphasise that the conclusions above are based on a simplified viewpoint. They are sensitive to several parameters which are subject to change, in particular the number of national broadcasters in Serbia. We note that while up to seven are anticipated in Serbia's Broadcasting Development Strategy, in fact there are currently eight.

Potential cost involved in assigning the 800MHz band to mobile broadband

4.55 Other countries have adopted channels 61-69 as a harmonised digital dividend band for mobile broadband. However, this gives rise to other problems because of the proximity of mobile devices to TV devices at or near channel 60.

4.56 In the UK, Ofcom has begun to study this in detail.[21] Ofcom's work shows that even when licensees comply with the technical licence conditions agreed in Europe for the 800 MHz band, there will still be a high potential for interference to DTT receivers. The issue is shown in Figure 4.6. It is widely accepted that the combination of the mobile block edge mask and the 1MHz guard band are insufficient to offer protection to DTT.

Figure 4.6: Interference from mobile operators A, B and C into DTT channels 60 and below



Source: Ofcom 2009

4.57 In particular Ofcom has found that mitigation at the DTT receiver (i.e. the use of filters) will be needed and may be the most economic method of maintaining DTT reception in many cases. Protecting DTT in or near channel 60, due to the introduction of the harmonised

[21] http://www.ofcom.org.uk/radiocomms/ddr/

digital dividend in channels 61-69, will thus have an associated cost which has not yet been quantified.

Interleaved spectrum

4.58 A low-power device operating within the coverage area of a TV transmitter could cause interference to TV reception if it transmitted within the RF channel used to provide that coverage.[22] However, low-power devices within the same area can transmit on other RF channels without causing interference. Thus, with careful control of radiated power levels and the frequencies used in a given area, it is possible for low power devices to share the UHF spectrum with TV broadcasts. In some countries this so-called interleaved spectrum is used for low power PMSE[23] applications, primarily radio microphones. This does not apply to Serbia which has PMSE in an SRD band above the TV bands, as shown above.

4.59 However, with the move to digital TV transmissions, which are less susceptible to interference, and the development of new technologies it is possible that some or all of the interleaved spectrum could be opened up to new uses and therefore form part of the digital dividend.

4.60 Releasing some of the UHF spectrum used for TV broadcasting as the digital dividend will clearly reduce the amount of spectrum from which the interleaved spectrum is derived, and might be expected to reduce the amount of interleaved spectrum available. However, digital TV receivers are less susceptible to interference than is the case with the analogue technology, with the result that more interleaved spectrum is available within the same amount of TV spectrum.[24]

4.61 Other uses for the interleaved spectrum can also be considered. Firstly, with careful planning local (i.e. lower power) TV stations can be co-sited with main transmitter stations. Secondly, Google and others have suggested that licence-exempt cognitive devices could share the interleaved spectrum with the existing users.[25] Other potential uses are mobile TV and possibly mobile broadband.

4.62 The proposed cognitive devices would automatically determine what interleaved spectrum was available in their locality and, if no other use was ongoing, make use of the spectrum. Proposed applications include fixed broadband access. By giving priority to existing uses it is claimed that such devices could share the spectrum without affecting

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[22] The low power applications typically occupy a much smaller bandwidth than the TV signals, and several may be transmitted within a single RF channel.

[23] Programme making and special events (PMSE) covers a wide range of wireless applications used primarily in support of programme making and broadcasting (SAP and SAB services) such as outside broadcasting and news gathering. It also includes the making of film, radio, advertisement and corporate material as well as the production of plays, concerts and shows and events of all sorts.

[24] The difference comes about because radio microphones can use almost the whole (>90%) of the RF channel adjacent to a digital TV transmission whereas channels adjacent to an analogue transmission cannot be used at all.

[25] The IEEE 802.22 standard is currently being developed for such devices.

existing PMSE usage. Prototype equipment has been tested by the FCC but so far has not proved reliable enough to be approved for use.

4.63 Determining the interleaved capacity both before and after digital switchover requires detailed studies which have not been undertaken for Serbia. In the UK, Ofcom has given significant consideration to this issue and an indication of the capacity of the interleaved spectrum is that with the 6 national UK multiplexes[26] there will be adequate capacity within the interleaved spectrum for the following:

(a) To award interleaved channels suited to local TV transmission at 25 main TV transmitter stations and at up to 81 stations in total.

(b) To award the remaining interleaved spectrum to a band manager primarily for PMSE use.

(c) To allow the operation of licence-exempt cognitive devices within the interleaved spectrum provided it is demonstrated that adequate protection will be provided to existing users.

4.64 The technical issues addressed above set out some of the opportunities and constraints that Serbia faces in allocating a digital dividend. Whilst these do rely on a number of assumptions that may change in the future, they provide a solid reference point for considering Serbia's options for use of the digital dividend.

Developing Serbia's options

4.65 As presented above, it is highly likely that even with a substantial increase in the number of broadcasting channels there will still be spectrum available to form a digital dividend after analogue switch off. Serbia could provide channels 61-69 to a harmonised digital dividend, which comprises 72MHz of spectrum.[27] There are few constraints on the allocation of a digital dividend (such as PSME or innovation reserve), with the biggest consideration being harmonisation with Serbia's neighbours.

4.66 The Serbian government has stated that no allocation of the digital dividend has been considered yet, and that the overarching aim in any allocation would be to enhance the benefit to society. Possible important uses of the spectrum highlighted at various stages by the government include the growth of television and media services, and the development of the internet and Web economy (in part through mobile broadband). RATEL has highlighted the significance of mobile broadband in achieving Serbia's goal of increased broadband penetration by 2012.[28] The availability of both digital television and

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[26] The 6 multiplexes are allocated a total of 256 MHz from which the interleaved spectrum is derived.

[27] As said, it is possible that fewer multiplexes will be allocated to broadcasting, in which case this 72 MHz represents a lower bound of spectrum available.

[28] , Milenko Ostojić, RATEL 'Development of mobile broadband access in frequency bands below 1GHz in Serbia – Regulatory

mobile broadband in rural areas is also an important concern for Serbia in terms of social inclusion.

4.67 This seems an appropriate place to caution against the reservation of too much spectrum for television broadcasting against a background of unknown consumer appetite for more of what already exists in abundance. Whilst the Serbian government has made no announcements in this direction, priority treatment for broadcasting is widespread within and beyond the EU, and appears to have been driven by political rather than economic rationales. There may yet be questions for governments to ask about whether television quality will keep pace with quantity, and if not what to do with the spectrum consumed by it. As mentioned previously, there are concerns about the ability of the digital terrestrial television broadcaster in Serbia both to increase the quantity and quality of digital television programme offerings and to compete with the current offerings provided via cable and satellite.

4.68 Given the fact that there has been no prospective reservation of spectrum by the Serbian government, there is no reason why the entire spectrum allocation released by analogue switch-off should not be offered by way of auction or beauty contents to whichever applicants bid for it. However, given the importance attached to broadcasting by a great many of countries we have studied (as well as some illuminating comments from the Serbian government) we think it likely that at least a portion of the digital dividend in Serbia will be reserved for broadcasting. However, as this is not yet certain, three possible scenarios emerge:

(a) Allocate the entire released spectrum to broadcasters

(b) Allocate the entire released spectrum to other uses

(c) Allocate part of the released spectrum to broadcasters and the rest to other users

4.69 Finally, there remains the question of how spectrum should be awarded to non-broadcasting services.

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problems'

5 WAYS OF VALUING THE DIGITAL DIVIDEND

Different methods available

5.1 We should like to emphasise at the outset that there is no one right way of valuing the digital dividend that makes all others wrong. A variety of economic techniques have been developed, and each has its strengths and weaknesses. Our own experience is that it is better to carry out more than one valuation and then to compare the differences, since the process of comparison may itself shed useful light on the valuation.

5.2 The most frequently used methods of valuation, and the two methods that we adopt in this report, are:

(a) To measure the benefit that consumers and producers get from using and supplying goods and services that make use of the spectrum. This is known in the jargon of economics as the "**total welfare**" approach. Total welfare in turn is made up of two further economic concepts – "consumer surplus" and "producer surplus" – both of which are explained below.

(b) Equally often used is a method which calculates **Gross Domestic product (GDP) impacts**, that is to say the increased revenue or employment across the whole economy which arises from goods and services that the allocation of spectrum makes possible. This technique too is further explained below.

The total welfare approach

5.3 Total welfare values the benefit that consumers get from using, and producers get from supplying, goods and services that (in this case) make use of the radio spectrum. It is essentially the measurement of private gains. As we have just said, total welfare is the sum total of two other valuations – consumer surplus and producer surplus.

Consumer surplus

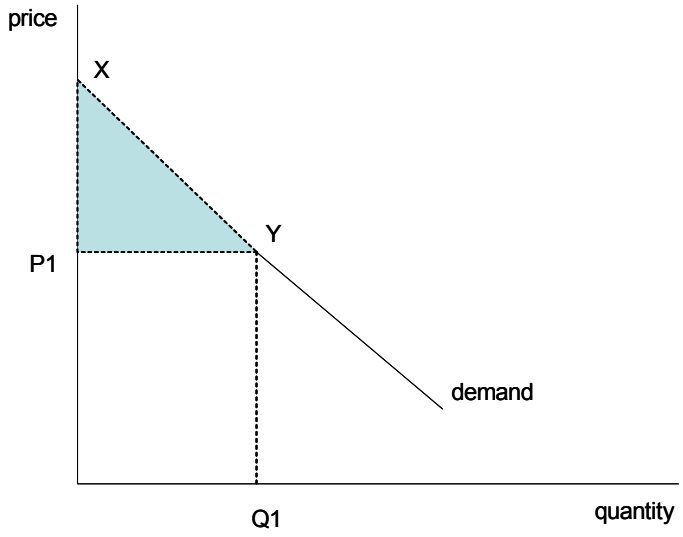
5.4 Consumer surplus was formally explained by Alfred Marshall in his *Principles of Economics* as long ago as 1890. In Marshall's words:

> "the price which a person pays for a thing can never exceed and seldom comes up to that which he would be willing to pay rather than go without it: so that the satisfaction which he gets from its purchase generally exceeds that which he gives up in paying away its price; and he thus derives from the purchase a surplus satisfaction. The excess of the price which he would be willing to pay rather than go without the thing, over that which he actually does pay, is the economic measure of this surplus satisfaction."

5.5 Thus, consumer surplus can be defined as the utility (or surplus) that the customer receives above the price that he or she actually paid. Figure 5.1 below gives a simple illustration.

5.6 Point X is the maximum price that the customer is willing to pay for this particular good or service. P1 is the actual price paid and Q1 the associated quantity consumed at this price. The area XYP1 is the consumer surplus for the marginal customer – or economic benefit.

Figure 5.1: Consumer surplus



5.7 As the price of the product or service increases, the consumer's surplus will decrease – as we come closer to his or her willingness to pay price. Further, the more inelastic the demand curve is, the greater the consumer surplus.[29]

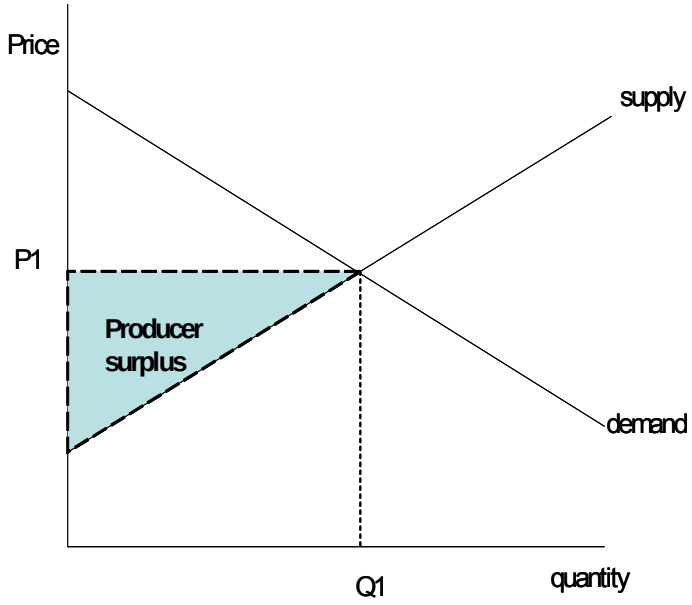
Producer surplus

5.8 Producer surplus is almost the mirror-image of consumer surplus. It can be defined as the revenue received by a supplier for any particular product or service over the minimum amount he would be willing to accept to maintain the same level of supply. In other words, producer surplus measures the difference between turnover and avoidable economic costs.[30] Figure 5.2 below illustrates.

[29] Elasticity in economic terms refers to how responsive consumption and production are to changes in price. If a good is demand price inelastic, this means that changes in price have a less than proportionate effect on demand. A good along these lines might be an essential commodity such as bread. Conversely, a good that is said to be demand price elastic will exhibit large shifts in demand in response to price changes.

[30] Church and Ware "Industrial Organisation, A Strategic Approach" McGraw Hill, 2000

Figure 5.2: Producer Surplus



5.9 As the supply curve varies, the level of producer surplus will vary. Thus, when supply is more elastic (price-sensitive), surplus is likely to be less than when supply is relatively inelastic (price-insensitive).

5.10 Producer surplus can be negative. Although a negative producer surplus cannot continue indefinitely, producers may be prepared to accommodate losses for a period of time in order to establish themselves in the market, or indeed to establish a market. Where companies have to invest money that will provide profits only after a few years it is likely that producer surplus would be negative. This can certainly happen in the communications industry.

5.11 Accounting profits and costs are not the same thing as economic profits and costs. The latter take into account inflation and the real cost of capital. Thus, even a start-up company reporting profits in its early years may not be making a true economic profit because its capital costs are not fully accounted for in book values.

Difficulties with measuring surpluses

5.12 Measuring consumer surplus is characteristically more difficult. Essentially, the following formula is used:

Consumer Surplus = No. of users * individual consumer benefit

5.13 For users of mobile phones (as an example) the number of users refers to the subscribers of mobile phone companies and the consumer benefit is the difference between their willingness to pay for the service and the actual price paid. The most straightforward way

of estimating consumer surplus is by means of up-to-date surveys of consumers' willingness to pay (WTP) for particular goods or services. However, in our experience it is rare to find fully up-to-date WTP surveys available in precisely the right product areas at precisely the time we wish to use them.[31]

5.14 An alternative is to carry out econometric tests on price changes, and consumer reactions to them, over a period of time. In a reasonably competitive market, consumer surplus will generally exceed producer surplus by a wide margin.

5.15 Measuring producer surplus can be reasonably easy where there is good accounting information which can be adapted to give the required economic information.

5.16 We explain in Section 6 of this report how we have dealt with these difficulties in the context of Serbia.

Maximising total welfare does not necessarily give the right answer

5.17 It is tempting for policy-makers to take the view that maximising total welfare is the right thing to do with the digital dividend, i.e. to allocate spectrum to those products and services that most consumers would get most surplus from, and that most producers will also value most.

5.18 However, maximising total welfare may benefit some sectors of society much more than others, and it is for politicians to judge whether that is the right thing for Serbia. There is a parallel of sorts here with Ireland, where the government has yet to decide on a number of aspects of allocation of the digital dividend. Dublin and its immediately surrounding area is much more affluent per head of population, and more receptive to technical innovation, than rural Ireland. Should this disparity continue, or should the government take steps to encourage internet provision in rural communities, and thereby start to raise their economic participation, if necessary at the expense of Dubliners? How would one estimate the benefits of one or other policy? Consumer welfare calculations would not be of much help here: political judgment would need to modify the maximisation of economic benefit.

5.19 Furthermore, we have already seen that spectrum allocations should not be done in isolation from what neighbouring countries have done or intend to do. There are international agreements that prescribe the uses of certain parts of the spectrum in the interests of wider harmonisation between nations (in order to avoid signal interference) and the potential for substantial economies of scale for manufacturers of communications equipment.

[31] For example, in our work for Ofcom, which was carried out in 2006, the most recent WTP surveys we could find in the communications sector were dated 2000.

5.20 In short, there is a balancing act to be done between economic and non-economic factors, and, even within economics, between different approaches to securing benefits.

The GDP impact approach

5.21 The GDP impact approach takes no notice of private gains (the welfare approach) but instead measures what changes take place in national revenues (Gross Domestic Product – GDP) and employment in response to spectrum allocation decisions. In other words, the GDP approach attempts to assess whether there would be a greater (positive) impact on the Serbian economy if the digital dividend remained with television broadcasters, or were allocated to mobile telephony and broadband, or if a mixed usage were determined.

5.22 The formula used for calculating GDP impacts is as follows:

Total GDP impact = Direct impact + Indirect impact + Multiplier impacts – Re-absorption

5.23 **Direct impact** is the revenue (or employment) of the Serbian companies that make up the spectrum-using sector, i.e. the broadcasters, the mobile network operators, the other telecoms network operators, and the equipment manufacturers in Serbia. We have reasonably up-to-date revenue and employment figures for all these activities.

5.24 The **indirect impact** is the revenue (or employment) of the companies which supply to, or depend on, these primary companies. They thus include equipment sales and distribution and internet service providers. We have reasonably good data on these activities too.

5.25 As an alternative, one can use national Input-Output Tables to calculate the effect on other sectors of increases or decreases in revenue. We have a little more to say about this alternative method later.

5.26 **Multiplier impacts** are the "ripple effect" that arises as employees of the direct and indirect companies spend their money in the wider economy. The multiplier effect is usually calculated as a percentage of the direct and indirect effects combined. In the UK the "standard" multiplier is 10 per cent, but in principle it can range from 5 per cent to 30 per cent. The Deloitte study has calculated the relevant multiplier for Serbia as 13 per cent.

5.27 Finally, the **re-absorption effect** recognises that, when an industry expands, some of the jobs gained are filled by people who leave other jobs. Conversely, when an industry gets smaller, for example when a factory closes, some of the people who lose their jobs find other jobs, or at least they do so over time. Thus, gross gains or losses of employment are not net gains or losses, and the re-absorption factor makes the necessary adjustment.

5.28 In the UK the standard re-absorption factor that the government uses is 52 per cent over three years. If the re-absorption factor in Serbia is not known, it is sufficient to calculate GDP effects without the re-absorption factor so long as it is recognised that the impact calculated is a gross effect, not a net effect.

Differences between methods of measurement

5.29 It is important to understand that measuring total welfare will not give the same result as measuring GDP impacts. In that sense, one cannot say that either basis of valuation of the digital dividend is the "right" one. Provided the calculations are arithmetically correct, both are "right" – but they are measuring different things.

5.30 If the two methods of calculation produce a similar result, that is pure co-incidence! It is pointless to compare a valuation based on GDP Impacts with one based on Total Welfare.

5.31 Above all, it is important to remember that all impact assessments are by nature approximate.

6 VALUATION AND BENEFITS

6.1 In this section we apply the two basic valuation techniques already described in Section 5 – namely the "total welfare" approach and the "GDP impact" approach.

The total welfare approach

6.2 As described in Section 5, the total welfare approach entails measuring the total benefit to consumers and producers arising from use of the goods and services that the allocation of spectrum makes possible. This approach involves estimating both "consumer surplus" and "producer surplus".

Assumptions

6.3 We have not conducted any surveys or interviews regarding the willingness to pay of Serbian consumers. This would have been a costly and time-consuming task. Rather, we base our evaluation on studies conducted in other countries and on publicly available data.

6.4 In particular we rely on:

- a series of documents published by Ofcom in its consultation on the digital dividend review in the UK;
- a report written by Spectrum Value Partners (SVP) commissioned by a number of mobile operators; [32] and
- a report written by Analysys Mason (AM) for ARCEP, the French regulator.[33]

6.5 Both SVP and AM value various spectrum-using services in a number of countries and include economic effects as well as societal values. Although their reports use different methodologies, they share a common basis for their analysis of the costs and benefits.

6.6 After a thorough review of the documents we came to the conclusion that the analysis conducted by SVP on Slovakia is the one that matches most closely the specific characteristics of Serbia. The other studies focus on considerably larger countries such as France, Italy and the UK.

6.7 The SVP report conducted its analysis for three EU country 'clusters'. Although Serbia was not considered in the study (the scope was limited to the EU27) the cluster that Slovakia represents has similar characteristics to Serbia, namely:

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[32] Spectrum Value Partners, *Getting the Most Out of the Digital Dividend*, 2008. This report was commissioned by Ericsson, Nokia, Orange, Telefonica and Vodafone.

[33] Analysys Mason, *Etude sur la valorisation du dividende numerique*, 2008

- Relatively low GDP per capita
- Low broadband penetration
- Medium penetration by cable and satellite
- Digital switchover dates, on average, of 2012

6.8 Furthermore, several of the other EU Member States in the same cluster (Poland, Latvia and Slovenia) have been highlighted in the Deloitte study as similar to Serbia in terms of mobile penetration, geographic location and/or GDP levels.

6.9 In our view, SVP's approach is apposite for a number of reasons.

- First, our own study represents only the first step in a process that Serbia will implement before the switch-off, and our primary aim is to provide an initial evaluation of the possible uses of the digital dividend.
- Second, the telecommunications market is one where innovation, coupled with continuously changing consumer tastes, implies that the situation faced by decision makers in three or four years' time could be substantially different from the one they face now.
- Finally, as we found in our previous research into this topic[34], precise estimates of the value of specific spectrum-using services are very difficult to obtain: ranges tend to be extremely wide and it is unclear what probability attaches to any particular value.

6.10 Given the limitations of our study, the results we show should be interpreted as indicative rather than precise.

Broadcasting and mobile broadband

6.11 There are, for Serbia, a number of alternative uses of spectrum. Whilst we do not feel it is necessary for Serbia to dedicate any significant resources to a detailed valuation of these alternative uses, it is possible to apply past estimates to Serbia in order to derive approximations which may be of use to policy makers.

6.12 We believe it is worthwhile to assess approximate values for two possible uses of the spectrum:

- the value of broadcasting services; and

[34] See, for example, Europe Economics (2008) 'How can Ireland best benefit from its digital dividend?' A report for ComReg

- the value of mobile broadband.

6.13 It is important to bear in mind that our objective should be to estimate the value of such services *over and above* the value that they are currently providing, either using spectrum bands that are not part of the digital dividend or that they could provide with less spectrum once the analogue switch off has been completed.

6.14 As explained above, our process is mainly to transpose the results obtained by SVP for Slovakia to the Serbian situation. In summary, the process that SVP applied was as follows.

6.15 SVP grouped EU Member States into three clusters: the "wealthy terrestrials", the "wealthy cabsat [cable-satellite]" and the "less wealthy." They then selected a country that was deemed representative in each of the three clusters.

6.16 The countries selected were Italy, the Netherlands and Slovakia for each cluster respectively. SVP then assessed the value of assigning spectrum to two different uses, i.e. mobile and broadcasting, for the three representative countries. For the value of broadcasting services SVP modelled the supply of different mixes of DTT service and available spectrum, where a service mix is defined by reference to the number of available channels, the channel supply for each platform, and the broadcast quality (i.e. SD or HD). For the value of alternative services, SVP modelled consumer demand for mobile broadband services under different demand forecasts, including detailed modelling of supply-side costs.

6.17 The analysis made use of a welfare approach similar to that described in Section 5, in that it considered the value of various spectrum allocations to both producers and consumers. Indirect benefits to producers and consumers were taken into account (e.g. economic activity related to mobile broadband or broadcasting, such as advertising) as well as an "externality" value (e.g. broader societal value placed on the consumption of mobile broadband and broadcasting, such as increased productivity or social inclusion).

6.18 Theoretically, in transposing SVP's techniques to Serbia, it would be possible to take account of a number of different features of the Serbian market. However, on grounds of transparency and robustness we decided that a "minimalist" approach would be more appropriate. The calculations are approximate in any event, and over-refining some of the inputs could suggest an accuracy which in practice would be spurious.

6.19 We focus therefore on factors that are easy to measure accurately and that have a decisive effect on the potential value of services. These are factors that influence either the number of people consuming such services or the amount of money they are willing or able to spend. Therefore we have adjusted the SVP results only on the basis of the following four factors:

- differences in total population;
- differences in GDP per capita;

- differences in the share of households relying solely on terrestrial television;
- differences in the current penetration of fixed broadband.

6.20 Factoring in total population slightly increases the aggregate benefits accruing to Serbia for the simple reason that its population is somewhat larger than that of Slovakia (7.35 million *versus* 5.41 million).

6.21 Adjusting for per capita GDP works in the opposite direction because (according to the World Bank) the figure for Serbia is 62 per cent lower than for the Slovakia. This suggests that Serbians will be less able to spend money on new services than Slovakians.

6.22 Since the share of households relying solely on terrestrial television is slightly higher in Serbia than in Slovakia (a smaller proportion of the population in Serbia relies on cable or satellite television) assigning spectrum to DTT would have somewhat more value in Serbia as consumers will have fewer alternatives to DTT to choose from. Similarly, given that the penetration of fixed broadband is lower in Serbia than Slovakia it is likely that demand for (and hence value of) mobile broadband will be higher in Serbia given the fewer available alternatives.

The value of broadcasting

6.23 As in the SVP report we provide results for five different scenarios regarding the amount of spectrum allocated to broadcasting services. The base case assumes that all national free-to-air channels will be in HD after the switch-off. The base case assesses, in essence, only the value of migrating the current analogue channels to digital, leaving (almost) the entirety of the digital dividend available for other uses. (The only difference is that consumers will receive the national channels in HD rather than, as now, in SD.) We acknowledge that this may not be the outcome for Serbia but we regard it as a useful benchmark.

6.24 The other scenarios assign additional spectrum capacity to broadcasters up to the point in which the entire dividend is assigned to them. With an increasing amount of spectrum available, broadcasters will be able to supply a larger selection of channels, both in HD and in SD. The modelling (critically) assumes that consumers will demand such additional channels, though at a decreasing rate.

6.25 The modelling results show that the majority of benefits associated with the digital dividend come from the migration of analogue to digital and that assigning additional spectrum to broadcasting yields (unsurprisingly) decreasing overall benefits to Serbia.

6.26 As shown in Table 6.1, transferring the current analogue channels to a digital platform (the base case) yields a benefit of €2,250 million. Assigning the entire digital dividend spectrum to broadcasters yields a benefit of €3,143 million. The intermediate scenarios produce results that lie between these two extremes and they show that the incremental

benefits associated with assigning additional spectrum to broadcasting taper off rapidly once less than 120 MHz are allocated to other uses.

Table 6.1: Estimated benefits generated by broadcasting services in terms of different amounts of the digital dividend assigned to other services

(NPV 2012 – 2027 in €million)[35]

Base Case	120 MHz to other services	80 MHz to other services	40 MHz to other services	Entire digital dividend to broadcasters
2,250	3,096	3,122	3,137	3,143

Source: Europe Economics estimates

6.27 The value of broadcasting in Serbia is relatively high (as with Slovakia) given the high consumer willingness to pay for TV and the high volume of television watched. It is, however, far lower than in other countries analysed in the SVP report, such as Italy.

6.28 It must be noted that in the SVP report, the value of externalities arising from broadcasting are measured in terms of advertising revenue. However, as mentioned in Appendix 1 (issues influencing take up of digital television) the advertising market in Serbia is relatively small and unlikely to grow substantially with an increase in broadcasting. Whilst we do not have appropriate data to factor this into our evaluations, it is likely that the value of allocating spectrum to broadcasting in Serbia will be somewhat lower in reality than what is presented above.

6.29 What is clear from the above values, and illustrated below in Figure 6.1 and Figure 6.2, is that the *additional* value of assigning more spectrum to broadcasting after the initial switchover from analogue to digital television is low.

The value of mobile broadband

6.30 The value of alternative uses is calculated as the value that would result from assigning the spectrum to entities other than broadcasters. For simplicity we use mobile broadband as a proxy for all possible alternative uses (as does SVP).

6.31 We have analysed a number of possible developments of the demand for additional services in terms of technology developments and change in consumer preferences. We report results for a "medium" outcome in which we assume that mobile broadband usage becomes relatively widespread and that there is an improvement in the functionality of mobile broadband applications. In addition connection speeds improve and there is a convergence in functionality between handsets and laptop computers.

[35] Figures in the SVP report are calculated for the period from switchover in 2012 until 2027. Values have been discounted back to 2008 prices.

6.32 Table 6.2 shows that assigning 40 MHz of digital dividend to mobile broadband would yield €414 million in terms of benefits to Serbia. The benefits would increase to €688 million if 180 MHz is allocated to other uses and to €733 million if the allocation increases to 200 MHz.

Table 6.2: Estimated benefits from assigning the digital dividend to mobile broadband (lower bound)

(NPV 2012 – 2027 in €million)

Spectrum assigned to other services								
40 MHz	**60 MHz**	**80 MHz**	**100 MHz**	**120 MHz**	**140 MHz**	**160 MHz**	**180 MHz**	**200 MHz**
414	474	549	586	624	658	688	711	733

Source: Europe Economics estimates

6.33 The results above represent a lower bound for the value of mobile broadband, using relatively conservative assumptions. We address these in turn and present revised figures below.

Refarming assumptions

6.34 The original values take into account the possibility of refarming part of the 900 MHz band to use for mobile broadband. As we are interested in the incremental value of the digital dividend, the availability of other spectrum (above the 862 MHz band) for mobile broadband would reduce the value of the 800 MHz band. The figures below represent values under the assumption that refarming of the 900 MHz band either does not take place, or is significantly delayed, thus increasing the value of the 800 MHz band for mobile broadcasting. Although feedback from Serbian operators does not rule out the possibility of using 900 MHz for mobile broadband technologies and mobile voice, it is likely that the amount of refarming able to be done (and the timing of it) will be less than that assumed in the original SVP calculations.

Elasticity of demand for mobile broadband

6.35 The original values assume a relatively conservative elasticity of demand for mobile broadband, based on the elasticity of demand for mobile voice.[36] It is likely that the elasticity of demand for mobile broadband will be higher than that for mobile voice, as the alternatives to broadband are more numerous (such as fixed broadband or watching TV at home) than mobile (the need to be calling on the move). Thus a decrease in the price of mobile broadband would result in a higher uptake. We have therefore included a slightly higher elasticity of demand in our evaluations of the value of mobile broadband.

[36] Elasticity of demand is the sensitivity of demand to changes in price. A higher elasticity means that is prices fall, demand will increase by a higher degree.

6.36 The consideration of these two assumptions described above results in higher values for allocation spectrum to mobile broadband. We consider these values an upper bound, and present them below.

Table 6.3: Estimated benefits from assigning the digital dividend to mobile broadband (upper bound)

(NPV 2012 – 2027 in €million)

Spectrum assigned to other services								
40 MHz	60 MHz	80 MHz	100 MHz	120 MHz	140 MHz	160 MHz	180 MHz	200 MHz
572	655	759	810	861	908	950	982	1,012

Source: Europe Economics estimates

6.37 Thus, the value of allocating spectrum to mobile broadband ranges from €572 million to €1.01 billion.

6.38 Even the upper bound values of assigning the digital dividend to mobile seem relatively low (compared to, say, Italy and the Netherlands), and these are influenced by a number of factors taken into account in estimates. These include lower forecasted levels of demand for mobile broadband in Serbia than other countries (resulting primarily from very low GDP per capita), higher capacity constraints, and conservative estimates of some factors such as social discount rates and the potential for long-term cost savings for MNOs. Current obstacles to mobile broadband penetration in Serbia, raised in stakeholder interviews, include administrative burdens to erect additional mobile sites and a 10 per cent tax on mobile revenues.[37]

Delay in allocating spectrum

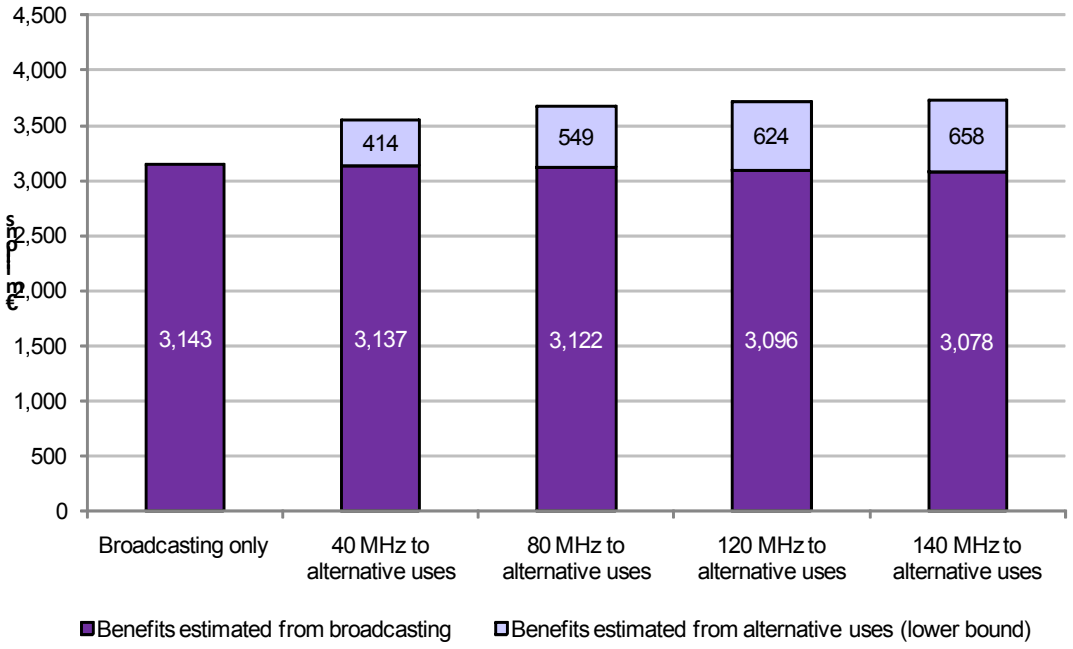
6.39 The estimated value of allocating spectrum to other uses assumes that UHF frequency will be freed and allocated in 2012. However, given the harmonisation constraints that Serbia faces (see Section 4) it is likely that the UHF network will not be available for allocation until 2015. SVP estimates that delaying the allocation of UHF spectrum for uses other than broadcasting from 2012 to 2015 results in a 17 per cent decrease in the value of the digital dividend. Any delay in allocating the digital dividend beyond 2015 will further reduce the benefits available to the Serbian society. This is an important consideration for allocation strategies.

The combined value of broadcasting and mobile broadband

6.40 We illustrate in Figure 6.1 and Figure 6.2 what the overall benefits obtained from broadcasting services and mobile broadband would be if the medium-demand level for

mobile broadband materialises. Again we represent the lower and upper bound values for mobile broadband.

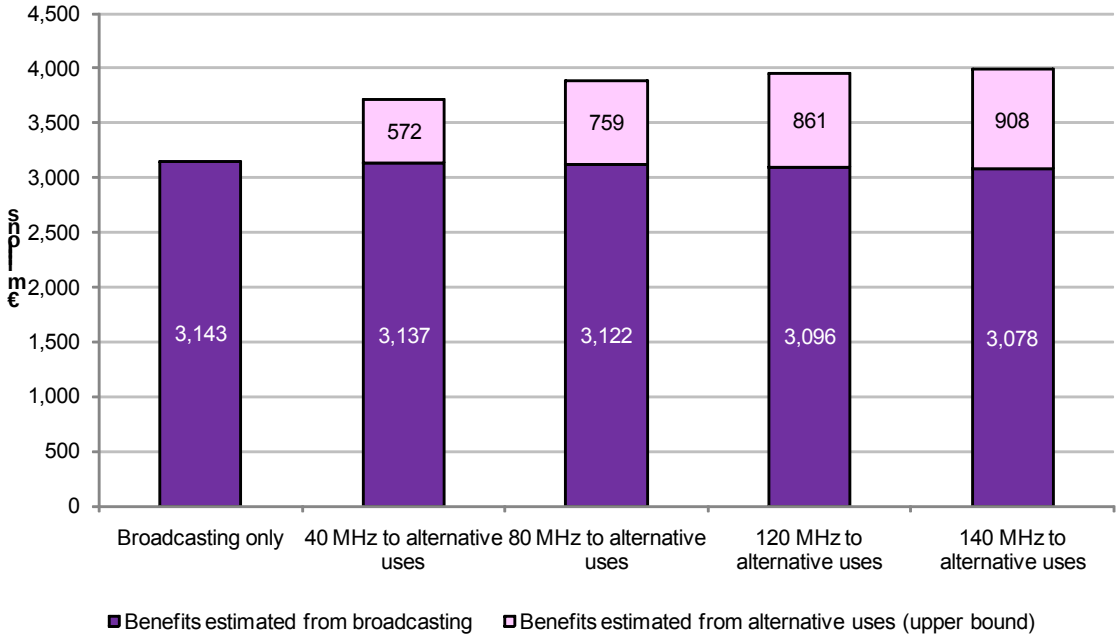
Figure 6.1: Combined value of broadcasting and mobile broadband based on medium demand for alternative services (lower bound)



Source: Europe Economics estimate

[37] Frontier (2010) ' The impact of broadband in Eastern and Southeast Europe' Report for Telekom Austria Group

Figure 6.2: Combined value of broadcasting and mobile broadband based on medium demand for alternative services (upper bound)



Source: Europe Economics estimate

6.41 It is important to note that even the lowest allocation of spectrum to non-broadcasting (40 MHz in Figure 6.1 and Figure 6.2 above) gives a value to Serbia higher than if the entire digital dividend is assigned to broadcasting only, and this increases the more spectrum is allocated away from broadcasting. The benefits to Serbia of assigning the digital dividend to both broadcasting and mobile broadband yields a higher value than assigning spectrum for one use only. This is wholly consistent with other studies, such as the AM findings for France, namely that a mixed allocation is better than a single-purpose (broadcasting) allocation.

6.42 There are a number of factors that must be kept in mind when considering the allocation between broadcasting and mobile broadband. As highlighted in the technical discussion in Section 4, it is probable that Serbia will not have significantly more than 72 MHz (channels 61-69, also known as the 800 MHz band) to allocate to mobile broadband services. However, additional spectrum may be available if fewer multiplexes are assigned to broadcasting – possibly as much as 150 MHz.[38] Use of this spectrum would represent scenarios in Table 6.2 and Table 6.2 where more than 72 MHz is allocated to mobile broadband. In our evaluations we have assumed that this additional spectrum is as valuable as the 800 MHz band, but are aware that this may not be the case as it is

[38] Based on feedback from mobile operators

more difficult to use isolated portions of spectrum for mobile broadband than a large contiguous section like channels 61 – 69.[39]

The GDP impact approach

6.43 As we explained in Section 5, the GDP Impact is derived from the following formula:

Total GDP impact = Direct impact + Indirect impact + Multiplier impacts – Re-absorption

6.44 We must caution at the outset that this technique produces results which are, by their very nature, approximate. It will not, for example, reliably measure the GDP impacts of *slight* differences in the allocation of spectrum.

The current position

Direct and indirect employment impacts

6.45 In the present context, the first task is to assess the GDP impact of the current status of spectrum-using businesses in Serbia. Conveniently, most of the impacts in employment terms are provided in Table 3.1, which originates with the Deloitte study already referred to. For two principal reasons we need to adapt this table.

6.46 First, Deloitte's table did not include TV or radio broadcasters, so we have had to estimate an employment figure for this sector. We have seen an estimate that employment in "radio and television activities" was 10,200 in 2004, and 8,600 in 2005.[40] We estimate that RTS employed approximately 4,000 people in 2008.[41] To this must be added employment among the pay-TV companies in Serbia. We have no hard figures on this point, but estimate employment in this sector to be 1,300 people.[42]

6.47 Secondly, the original table conflates direct and indirect employment. We define direct impacts as the employment arising among network operators, and broadcasters, and all other employment shown as indirect. Furthermore, we regard the activities of fixed network operators in support of mobile traffic as an indirect effect, not a direct effect.

6.48 Thus we have modified Table 3.1 to give Table 6.4 below.

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[39] Furthermore the use of any interleaved spectrum may be constrained by the necessity of additional harmonisation with Serbia's neighbours.

[40] Source: Svetlana Jovičić and Hristina Mikić: *Creative industries in Serbia - basic facts and recommendations*, British Council, Belgrade, 2006; H. Mikic, P*otentials for creative-led development in Serbia,* Economic policy and development of Serbia, Faculty of Economics, 2007, pp. 129-141.

[41] Calculated from Table 12, Mirjana Milošević & Tanja Petrović "The Late Beginning of Digital Television in Serbia".

[42] We have based these estimates on the fact that Serbia Broadband (SBB), which accounts for 54 per cent of the subscriber TV market, employs 700 people. See http://www.sbb.rs/SBB/1103/About+us.shtml

Table 6.4: Employment in the spectrum-using sector, 2007

	2007
Direct employment	
Mobile network operators	2,860
Broadcasters (see paragraph 6.46)	5,300
Indirect employment	
Fixed network operators	630
Network equipment suppliers	180
Network support suppliers	785
Handset importers	270
Other suppliers of capital items	115
Suppliers of non-network support services	960
Airtime/ SIM sellers and mobile phone sellers	20,750
Multiplier	7,110
Total employment impact	**38,960**

Source: Table 3.7, adjusted by Europe Economics. The ultimate source is Deloitte.

6.49 The percentage of employment that Deloitte estimate is accounted for by airtime/SIM sellers is strikingly high, but we have no basis on which to challenge it.

6.50 We acknowledge that broadcasters also give rise to indirect employment effects, but our intuition is that such effects are small-scale, and we have not therefore attempted to estimate them.

The multiplier effect

6.51 The multiplier used in Table 6.4 – namely 1.3, applied to indirect employment – is a value chosen by Deloitte. It seems to us somewhat high, but we acknowledge that Deloitte have benchmarked it against a variety of other countries.

6.52 In round terms, the spectrum using sector thus gives rise to just under 39,000 jobs in Serbia. This is equivalent to roughly 1.3 per cent of the population of working age.

GDP impacts in monetary terms

6.53 To assess the GDP impact in monetary terms, we have relied substantially on the Deloitte report for Telenor (already referred to) because it seems to us a thoroughly well-founded piece of work, and not one to which we can contribute anything material.

6.54 Figure 20 on page 28 of the report indicates that, for 2007, the supply-side impact of the mobile sector on GDP was equivalent to about 2.2 per cent of total GDP, an estimate

which we regard as broadly consistent with the employment impact of 1.3 per cent.[43]

6.55 Our view is that Deloitte's calculation is well-founded for the mobile sector, and we have nothing material to add to it.

6.56 However, including an estimate for the broadcasters would raise the figure of 2.2 per cent to approximately three per cent for the spectrum-using sector as a whole.[44]

6.57 This estimate of three per cent of GDP arising from spectrum-using businesses is consistent with a number of other countries, notably the UK (where radio-spectrum use was worth £37bn or three per cent of UK GDP in 2008)[45] and the EU (estimated at around 2.5% of aggregate EU GDP).[46]

6.58 In one sense it is possible to say that the implied figure of RSD 81 billion[47] (€1.01 billion[48]) is the value of the digital dividend in Serbia, since in theory the whole of the spectrum currently used by the broadcasters and telecoms network operators is available for re-allocation. In practice, some commitments may already have been made, so the actual amount of spectrum to be released may be smaller. As our summaries of other countries show (see Volume 2 of this report), the scale of the digital dividend can vary greatly from country to country – from 128 MHz in the UK to 229 MHz in France.

6.59 This approach does not attempt to assess the GDP impact of allocating the digital dividend to different uses, for example between broadcasting and mobile broadband. This is due to the complexity of estimating what additional spectrum could be available for various used over and above what is currently used.

An alternative approach to indirect effects

6.60 We have been fortunate in having at our disposal Table 3.1 and Table 6.4 which have provided explicit statements of indirect effects. It is not always possible to have access to such detail, so, for the sake of record, we describe an alternative approach which can be useful when indirect impacts are not explicitly known.

6.61 This alternative approach uses what are known as "Input-Output Tables" (I-O Tables). Where I-O Tables exist, they permit users to enter a *direct* revenue in one or more industrial sectors, and the I-O Table then computes the effects of that input on all other sectors in the economy. For any given economy I-O Tables rely on immense amounts of

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43 Deloitte calculates a total impact of 4.1 per cent by adding in productivity and intangible increases which we are unable to verify.

44 Whilst there is no available data on the value of broadcasting as a share of GDP in Serbia, estimates for the ratio of broadcasting to mobile value for Europe range between 0.24 to 0.58. (See SCF Associates 'The Mobile Provide' September 2007). We have chosen the mid-range of 0.41, giving the total contribution of the spectrum using sector to GDP of 2.2 + (0.41*2.2) = 3.1 %

45 http://www.crfs.co.uk/news/pr26jun08.html

46 http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/_document_storage/consultations/2010_rspp/rspp_consultation.pdf

47 3 per cent of 2008 GDP

48 Approximate 2008 exchange rate DIN/EUR ~82. Oanda.com

empirical research. They exist for a number of economies round the world, but we have been unable to find I-O Tables for Serbia, so we have not been able to undertake a second calculation of indirect effects.

The re-absorption effect

6.62 Neither we nor Deloitte have applied a "re-absorption factor" to our estimates of the GDP impacts. The re-absorption factor recognises that, when companies or whole industries expand or reduce their employment, the increase or decrease in jobs they cause is not a net effect. When (for example) a factory closes some of the displaced employees find other work, or at least they do so over time. Conversely, when a factory expands, some of the additional jobs may be filled by employees who leave other jobs. Thus the net employment effects are smaller than the gross effects.

6.63 In many GDP impact analyses it is customary to take this re-absorption into account, using a factor determined by government through empirical studies. We know of no such factor for the Serbian economy, and its relevance to our primary aim in producing this report – to value the digital dividend – is not great. We have not therefore applied re-absorption to our calculations.

The future

6.64 We cannot predict what the future GDP impacts of the digital dividend, and thus its future value, will be. Any such forecast would depend heavily on:

- how much spectrum is released to what operators;
- what uses they make of it and what services they provide;
- what the consumer response is; and
- what additional employment and expenditure arises.

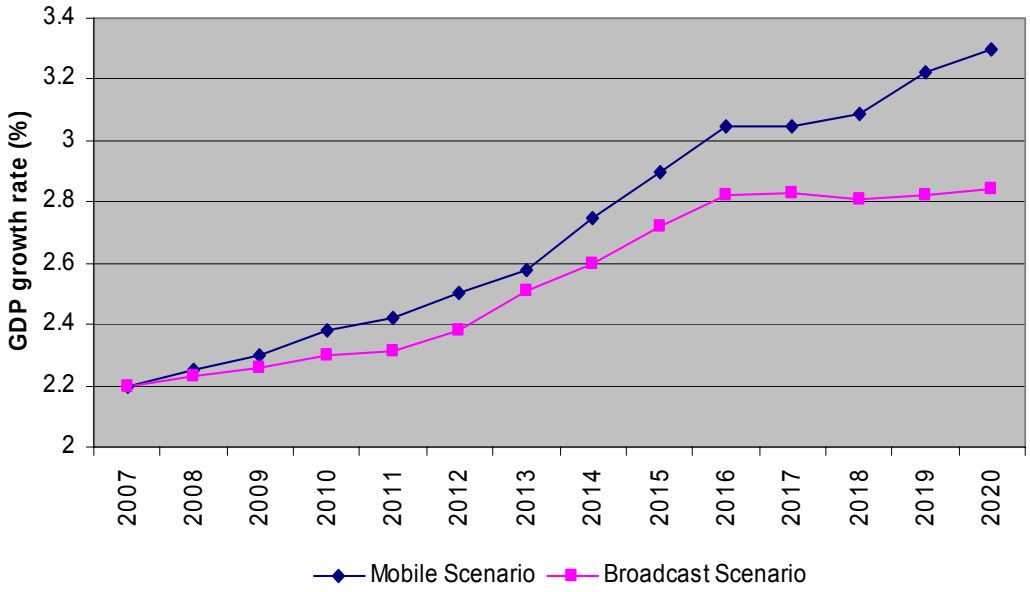
6.65 However, experience from other countries tells us that the total welfare effects of spectrum-using industries increase over time, as suppliers develop new services and price them more attractively, and consumers make more and more use of them.

6.66 Our 2006 report for Ofcom found that the total welfare effect of the spectrum using industries in the UK rose by 50 per cent between 2002 and 2006. We do not have a comparison of GDP impacts over those same years, but it is inconceivable that the GDP impact would not have increased.

6.67 In general, the evidence we have from other countries suggests strongly that greater growth emerges from mobile technologies than from broadcasting, even where there is evident consumer willingness to pay for broadcasting rather than to confine television viewing to free channels. For example, a study by SCF Associates estimated the economic output per MHz of bandwidth at €168 million for mobile compared to €28 million

for digital TV.[49] The figure below shows GDP growth rates in the EU resulting from increases in mobile and broadcasting respectively.

Figure 6.3: GDP growth rate in the EU for increases in mobile and broadcasting



Source: SCF Associates (2007)

6.68 Indeed, it seems evident that, over time, mobile technologies will become more and more widely adopted as the means of delivering content traditionally supplied by broadcasters.

6.69 In these circumstances, it seems to us highly desirable that, if one aim of spectrum policy is to add to GDP, governments and regulators should strike a balance between awarding too much spectrum too early (thus possibly constraining future uses) and awarding too little too late (thus making it difficult for the spectrum-using industries to plan long-term).

Lessons for South East Europe

6.70 Whilst this report focuses on Serbia, lessons can be drawn for other South East European countries in terms of the potential value of their digital dividend and how it should be allocated between broadcasting and other uses. We do not undertake any analysis of technical issues in each country, and rely mainly on comparative statistics taken from the Cullen Report (2010).

6.71 We consider a range of South East European countries, such as Albania, Bulgaria,

[49] SCF Associates 'The Mobile Provide: Economic Impacts of Alternative Uses of the Digital Dividend' September 2007 http://gsmworld.com/documents/SCF_Associates_report.pdf?PUPOL=SCFAR

Bosnia & Herzegovina, Croatia, Macedonia, Montenegro and Turkey. Using the values estimated for Serbia of allocating the digital dividend to broadcasting and mobile broadband (upper bound), we adjust these for the South East European countries taking into account population and per capita GDP. The key indicators used are presented below for reference. Where possible data were taken from the same source to maintain consistency.

Table 6.5: Key indicators for the SEE-8

	GDP (2008 USD)	GDP/capita	Population
Serbia	50,061	6,811	7.35
Albania	12,295	3,911	3.14
Croatia	69,332	15,637	4.43
B&H	18,512	4,906	3.77
Turkey	734,853	9,942	73.91
Macedonia	9,521	4,664	2.04
Montenegro	4,891	7,859	0.62
Kosovo	5,300	2,560	2.07

Source: World Bank and US Department of State

Constraints of the size of the digital dividend

6.72 Determining the size of the digital dividend for any country requires detailed analysis, which has not been undertaken in the case of Serbia nor for the South East European countries we consider here. We have assumed that Serbia will follow the EU agreement of allocating channels 61 – 69 as a digital dividend, and do so for the rest of the South East European countries as well. Additional spectrum may also be available to allocate to uses other than broadcasting (by using unused TV spectrum or interleaved spectrum) but this depends heavily on the evolution of broadcasting in each country and levels of agreement and harmonisation between them.

6.73 Of the factors that may influence the constraints that various countries may face in allocating the digital dividend, geographical location is important. Interference constraints would be less relevant for non-land locked countries like Albania, Bulgaria, Croatia and Montenegro. Whilst ARNS interference from Russia is not considered a direct constraint on Serbia, it may be a constraining factor for countries nearer to Russia, such as Bulgaria.

6.74 Location is also important in that proximity to EU Member States (or indeed, being in the EU like Bulgaria) may mean that there is encouragement to allocate the 800 MHz band of the digital dividend earlier than the 2015 benchmark set by the ITU, given the importance the Council of Ministers has placed on quick and harmonised spectrum allocation. As mentioned earlier, the potential value of the digital dividend increases the earlier it is allocated, and countries such as Croatia and Bulgaria may be able to reap some of these benefits. This will have to be balanced, of course, with the need to harmonise with non-EU neighbours who will be aiming for a 2015 allocation.

Factors influencing the value or allocation of the digital dividend

6.75 Using key indicators described above we have adjusted the values obtained for Serbia to provide approximate values for the rest of the SEE-8. Given the many other factors involved in valuing both broadcasting and mobile uses these figures must be viewed as purely indicative. Some considerations are discussed below.

Table 6.6 Estimated benefits generated by broadcasting services in terms of different amounts of the digital dividend assigned to other services

(NPV 2012 – 2027 in €million)

	Base	120 MHz to other services	80 MHz to other services	40 MHz to other services	Entire digital dividend to other services
Serbia	2,250	3,096	3,122	3,137	3,143
Albania	553	760	767	770	772
Croatia	3,116	4,288	4,324	4,345	4,353
B&H	832	1,145	1,154	1,160	1,162
Turkey	33,028	45,447	45,828	46,048	46,136
Macedonia	428	589	594	597	598
Montenegro	220	302	305	306	307
Kosovo	238	328	331	332	333
Total	**40,665**	**55,955**	**56,425**	**56,696**	**56,804**

Source: Europe Economics estimates

Table 6.7 Estimated benefits from assigning the digital dividend to mobile broadband

(NPV 2012 – 2027 in €million)

	40 MHz	60 MHz	80 MHz	100 MHz	120 MHz	140 MHz	160 MHz	180 MHz	200 MHz
Serbia	572	655	759	810	861	908	950	982	1,012
Albania	141	161	186	199	212	223	233	241	249
Croatia	792	907	1,051	1,121	1,193	1,258	1,315	1,361	1,402
B&H	212	242	281	299	318	336	351	363	374
Turkey	8,399	9,617	11,135	11,884	12,643	13,332	13,941	14,421	14,860
FYROM	109	125	144	154	164	173	181	187	193
Montenegro	56	64	74	79	84	89	93	96	99
Kosovo	61	69	80	86	91	96	101	104	107
Total	**10,341**	**11,841**	**13,710**	**14,632**	**15,566**	**16,415**	**17,165**	**17,755**	**18,296**

Source: Europe Economics estimates

6.76 One of the most significant factors influencing the potential value of the digital dividend is per capita GDP. This will affect the willingness to pay of consumers for both additional mobile and broadcasting services. The impact of per capita GDP is likely to be relatively higher on mobile services than on broadcasting, given that many national broadcasters that will be using digital terrestrial television provide free-to-air services; costs to consumers are likely to be limited to new television top boxes, as opposed to mobile customers who will be expected to pay ongoing fees for increased mobile services, as well as potentially for newer phone models.

6.77 Many countries in South East Europe have similar per capita GDP figures to Serbia (USD 6,811in 2008), with the exception of Albania and Bosnia & Herzegovina (43 per cent and 30 per cent lower respectively than Serbia's per capita GDP) and Croatia (110 per cent higher than Serbia's). The potential value of the digital dividend in Albania and Bosnia & Herzegovina is therefore likely to be lower than that estimated for Serbia (with a relatively lower value for allocation to mobile services as well), whilst the opposite would apply to Croatia.

6.78 Other factors influencing the demand for mobile services (such as mobile broadband) and thus the value of allocating digital dividend to these services include current mobile penetration rates, current fixed broadband penetration, and computer usage. Most countries in South East Europe have high mobile penetration rates, either higher than or slightly less than Serbia (at 128 per cent in 2008). This suggests that the take up of additional mobile services, and thus the value of the digital dividend allocated to these uses, will be similar across the South East European countries, with possibly Bosnia and Herzegovina (with a penetration rate of 82 per cent) with a slightly lower value.[50]

6.79 Whilst the demand for additional mobile services such as broadband is likely to stem mainly from consumers already using a mobile phone, other factors such as current fixed broadband penetration may also influence the take-up of mobile broadband among those consumers not currently in this market. Mobile broadband may provide a viable alternative to fixed broadband, particularly in rural areas and those difficult to reach via fixed technologies. It is thus possible that the demand for mobile broadband will be higher in countries with a lower fixed broadband penetration. Montenegro and Bosnia & Herzegovina have similar penetration rates to Serbia, but the demand for mobile broadband may be slightly lower in Bulgaria, Croatia and Macedonia which have fixed broadband penetration rates between three and six per cent higher than Serbia.[51]

6.80 The demand for digital terrestrial television will also influence the potential value of allocating the digital dividend to different uses. Whilst information relating to willingness to pay for television is not readily available for many South East European countries, we do know that Serbians watch above-average amounts of television and many pay for

[50] Although this does not take into account possible future increases in mobile penetration in this country.
[51] See Appendix 1 for more details.

television. This suggests that the value of allocating spectrum to broadcasting may be higher in Serbia than other countries.

6.81 Another factor influencing the value of allocating spectrum to mobile services is the level of infrastructural constraints. The Frontier report found evidence that in a number of South East European countries the key obstacle for further deployment of mobile broadband services is the time and costs to erect mobile sites, as well as administrative burdens in erecting mobile sites and taxes. Whilst this information is not available for all South East European countries, it appears that Serbia may have higher regulatory constraints on the development of mobile services than Croatia and Macedonia, and for this reason the value of allocating spectrum to mobile services in these countries may be higher than in Serbia.

6.82 In summary it is not possible to say with any certainty what the size and value of the digital dividend in the rest of South East Europe will be, but important points include the need for harmonisation in terms of allocating channels 61 – 69 as a digital dividend for mobile broadband, potential interference constraints from ARNS in Russia, and the effects of per capita GDP on the ability of consumers to pay for additional broadcasting and (in particular) mobile services.

7 CONCLUSIONS

7.1 In this report we have attempted to value the potential digital dividend that will become available to Serbia when analogue television signals are switched off in favour of digital transmission and freed spectrum becomes available. Possible uses include additional broadcasting or mobile services, in particular mobile broadband.

Key findings

7.2 Our key finding is that once the initial benefits associated with broadcasting are guaranteed there is little scope for increasing the value by assigning larger amounts of spectrum to it. Even the lowest allocation of spectrum to non-broadcasting gives a value to Serbia higher than if the entire digital dividend is assigned to broadcasting only. The total value to Serbia increases the more spectrum is allocated away from broadcasting.

7.3 Therefore, it is clear that a mixed approach to the allocation of the digital dividend spectrum is central to Serbia's ability to achieve greatest benefit from its digital dividend.

Available spectrum

7.4 On the assumption that Serbia uses the proposed harmonised channels (the 800MHz band), approximately 72 MHz will be available as a digital dividend for mobile broadband. More spectrum may be available for a mix of alternative uses if the number of multiplexes allocated to broadcasting is reduced.

7.5 If 72 MHz of spectrum is set aside for mobile broadband, at least five national multiplexes will still be available for broadcasting. This is equivalent to 20 HD programme services per zone, which is significantly greater than the current assumed broadcasting usage.

Value of Spectrum

7.6 We use two approaches in valuing the digital dividend, namely the "total welfare" approach and the "GDP impact" approach.

7.7 In terms of the total welfare approach, we estimate that, if the whole digital dividend were allocated to broadcasting, the digital dividend in Serbia would have a net present value over the period 2012 to 2027 of €3.1 billion. If spectrum is allocated to other uses (in this case mobile broadband), the net present value would increase (depending on the allocation) by between roughly €572 million and €1.01 billion. These figures represent an upper bound, but even the lower bound illustrates our key finding that the total value of the digital dividend increases the more 'mixed' the allocation is.

7.8 Both lower and upper bound values can be considered conservative given the likelihood that externalities to broadcasting would be lower in Serbia than in the benchmark country, and externalities to mobile broadband higher. On the other hand, the evaluations have assumed that spectrum amounts available for a mix of new applications in excess of 72 MHz (the 800 MHz band) are of the same value as this band, whereas in reality they are

likely to be of less value. There is also likely to be a cost in allocating the 800MHz band to mobile broadband, although this has not been definitively valued for any country. Furthermore, delays in allocating the digital dividend to mobile broadband are likely to reduce the value of the estimated digital dividend.

7.9 Estimating the full GDP impacts of allocating the digital dividend to different uses has not been possible given the significant number of unknowns. However, evidence from a number of relevant studies point to the advantages of mobile services over broadcasting in terms of GDP growth.

Considerations for Serbia

7.10 Harmonisation is an important issue for Serbia in a number of respects. First, and as we have assumed, it will be important for Serbia to harmonise with the rest of Europe on the allocation of channels 61-69 for a digital dividend. Second, harmonisation on the use of interleaved spectrum will be important should Serbia wish to make use of any additional spectrum over and above channels 61-69 as a digital dividend. Third, the need to harmonise with non-European neighbours, in particular Russia, may mean that Serbia will be unable to reap the benefits of allocating the digital dividend before 2015.

7.11 Our current estimates of the value of allocating the digital dividend to mobile and broadcasting assume that demand for both these services will be met. It is crucial that Serbia monitors the ability of the spectrum to be used by either broadcasters or mobile operators. We recommend that any spectrum not likely to be utilised should not be allocated, but reserved for future, possibly more valuable, uses. For this reason Serbia will need to strike a balance between having a relatively comprehensive allocation plan in order to provide stakeholders with sufficient certainty, and being flexible enough to alter the amounts allocated should insufficient demand exist.

The rest of South East Europe

7.12 Whilst it is not possible to say with any certainty what the size and value of the digital dividend in the rest of South East Europe will be, a number of important points emerge. The prime need is for harmonisation, as far as possible, with the rest of Europe in the allocation of channels 61-69 as a digital dividend. Potential interference constraints from ARNS in Russia may reduce the amount of spectrum that some countries are able to allocate as a digital dividend. Of final importance is the ability of consumers to pay for additional broadcasting and (in particular) mobile services, and this impact on the value of the potential digital dividend.

APPENDIX 1: ADDITIONAL INFORMATION

The Digital Dividend – an introduction

A1.1 The background to this study is that we received approaches from the GSM Association in 2009 and 2010, seeking a proposal to develop, in a way that would be useful to policy-makers in Serbia, work on spectrum policy that we had already completed for Ofcom in the UK (2006) and for ComReg in Ireland (2008). To do this we have researched basic factual information about Serbia and have applied the analytical techniques used in our earlier work in order to value the digital dividend that could arise in Serbia.

The digital dividend

A1.2 The digital dividend is defined as the benefit that becomes available when analogue broadcasting signals are switched off in favour of digital, and radio spectrum is thereby released. Because of its propagation characteristics, the spectrum released from television broadcasting is valuable for a variety of services, and the providers of such services may therefore find themselves competing for such spectrum as becomes available.

A1.3 Digital broadcasting has already begun in a number of jurisdictions; but in many it is taking place in parallel with the continuing transmission of analogue signals. The digital dividend arises only when all, or substantially all, analogue TV broadcasting has ceased in a given country and, where applicable, in neighbouring countries.

A1.4 It is for policy-makers – generally governments and regulators – to determine how much of the spectrum released should be made available, and when, and for what services. Thus, the digital dividend is not something of a fixed size. It can be used to expand and/or enhance established services such as television broadcasting and mobile telephony. But other services may also have legitimate claims upon released spectrum: for example, mobile broadband, mobile television, or "fixed wireless" services such as the provision of broadband to remote communities.

A1.5 Furthermore, the electronic communications sector is highly innovative: new applications and services will arise that are as yet unknown. National governments and regulators therefore have objectives to set and choices to make in the current *and future* application of the digital dividend.

A1.6 However, it is infeasible for individual nations to take decisions about spectrum allocation entirely in isolation from the decisions of other countries. It is important to avoid signal interference close to border areas – and in land-locked countries this can be an important issue. Likewise, if economies of scale are to be exploited in the manufacture of spectrum-using equipment such as television receivers and mobile phone handsets, it is highly desirable for individual countries to allocate spectrum in a way that is consistent with what other have done, i.e. via the process of harmonisation.

A1.7 A more detailed description of the technical and regulatory issues that arise appears in Appendix 1.

Demographic and geographic profile of Serbia

A1.8 The principal sources of information we have used are the Statistical Office of the Republic of Serbia, and publications by the Republic Telecommunications Agency of Serbia (RATEL), the Economist Intelligence Unit, Eurostat and the 2010 CIA World Factbooks.

A1.9 Serbia has a population (according to the 2002 census) of 7.49 million people, comparable to Bulgaria. The population is split nearly equally between urban and rural. In these respects it compares broadly with a number of what one might call middle-sized EU Member States, for example Portugal or Bulgaria.

A1.10 The labour force is estimated at 3.1 million, with an unemployment rate of 16.1 per cent – substantially higher than the EU27 average for 2009, which was 9.4 per cent.

A1.11 GDP in 2008 (at the official exchange rate against the euro) was €33.42 billion. Growth had been 5.5 per cent in 2008 but it fell to minus 3 per cent in 2009. GDP per capita in 2008 was €4,547, about 20 per cent of the EU27 average. In respect of GDP per capita, according to the IMF's projections for 2009, Serbia ranks no. 74 in the world.

A1.12 Serbia's land mass is just over 88,000 sq km, and its population density is 85 per sq km. Its terrain is extremely varied, and the largest part of the country is mountainous. In respect of size and topography, Serbia is comparable with Austria.

A1.13 Serbia borders Hungary to the north, Romania to the north-east, Bulgaria to the south-east, Kosovo, Macedonia and Albania to the south, Montenegro to the south-west, Bosnia & Herzegovina to the west and Croatia to the north-west. Specific spectrum-related problems arise for land-locked countries which have a relatively large number of surrounding jurisdictions.

Electronic communications

Market revenues

A1.14 For the most part, we have consulted for background information the Enlargement Countries Monitoring Report III; "Supply of services in monitoring regulatory and market developments for electronic communications and information society services in Enlargement Countries". This was published by Cullen International in March 2010, and we refer to it as "the Cullen Report".

A1.15 The Cullen Report sets out statistics highly relevant to this study for eight countries of south-east Europe – Serbia itself, and (in alphabetical order) Albania, Bosnia-Herzegovina (which we abbreviate in our tables to B&H), Croatia, Kosovo, the Former Yugoslav

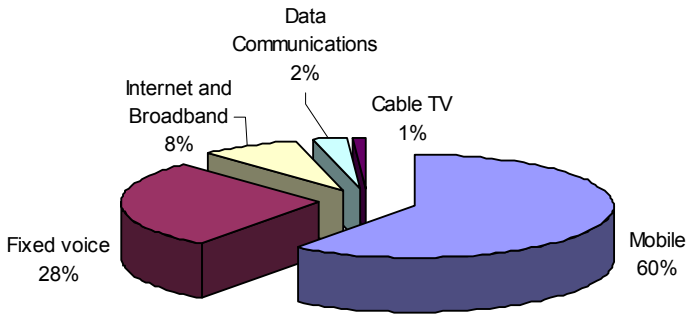
Republic of Macedonia (FYROM), Montenegro, and Turkey. These are later referred to as the south-east Europe eight (SEE-8).

A1.16 The total value of the electronic communications market (fixed telephony, internet services, mobile communications, data communications and cable TV) in these eight countries was estimated at €16.4 billion in 2008, an increase of 4 per cent from 2007, and about 2.8 percent of combined GDP. By way of context, the EU27 total for the electronic communications market in 2007 was almost €357 billion, or 2.9 per cent of GDP, and the sector grew by 1.3 per cent in real terms during 2008.[52]

A1.17 The fastest growing sectors in the eight monitored countries of the Cullen Report were internet services (fixed and mobile), with just over 40 per cent annual growth, and mobile communications with 10 per cent.

A1.18 In terms of revenue, mobile telephony (voice and text services) accounted for 60 per cent of the total revenue across all eight countries, and fixed-line telephony for 28 per cent. Internet services (fixed and mobile) accounted for only 8 per cent of total revenue (see Figure A1.1below).

Figure A1.1: Electronic Communications Market in 2008 in SEE-8, by sector

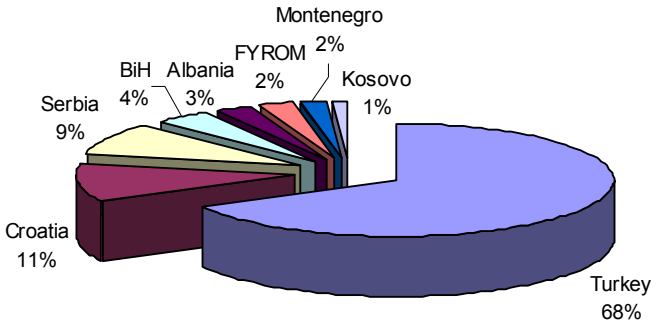


Source: Cullen International 2010

A1.19 The figures are of course dominated by the Turkish market (see Figure A1.2), though Serbia ranks high among the remainder.

[52] EIU 2008, Cullen Report 2009

Figure A1.2: SEE-8 – electronic communications market in 2008, by country



Source: Cullen International 2010

A1.20 Electronic communications as percentages of GDP reflect the different levels and patterns of spending, production and supply within the various economies (see Table A1.1). The average value for all the countries is 6.1 per cent, somewhat weighted by the lower Turkish value. Excluding Turkey gives an average of 6.6 per cent, significantly above the EU27 average of 2.9 per cent for the year 2007.

Table A1.1: Electronic communications as percentage of GDP

	Croatia	Macedonia	Turkey	Kosovo	Albania	B & H	Montenegro	**Serbia**	**EU27**
2004	4.65	7.66	3.48	9.76	6.04	9.01	11.56	**3.53**	**2.57**
2005	4.92	7.78	3.58	6.79	6.18	7.55	11.67	**4.53**	**2.62**
2006	4.97	7.10	2.10	5.02	6.03	6.02	10.17	**5.60**	**2.51**
2007	4.61	7.38	2.26	8.85	6.69	5.04	12.29	**4.70**	**2.90**
2008	4.59	6.26	2.37	10.20	5.67	5.32	9.58	**4.87**	

Source: Cullen International 2010 and RATEL

Fixed line telephony

Penetration Rate

A1.21 After Turkey, with 17.5 million, Serbia has the largest number of fixed lines, at over 3 million, followed by Croatia with 1.7 million, and Bosnia & Herzegovina at just over 1 million.

A1.22 The Cullen Report indicates that Serbian fixed line penetration has increased by 23 per cent between 2004 and 2009, from 34 lines per 100 population to 42 lines per population. However, BMI forecasts that the penetration rate will slow over the coming years, peaking

at 43 per cent in 2010 and remaining at this level beyond 2013.[53]

Competition

A1.23 Party or group lines remain a significant factor in Serbia. These lines serve two or more subscribers and are a potential barrier to more intensive use of broadband and to local loop unbundling, which in turn may inhibit competition in the market. Serbia has the highest level of party lines of the SEE-8 at 5.75 per cent, followed by Albania at 5.4 per cent.

A1.24 In Serbia, despite the official opening of telephony services to competition,[54] fixed voice telephony services have remained highly concentrated. This is illustrated by the fact that the incumbent operator's share in fixed telephony on 2009 was 99.87 per cent, both in terms of minutes used and revenues. Similarly high levels of concentration exist in the other SEE-8 countries with, for example, incumbents' market shares in terms of revenue being 95 per cent in Albania, 93 per cent in Montenegro and 90 per cent in Macedonia. However, it must be noted that Orion Telekom is shortly to begin providing fixed services via FWA in Serbia, with Telenor doing so in 2011, thus significantly increasing the potential for competition to develop in the Serbian market.

Revenues

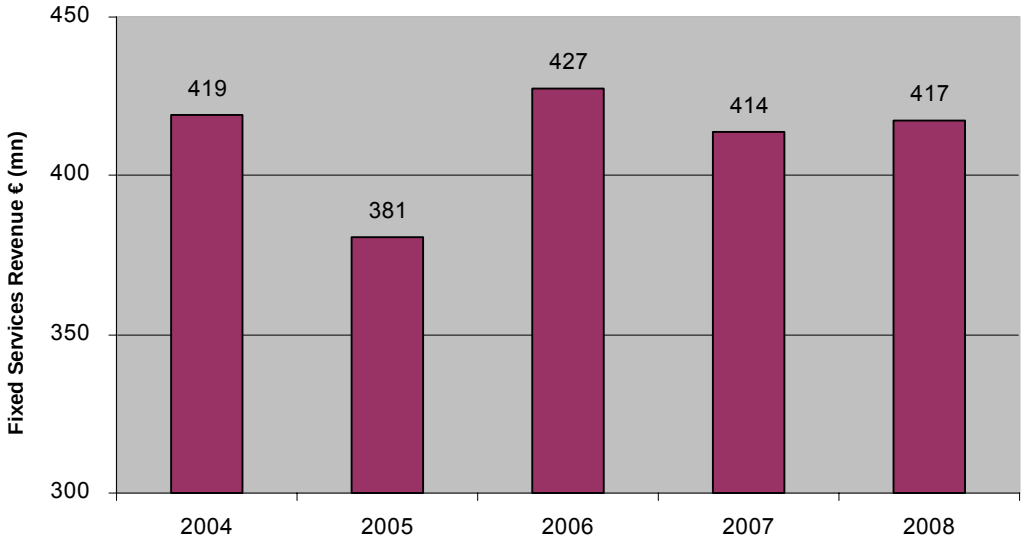
A1.25 As shown in Table A1.3 below, revenues in Serbia have remained fairly stable, at between RSD 30 and 36 billion (equivalent to €419 in 2004 and €427 million in 2006).[55]

[53] Business Monitor International, Serbia Telecommunications Report 2009

[54] Between December 22, 2008 and January 1, 2010 RATEL issued 31 authorisations for public telecommunications networks and 40 authorisations for voice transmission service over the Internet (without the right to use numbering resources). In June 2009 two FWA licences were issued to Telekom Srbija and Media Works. Media Works now provides public fixed telephony services based on wireless CDMA2000 technology in the 450 MHz band. In February 2010, the second licence for provision of public fixed telephony services over fixed telephone network was issued to Telenor.

[55] Yearly average exchange rates from O and A Historic Exchange Rates, http://www.oanda.com/currency/historical-rates

Figure A1.3: Revenue from fixed telephony services in Serbia (€m)



Source: RATEL 2008

A1.26 Approximately 60 per cent of these revenues come from traffic rather than from subscriptions (11 per cent), leased lines (6 per cent), or connection charges (3 per cent).

Mobile telephony

A1.27 Mobile telephony can be of great importance to spectrum usage in several respects. First, it uses spectrum directly and thus has a primary claim upon spectrum allocation. Secondly, as a technology it presents (in many important respects) an alternative to fixed line telephony, and is often subject to rapid take-up where the fixed line infrastructure gives rise to capacity or coverage difficulties (particularly for broadband). Thirdly, consumers' increasing familiarity with mobile telephony may well serve to condition their willingness to take up other forms of mobile communication, particularly use of the internet by mobile broadband.

Penetration Rate

A1.28 By the end of 2009 there were, across the SEE-8, slightly over 90 million users of mobile services. The average mobile penetration rate across the eight countries was 95 per cent.

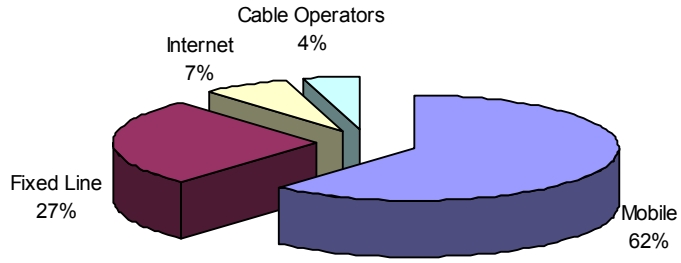
A1.29 In Serbia, mobile telephony substantially outstrips fixed line, in terms both of revenue and subscribers, as shown in Table A1.2 and Figure A1.4 below. RATEL reports that just over 60 per cent of all revenue from communications services in Serbia in 2008 was attributable to mobile subscriptions.

Table A1.2: Communications users in Serbia

	2006		2007		2008	
	'000 Subscribers	Penetration Rate (%)	'000 Subscribers	Penetration Rate (%)	'000 Subscribers	Penetration Rate (%)
Fixed	2,719	36.3	2,855	38.0	3,085	41.1
Mobile	6,643	88.6	8,453	112.7	9,619	128.3

Source: RATEL 2008

Figure A1.4: Telecoms Revenues Serbia 2008



Source: RATEL 2008

A1.30 Comparing Serbia with the rest of the SEE-8 shows that the mobile sector is one where competition has generally been allowed or encouraged, with most countries having three providers. The rise in mobile penetration rates has been rapid and sometimes dramatic. Serbia, Croatia and Montenegro now exceed the EU27 average, as Table A1.3 shows.[56]

Table A1.3: Mobile penetration (users per 100 population)

	Croatia	Mac.	Turkey	Albania	B&H	Mont.	Kosovo	**Serbia**	**SEE-8**	**EU27**
2004	64.0	49.0	48.9	38.6	34.2	77.9	16.0	**57.9**	**48.31**	
2005	82.1	62.4	61.1	48.0	42.3	87.6	18.0	**73.5**	**59.38**	
2006	99.0	70.1	72.2	61.0	48.6	103.0	29.5	**88.6**	**71.50**	
2007	113.4	96.2	89.0	73.2	63.8	168.7	54.0	**112.7**	**88.6**	**111.8**
2008	132.5	123.7	92.0	92.0	82.7	185.5	59.0	**115.0***	**98.1**	**119.0**
2009	140.9	92.0	89.0	110.0	81.5	226.4	70.0	**118.5**	**94.7**	

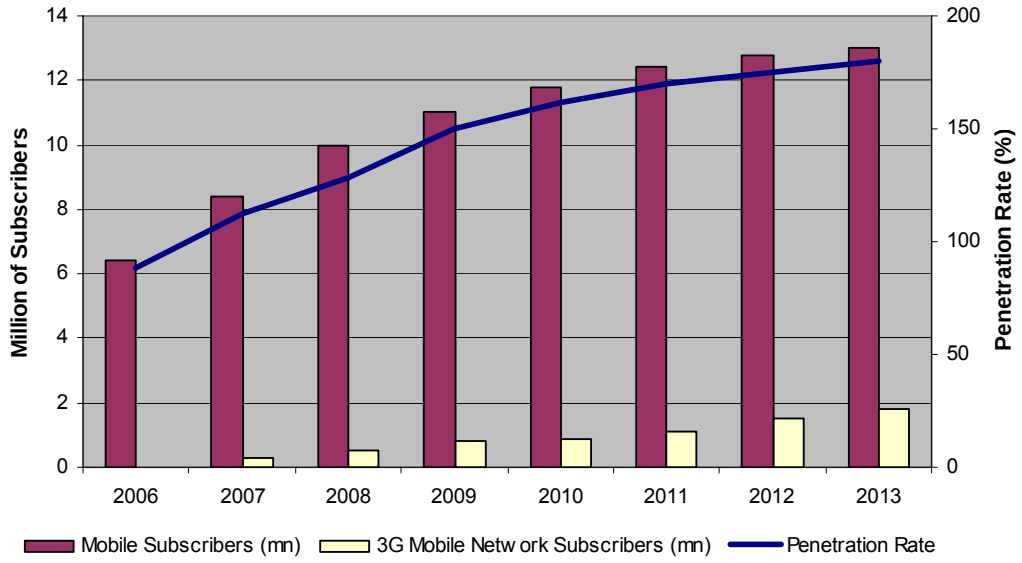
** Note: According to RATEL mobile penetration in Serbai in 2008 was 128 per cent. The difference between this and Cullen International is likely to be due to differences in measurement techniques. We have presented Cullen's figure for comparative purposes.*
Source: Cullen International 2010

[56] However, the headline figures need to be read with a little caution: there appears to be a significant number of "plastic roamers" (people with multiple SIM cards who switch to a local operator when moving between countries); other users have multiple domestic SIM cards in order to exploit particularly attractive tariffs or to ensure network coverage; and discrepancies also stem from different practices in defining "active" pre-paid customers.

A1.31 Although mobile penetration in Serbia is still growing, it continues to do so at a decreasing rate. This must stem partly from the high penetration rate already achieved, and the extent to which the market has moved closer to saturation.

A1.32 BMI's 2009 report estimates that mobile operations in Serbia will continue to grow rapidly (albeit also at a decreasing rate), with the forecast penetration rate exceeding 175 per cent, as shown in Figure A1.5. In making its estimate, BMI places emphasis on the fact that mobile operators have been licensed to offer 3G/UMTS services in the 2.1 GHz band, and it envisages a major expansion of the country's 3G sector over the next few years.

Figure A1.5: Projected mobile telecommunications penetration rate in Serbia



Source: Business Monitor International, Serbia Telecommunications Report 2009

A1.33 With the exception of Albania and Kosovo, mobile operators in the other SEE-8 countries have also been licensed to offer 3G/UMTS services in the 2.1 GHz band, so some "peer pressure" is foreseen.

Competition

A1.34 Although mobile telephony is the only communications sector in the SEE-8 where competition has emerged on any significant scale, most of the national mobile markets remain highly concentrated, with only Bosnia & Herzegovina and Montenegro coming close to an even distribution of market shares. While the entry of new operators is increasing competition and is reflected in the acceleration of mobile penetration, in general (for the eight countries) new entrants struggle to secure the higher-spending business customers.

A1.35 This can be seen clearly in Serbia, where in 2008 the incumbent, Telekom Srbija, still held

close to a 60 per cent mobile market share in respect of users as well as of revenues. In 2008 competitors Telenor and VIP had approximately 32 and 9 per cent of the market respectively.

Revenues

A1.36 Mobile operator revenues have increased dramatically in Serbia over the past few years, from €256 million in 2003 to €986 million in 2008, although growth has slowed somewhat since 2007.

Mobile retail tariffs

A1.37 Mobile retail tariffs matter in the context of the digital dividend because they condition consumers' willingness to consider using mobile networks, initially for calling but subsequently for other services too.

A1.38 Mobile network operators across the SEE-8 provide a range of tariff options that are difficult to compare. Consumers have to take into account the initial activation charge, monthly subscription charge, peak and off-peak tariffs, "free" calls and text messages included in the package, volume-dependent tariffs, SMS tariffs, tariffs for calls within the same network (on-net calls), tariffs for calls to other mobile networks (off-net), calls to fixed networks and, of course, subsidies for the handset.

A1.39 In order to be able to make comparisons between member countries, the OECD constructed a set of mobile tariff "baskets", used in comparisons between the SEE-8 and the EU27. The results show that Serbia, as well as most of the other SEE-8 countries, have offerings that are cheaper than the simple average of EU mobile operators. This suggests that willingness to pay in Serbia and other SEE-8 countries is lower than the EU27 average.

Internet

A1.40 In fixed-line internet access, the proportions of dial-up (narrowband) and broadband are highly varied across the SEE-8 countries.[57] Serbia has a higher ratio of broadband to dial-up connections (469,000 compared with 397,000). This is similar to Albania and Bosnia & Herzegovina, where, although broadband connections outstrip dial-up, there are still a significant number of the latter. This is different again from Macedonia and Turkey, both of which have very few dial-up connections.

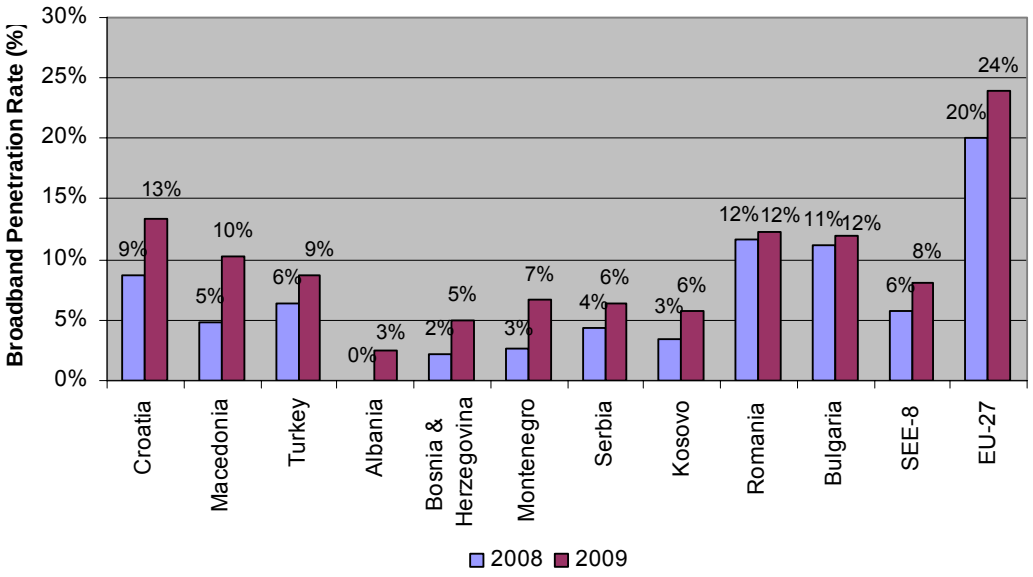
Penetration Rate

A1.41 The broadband penetration rate, measured as the overall number of broadband lines

[57] In line with EC practice, broadband capacity is defined as at least 144 Kbs

divided by the population, was 6 per cent in Serbia in 2009. This was just below the average for the SEE-8 countries of 8 per cent, which in turn was significantly below the EU27 average of 24 per cent (see Figure A1.6 below).

Figure A1.6: Broadband penetration rate, 2008 and 2009



Source: Cullen International 2010

A1.42 In Serbia, the number of internet users (dial-up, broadband and UMTS) has more than doubled in the past few years, from just over 700,000 subscribers in 2005 to 1.6 million subscribers in 2008.

A1.43 For Serbia a trend can be observed away from dial-up and towards broadband, of which particularly Universal Mobile Telecommunications System (UMTS), as illustrated in Table A1.4. The first mobile internet users were recorded by RATEL in 2008. More recent data from the 2009 Cullen Report for January 2009 are substantially similar to the RATEL numbers for 2008.

Table A1.4: Distribution of users by access technology in Serbia, 2005 – 2008

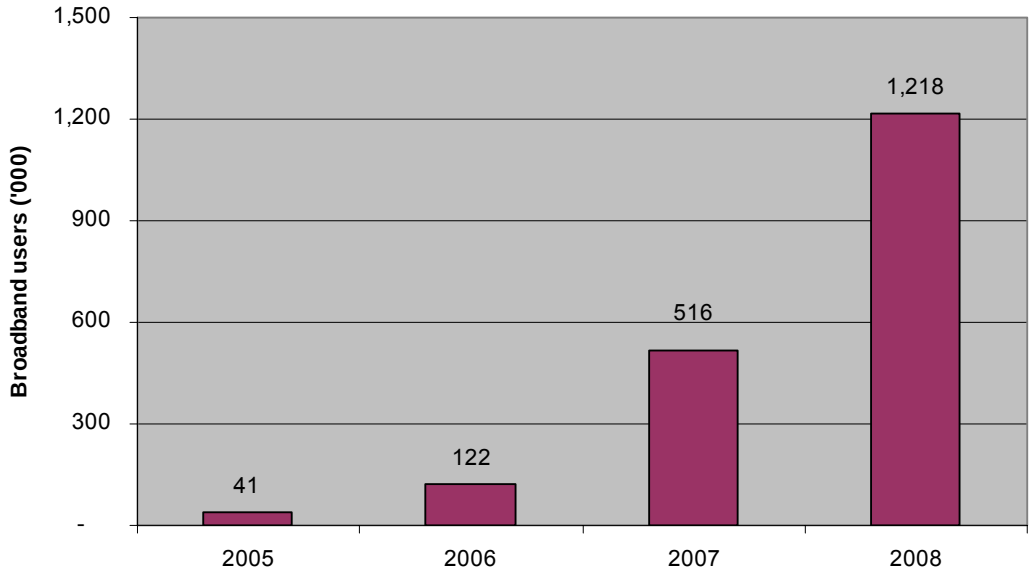
		Broadband					
	Dial-up	**ADSL**	**Cable**	**Wireless**	**Mobile internet**	**UMTS**	**Other**
2005	708,226	9,530	23,956	1,049	0	0	13,914
2006	882,611	26,126	54,598	21,968	0	9,687	10,210
2007	692,905	132,359	87,731	36,059	0	257,379	2,276
2008	397,202	267,876	151,154	48,130	25,489	738,401	1,135

Source: RATEL 2008

A1.44 The total number of broadband connections in Serbia in 2008 was over 490,000 (55 per cent of total internet connections), twice as many as in 2007.

A1.45 Similarly, the number of broadband users (ADSL, cable, wireless, mobile internet and UMTS) has increased markedly in the past few years, as Figure A1.7 shows.

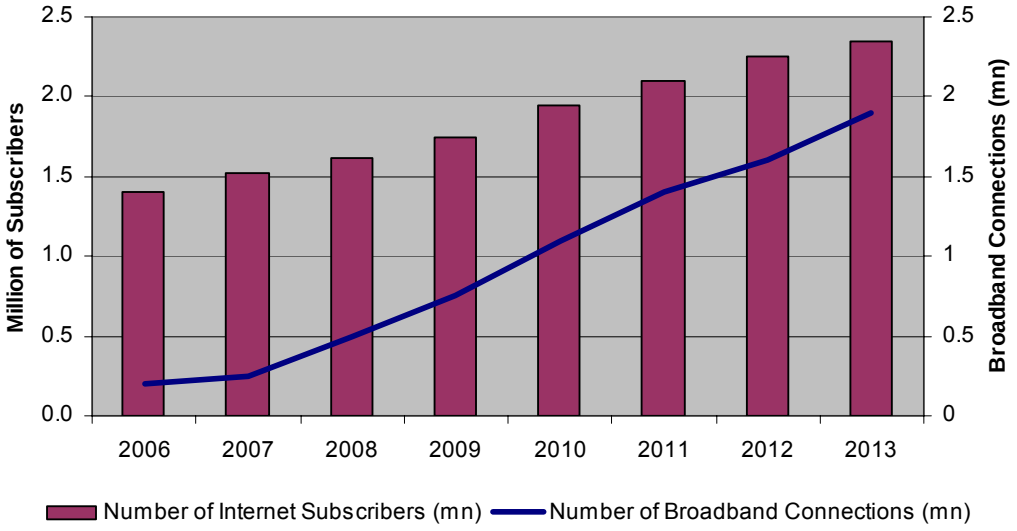
Figure A1.7: Broadband users in Serbia



Source: RATEL 2008

A1.46 The growth in internet subscribers as well as broadband connections is expected to continue over the coming years, as shown in Figure A1.8.

Figure A1.8: Projected internet subscribers and broadband connections in Serbia



Source: Business Monitor International, Serbia Telecommunications Report 2009

A1.47 In Serbia the proportion of urban households that have an internet connection is twice as great as for rural households, as Table A1.5 shows. However, both rural and urban populations have increased their access to the internet over the past few years.

Table A1.5: Percentage of Serbian households with internet connections, 2006 – 2008

	Urban Households	Rural Households
2006	23.0%	12.5%
2007	35.0%	13.7%
2008	41.0%	21.7%

Source: RATEL 2008

Technologies

A1.48 Fixed-line broadband retail markets are dominated by fixed incumbent operators in most of the SEE-8 countries, where xDSL is the main access technology. Exceptions are Serbia and Kosovo. In Serbia, competitors use mainly wholesale xDSL broadband access from the incumbent and cable infrastructure.

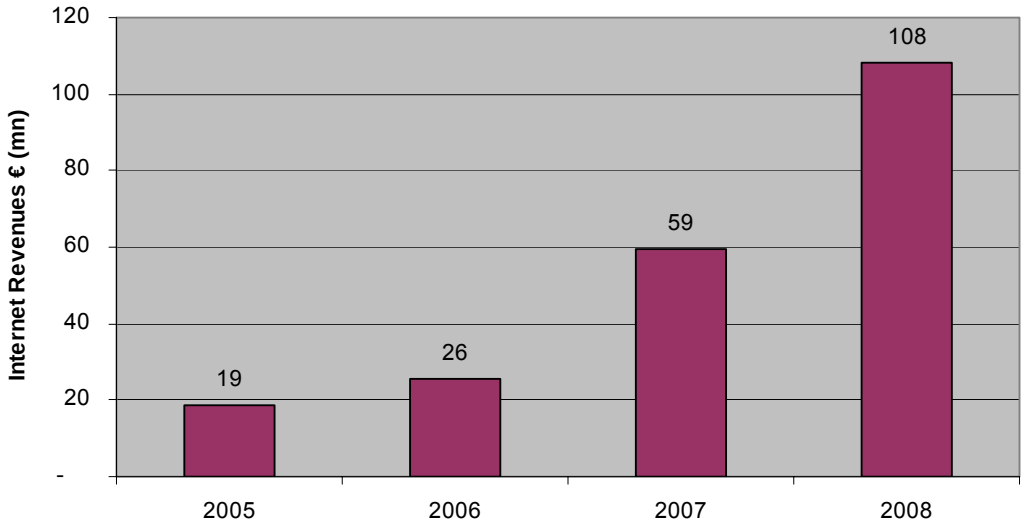
Competition

A1.49 Competition in the retail xDSL broadband market in Serbia is relatively well developed, although the incumbent still held over 60 per cent of the market in 2008. Furthermore, the incumbent supplies 100 per cent of the bitstream access connections to alternative operators in the wholesale market. Competition in the other SEE-8 countries is even less well developed.

Revenues

A1.50 Revenues from the internet have increased almost six-fold in the past four years in Serbia, from €19 million in 2005 to €108 million in 2008, as shown in Figure A1.9.

Figure A1.9: Internet revenues in Serbia (€m)



Source: RATEL 2008

Internet and broadband retail prices

A1.51 For dial-up, Serbia is the least expensive of the SEE-8 countries. For our purposes, however, broadband, and particularly mobile broadband, is more significant.

A1.52 Table A1.6 below compares the fixed-line broadband monthly subscription charges of the incumbents and alternative operators for speeds of 512 kbps, 1 Mbps and 2 Mbps (expressed in €/PPP, including VAT) with the EU-27 median offerings from the preceding year. In Serbia the charges levied by both the incumbent and the alternative providers for 1Mbps and 2Mbps are lower than the EU27 average.

Table A1.6: Broadband monthly charges by incumbents and alternative operators 2009 (€/PPP incl. VAT)

Country	Speed	Incumbent	Alternative Operator
Croatia	512 kbps	-	-
	1 Mbps	-	-
	2 Mbps	10.98	5.28
Macedonia	512 kbps	9.63	9.45
	1 Mbps	22.30	35.69
	2 Mbps	-	-
Turkey	512 kbps	-	-
	1 Mbps	25.62	25.62
	2 Mbps	29.34	29.34
Albania	512 kbps	22.29	25.00
	1 Mbps	44.58	34.99
	2 Mbps	66.88	23.94
Bosnia & Herzegovina	512 kbps	14.96 – 17.35	14.96
	1 Mbps	10.17 – 11.37	-
	2 Mbps	26.92 – 41.87	26.92
Montenegro	512 kbps	-	15.00
	1 Mbps	20.00	30.00
	2 Mbps	-	38.00
Serbia	**512 kbps**	**-**	**-**
	1 Mbps	**26.30**	**15.83**
	2 Mbps	**22.69**	**23.95**
Kosovo	512 kbps	15.13	-
	1 Mbps	10.08	14.96
	2 Mbps	45.39	19.95
EU27*	**512 kbps**	**30.28**	
	1 Mbps	**28.19**	
	2 Mbps	**30.95**	

*Source: Cullen International 2010; *Data from previous year (2007)*

Market access

A1.53 Conditions for market access conditions bear upon the digital dividend to the extent that they offer competition among network and service providers and choice to business and retail consumers.

A1.54 Under the Telecommunications Law of 2003, the fixed incumbent operator in Serbia was granted an exclusive right, valid to June 2005, to provide all types of fixed telecommunications services, with the exception of those internet and cable TV services that were already open to competition. Yet five years after that cut-off date, Telekom

Srbija still remains, in practice, the only licensed public fixed voice telephony operator. It also maintained a *de facto* monopoly over international interconnection until December 2008, when alternative operators were issued international interconnection licences. Orion Telekom is to shortly begin providing fixed services via FWA, and Telenor will begin providing these services in 2011.

A1.55 Data networks and services are now open to competition in all SEE-8 countries.

A1.56 The EU 2003 regulatory framework establishes a general authorisation regime for the provision of electronic communications networks and services. Thus undertakings may only be required to notify the intention to begin the provision of services, and to submit only such information as is required to allow the National Regulatory Authority (NRA) to keep a register of providers. So far, only five of the SEE-8 countries have implemented a general authorisation regime.

A1.57 Serbia has an authorisation regime that seems to us somewhat complex, combining different categories of individual and class licences (authorisations). This regime also envisages complex public tender procedures for some of the most important licensing categories, including the provision of public fixed voice telephony networks and services. The recent Law on Electronic Communications has stipulated the liberalisation of the fixed network market from 2012.

Analysis of relevant markets by NRAs

A1.58 The implementation of competitive safeguards is still at an early stage and depends very much on the capacity and expertise of individual NRAs.

A1.59 In Serbia, the NRA has identified and analysed two broad markets that do not reflect either the EU 1998 or 2003 frameworks. As a result, Telekom Srbija was designated as having significant market power (SMP) in the market for public fixed telephone networks and services, and SBB, the major cable TV operator, as having SMP in the market for radio and television programme distribution via cable networks.

A1.60 In 2008 the Serbian NRA adopted a decision identifying six markets relevant for *ex ante* regulation: fixed telephony, mobile telephony, leased lines, interconnection, internet services and the provision of cable distribution systems. The new market analysis was expected to be started by RATEL in the third quarter of 2009 but we are unsure whether the analysis was either started or completed.

National roaming, mobile access and call origination

A1.61 In five of the SEE-8 countries including Serbia, the new entrant mobile operators have reached commercial agreements on national roaming with the established mobile operators.

Broadcasting

The current position

A1.62 Serbia's *Broadcasting Development Strategy to 2013* (Official Gazette of Republic of Serbia, No 115/05) allows up to 5 television broadcasters with national coverage, up to 40 regional television broadcasters, and up to 160 local television broadcasters. In fact, Serbia now has a total of 8 national broadcasters: Radio Television of Serbia (RTS), which broadcasts RTS1 and RTS2, plus privately-owned networks Pink, B92, Fox Serbia, Avala, Košava and Happy TV – these last two sharing the same frequency.

A1.63 In addition, each region in Serbia has its own broadcasters. For example, the northern province of Vojvodina has Radio Television of Vojvodina, which broadcasts RTV1 and RTV2 throughout Vojvodina and which, via cable television, can be viewed throughout Serbia (as indeed is the case with other regional-only broadcasters).

A1.64 Finally, and in addition to national and regional broadcasters, there are 148 local television stations which can be watched only in certain towns and cities.

A1.65 According AGB Nielsen Research in 2009, Serbia on average watches 5 hours of television per day, making it the highest average in Europe. The most-watched channels are said to be RTS1, with 26 per cent of viewing hours, followed by Pink, with just under 24 per cent. No other channel exceeded 8 per cent.

Cable and satellite TV

A1.66 Out of 2.5 million television households, it is estimated that around 30 percent have some form of multi-channel television access, mostly analogue cable television.[58]

A1.67 RATEL's report indicates that television broadcasting via cable and satellite reaches 922,000 subscribers, a very substantial increase from 540,000 in 2005, and equivalent to just over 12 per cent of the population (or 37 per cent of households). The revenues of cable operators in particular have shown a significant increase – a more than three-fold rise in revenue from 1.8 million dinars in 2005 to 5.6 million in 2008. Serbia has a relatively high percentage of cable television viewing. Cable operators generally offer not only Serbian channels but also foreign television programming, mostly from Western Europe.

A1.68 The supply of free-to-air television services is monopolised by RTS; while the supply of cable and satellite (cabsat) broadcasting, though theoretically competitive, remains highly concentrated too. RATEL's 2008 publication already referred to identifies SBB (a subsidiary of RTS) as holding 54 per cent of the cabsat market, five smaller players

[58] Usage of ITC in Republic of Serbia - Republički zavod za statistiku Srbije, 2007

having market shares of between 3 per cent and 11 per cent, and an "others" category accounting for 13 per cent. Thus the CR3 ratio is 73, the CR5 ratio 84,[59] and (if we count "others", with their 13 per cent, as one player) an HHI value of 3344 – far above the level of about 1850 that competition authorities regard as concentrated.[60]

A1.69 For the sake of brevity we do not here explore radio broadcasting because the small amounts of spectrum required by radio have no material effect on the digital dividend. RATEL reports, however, in its consultation document already referred to, that unlicensed radio stations are a problem in Serbia, and that the switchover to digital should deal with them.

Potential issues for the take up of digital TV

A1.70 There are a number of issues that may negatively influence the take up of digital terrestrial television in Serbia. According to a Serbian report written in 2008[61] about the opportunities for digital TV in Serbia, terrestrial programme offerings (which are dominated by the public-service broadcaster RTS) in Serbia are considered to be of a low quality level, including mainly domestic reruns and foreign acquisitions. At the time of the report, although RTS had launched two digital terrestrial transmitters, no programmes had been produced for digital platforms, and it is thought likely that the situation in analogue terrestrial broadcasting will most likely be repeated in the digital sphere with little (at present) improvement in the quantity or quality of programmes.

A1.71 In addition, there is some criticism of the Serbian Broadcasting Development Strategy and its allocation of broadcasting licences. The Serbian advertising market, worth around €130 million, is considered to be insufficient to support such a large number of broadcasters, and according to some opinions the Broadcasting Development Strategy did not take into account the level of development and economic sustainability of the broadcasting market when licensing issues were discussed.

A1.72 Cable and satellite providers appear to offer significantly more choice than RTS. For example, SBB, the largest cable and broadband operator in Serbia, delivers a portfolio of around 200 free-to-air TV channels, along with high-speed cable internet and analogue Pay TV. As from April 2006, SBB also offered satellite digital DTH (direct to home) service. Cable operators offer domestic (national and regional) TV channels along with international channels such as Discovery, CNN, BBC, National Geographic, MTV, HBO, Eurosport, etc. "Neighbour channels" are also offered, for example, Croatian HRT or Bosnian OBN. Certain domestic channels are available exclusively through cable (Auto

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59 The terms CR3 and CR5 refer to "concentration ratios", here the combined market share of the top 3 or top 5 players respectively.

60 The term HHI refers to the Hirshchmann-Herfindahl Index, a different measure of concentration in which the index value ("the HHI value") is the sum of the squares of the market shares of all the competitors. A market which had two players of 25 per cent each and five players of 10 per cent each would yield an HHI value of 1750, calculated as $25^2 + 25^2 + 5(10^2)$.

61 Mirjana Milošević & Tanja Petrović (2008) "The Late Beginning of Digital Television in Serbia" in Sükösd Miklós and Adla Isanović (eds.) *Public Service Television in the Digital Age: Strategies and Opportunities in Five South- East European Countries*. Mediacentar Sarajevo, 2008

Plus, Stankom, Sport Klub, Spectrum, Kopernikus, KTV Zrenjanin, Kanal D, etc.).[62]

A1.73 Given the wide range of programme offerings by cable and satellite providers, and the slow development of digital terrestrial television, it is questionable as to whether allocating large amounts of spectrum to digital terrestrial broadcasting will significantly improve the quantity and quality of DTT, or entice new (and old) television consumers away from cable and satellite providers.

Revenue and employment in the spectrum-using sector

A1.74 As we have reported, total revenues from Serbian telecom services amount to €1.61bn, equivalent to 4.87 per cent of GDP.

A1.75 Employment figures are also substantial. According to a Deloitte study[63], in 2007 there were close to 34,000 people employed in the communications sector, as shown in Table A1.7.

Table A1.7: Employment in the mobile and fixed telecommunications sector, 2006 and 2007

	2006	2007
Mobile network operators	2,680	2,860
Fixed telecommunications operators	620	630
Network equipment suppliers	175	180
Network support suppliers	780	785
Handset importers	200	270
Other suppliers of capital items	115	115
Suppliers of non-network support services	930	960
Airtime/ SIM sellers and mobile phone sellers	18,500	20,750
Multiplier	6,400	7,110
Total domestic employment	**30,400**	**33,660**

Source: Deloitte analysis based on data provided by key industry players in interviews, analysis of company accounts and industry reports, and data provided by Telenor.

A1.76 Deloitte caution that they regard their figures as conservative (especially as a guide to the future) since the market is undergoing change. For example, new retail chains are opening in urban and rural areas. They estimate that there were over 20,000 non-mobile-specific points of sale for mobile airtime in Serbia in 2007, including small groceries,

62 Mirjana Milošević & Tanja Petrović (2008) "The Late Beginning of Digital Television in Serbia" in Sükösd Miklós and Adla Isanović (eds.) *Public Service Television in the Digital Age: Strategies and Opportunities in Five South- East European Countries*. Mediacentar Sarajevo, 2008

63 Deloitte, Economic Impact of Mobile Communications in Serbia, Ukraine, Malaysia, Thailand, Bangladesh and Pakistan, January 2008.

kiosks, tobacconists, petrol stations, banks and post offices. In addition, top-up services are available from those locations where Nokia e-load terminals are present.[64] In addition to non-mobile-specific points of sale, Deloitte estimated that in September 2007 120 mobile dedicated retail shops existed, and the MNOs have begun to develop their own retail shops.

[64] Deloitte's employment figures do not include all employees working within each point of sale, but include only the full time equivalents (FTEs) attributable to mobile services.

APPENDIX 2: TECHNICAL AND REGULATORY ISSUES

Technical issues

A2.1 We begin with a short explanation of what frequencies are currently in use in public broadcasting.

A2.2 Very high frequency (VHF) is the radio frequency range from 30 MHz to 300 MHz. Common uses for VHF are radio and television broadcasting, but other important uses include mobile stations (emergency, business, and military), amateur radio, marine communications, air traffic control communications and air navigation systems.

A2.3 The next higher frequencies are known as Ultra High Frequency (UHF), and run from 300 MHz to 3,000 MHz (3 GHz). UHF too is commonly used for the transmission of television signals. Modern mobile phones also use the UHF spectrum, as do public service agencies for two-way radio communication. Until recently there has traditionally been very little radio broadcasting in this band but digital audio broadcasting (DAB) is now present there. Finally, the Global Positioning System (GPS) also uses UHF.

A2.4 The VHF and UHF television broadcast spectrum is divided into Bands. Bands I, III, IV and V (particularly IV and V) are of relevance to this study, and they cover the following frequencies:

Band I	47-68 MHz
Band III	174-230 MHz
Band IV	470-582 MHz
Band V	582-862 MHz in Europe, 582-962 MHz in the Americas

A2.5 The frequencies to be released when analogue television broadcasting ceases lie mainly, though not only, between 470 MHz and 862 MHz, i.e. Band IV and Band V.[65] Propagation characteristics at these frequencies make them ideal for many applications requiring mobility and wide area coverage. As a consequence, spectrum released in this bracket – the digital dividend – has the potential to be the key enabler not only of future broadcasting services but also of future broadband and multimedia mobile services.

A2.6 Following the cessation of analogue television broadcasting, spectrum in Bands III, IV and V can be used for several different kinds of services, including:

- standard definition (SD) television broadcasting in digital terrestrial format;

[65] Ireland also uses Band III (174 – 230 MHz) for analogue television broadcasting

- high definition (HD) television in digital terrestrial format;
- wireless broadband for reception at fixed locations;
- mobile television;
- mobile telephony;
- mobile broadband;
- enhanced public safety applications.

A2.7 Other applications may be contemplated too. These may involve digital sound broadcasting, low-power transmissions not requiring a licence66, military systems or as an innovation reserve for testing new spectrum-using applications.

A2.8 The release and reassignment of frequencies is a complex task. Because of differences in starting positions the issues are not exactly the same for every EU Member State, nor indeed for countries beyond the EU. Determining the most valuable uses of the spectrum (economically or socially or both) and devising the best way of awarding licences to use the spectrum are significant challenges in themselves. This is particularly so since future broadband and multimedia mobile services, although widely seen as important to the future of national economies and of the world economy, are technically dynamic and difficult to forecast.

The international regulatory framework

The International Telecommunications Union

A2.9 At the highest level, the use of radio spectrum is managed by the International Telecommunications Union (ITU), a United Nations specialized agency whose raison d'être is to promote international cooperation in communications and to define a framework covering the rights and obligations of nations in relation to spectrum.67

A2.10 A basic ITU principle is that countries should generally have freedom in how they use spectrum, but must not interfere with legitimate uses in other countries.

A2.11 In relation to analogue television, a fully coordinated spectrum plan was agreed for Europe at an ITU conference held in Stockholm as far back as 1961. The Stockholm Regional Agreement covered the use of VHF Bands I and III, and UHF Bands IV and V.

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66 In this document we use the UK spelling convention, i.e. "licence" for the noun and "license" for the verb. The only exceptions are where we quote directly from a US document, where "license" is used for both.

67 The origins of the ITU go back to 1865. It became a specialised agency of the UN in 1947, and is now based in Geneva. It currently embraces 191 member states.

A2.12 The ITU holds a World Radio Communication Conference every three or four years in order to review, and if necessary amend, the Radiocommunications Regulations. The conference held in Geneva in 2006 (the Regional Radiocommunication Conference, RRC-06) agreed a plan, sometimes referred to as "Geneva 06" or "GE06", allowing for the transition from analogue to digital broadcasting in Europe and other regions.

A2.13 The ITU's World Radiocommunications Conference of 2007 (WRC-07) considered spectrum allocations for new wireless services and particularly the future of International Mobile Telecommunications (IMT). The outcome of the conference included a co-primary allocation for mobile services with broadcasting services in the 790-862 MHz spectrum (channels 61-69) in Region 1, which includes Europe.[68] The WRC-07 allocation comes into effect on 17 June 2015.

The European Union

A2.14 Within the prescriptions of RRC-06 and WRC-07 the European Union has established its own policy making structure and policies.

Structural arrangements

A2.15 Under the Radio Spectrum Decision of 2002[69] the European Parliament and Council adopted a framework for radio spectrum policy in the European Union. The principal aims of the Decision were:

> "to establish a policy and legal framework in the Community in order to ensure the coordination of policy approaches and, where appropriate, harmonised conditions with regard to the availability and efficient use of the radio spectrum necessary for the establishment and functioning of the internal market" (Article 1.1)
>
> "to facilitate policy making with regard to the strategic planning and harmonisation of the use of radio spectrum in the Community taking into consideration inter alia economic, safety, health, public interest, freedom of expression, cultural, scientific, social and technical aspects of Community policies as well as the various interests of radio spectrum user communities with the aim of optimising the use of radio spectrum and of avoiding harmful interference;" (Article 2 (a))

A2.16 Also under this Decision the Radio Spectrum Committee (RSC) was formed to "assist the Commission in the adoption of technical implementing measures in support of Community policies".

A2.17 The Radio Spectrum Policy Group (RSPG) was set up at the same time to gather "high-level governmental experts from member States and to help the Commission in

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[68] The other areas included are Africa, the Middle East west of the Persian Gulf, Iraq, the former Soviet Union and Mongolia.

[69] http://ec.europa.eu/information_society/policy/radio_spectrum/docs/policy_outline/decision_6762002/en.pdf

developing general radio spectrum policy at Community level".[70]

A2.18 The RSPG and RSC work in parallel. The members of RSPG are representatives of the Member States and of the Commission. Representatives of the European Economic Area countries, the European Parliament, the European Conference of Postal and Telecommunications Administrations (CEPT) and the European Telecommunications Standardisation Institute (ETSI) attend as observers.

A2.19 The RSPG is required to consult extensively and to publish Opinions based on its work. Its opinions are intended to provide high-level strategic advice to the RSC and European Commission on radio spectrum policy issues. The RSC in turn, under the chairmanship of the Commission, develops technical implementation matters, i.e. legislative instruments including Commission Decisions and Recommendations.

A2.20 Member States are legally bound to implement Commission Decisions at national level, and the Commission regularly requests detailed information on implementation from Member States.

The Council's current thinking

A2.21 Most recently, the EU Council of Ministers has underlined that Member States:[71]

- need to make best use of the digital dividend, taking into account social, cultural and economic benefits, while considering also the different national circumstances;
- should take digital dividend as an opportunity to extend broadcasting, both terrestrial and non-terrestrial, and to encourage new communications services such as wireless broadband communications and mobile multimedia;
- should have the right to determine the amount of spectrum to be used for general interest objectives;
- should coordinate spectrum usage in the EU in order to enhance efficient use and avoid cross-border signal interference;
- should allocate parts of the UHF spectrum for (non-mandatory) use by uni-directional and bi-directional networks in order to achieve more efficient spectrum use;
- should coordinate spectrum usage in the EU to provide benefits of economies of

[70] See http://ec.europa.eu/information_society/policy/radio_spectrum/activities/index_en.htm for references to RSC and RSPG.
[71] "Reaping the full benefits of the Digital Dividend in Europe: A common approach to the use of the spectrum released by the digital switchover" – Council of Ministers, 12 June 2008

scale;

- should ensure flexibility of usage with the exception of services of general interest;
- should consider differences in national plans and digital switchover across other Member States when coordinating the usage of the spectrum;
- should release the digital dividend as quickly as possible once digital switch-over (DSO) has occurred.

The Commission's current thinking

A2.22 The Commission sees the digital dividend as a unique opportunity for Member States to meet growing demand for wireless services, to allow broadcasters to develop and expand their services, and to address social and economic problems – for example, the so-called "digital divide" (the adverse effects that arise when some groups in society do not have reasonable access to modern communications services).

A2.23 The Commission focuses on the possibilities of releasing spectrum in a harmonised way by promoting the clustering of services. In this way, the Commission believes, the greatest economic value from DSO may be achieved, on the grounds that European businesses should be able to benefit from opportunities to develop goods and services for a single market rather than for separate national markets.

A2.24 If harmonisation is one plank of the Commission's thinking on the digital dividend, the other is that spectrum should be distributed in a manner that is technology- and service-neutral. The Commission is quite ambitious as to how much spectrum should be released for non-broadcasting services. On June 12th 2008 the DG Information Society Commissioner, Ms Viviane Reding, proposed by 2010 that half the digital dividend should be allocated to new mobile and wireless services:

> "Let us agree to allocate by 2010, 50 per cent of this digital dividend to new mobile and wireless services. This would allow us to turn the dream of 'broadband for all Europeans' into reality, while at the same time allowing enough space for commercial and public broadcasters to develop and offer new and more modern TV services."

A2.25 However, although CEPT is examining conditions under which the upper part of Band V could be harmonised for non-broadcasting services, there appears to be little consensus within Member States, and several appear unlikely to implement any such harmonisation if it is proposed.[72]

A2.26 The Commission's push towards harmonisation is especially noticeable in a recently

[72] See "Breakthrough on mobile services in Digital Dividend", Policy Tracker, 20 June 2008, www.policytracker.com

published invitation to tender to consulting firms entitled "Exploiting the digital dividend, a European Approach".[73] The study is to:

> "assist the Commission in identifying and assessing the options and possible scenarios to achieve the required EU coordination of the digital dividend as outlined in the Commission Communication COM(2007) 799 on 'Reaping the full benefits of the digital dividend in Europe: A common approach to the use of the spectrum released by the digital switchover'."

A2.27 Two of the tasks in the study are to assist in:

> "identifying and assessing external constraints affecting the process of a coordinated usage of the dividend in Europe" [and] "developing the main options and scenarios for the EU coordinated approach".

The legal and regulatory framework in Serbia

A2.28 The legal and regulatory framework within which DSO will take place in Serbia is based on the following principal pieces of legislation:

(a) **Law on Telecommunications** ("Official Gazette of the Republic of Serbia", No. 44/03,36/06)

- The Telecommunications Law adopted in April 2003 defines the legal and institutional framework for the telecommunications sector, including the responsibilities of the government, the relevant ministry and the national regulatory authority.

  In December 2008 the Ministry for Telecommunications and Information Society initiated work on drafting a new Law on Electronic Communications that is intended to harmonise Serbian law with the EU 2003 regulatory framework for electronic communications. This Law was subsequently adopted by the government on 28 May 2010, and ratification by Parliametn is expected shortly.

(b) **Broadcasting Law** ("Official Gazette of the Republic of Serbia", No. 42/02, 97/04, 76/05, 79/05, 62/06, 85/06, 86/06)

- The Broadcasting Law places great emphasis on the protection of freedom of speech and pluralism.

- Technically, it covers procedures for the grant of broadcasting licences, the efficient use of spectrum, and the importance of adhering to technological

[73] http://ec.europa.eu/information_society/policy/ecomm/library/calls_tenders/index_en.htm

standards.

(c) **Law on Public Information** ("Official Gazette of the Republic of Serbia", No. 43/03, 61/05)

- The Public Information Law "regulates the right to public information [and] the right to free expression of thoughts, as well as the rights and obligations of the participants in the public information process". It seems to us to reinforce rights articulated by the Broadcasting Law in ways which will, admittedly as a side effect, reinforce the value of the digital dividend.

A2.29 Of great importance also are the following strategy documents:

(d) **Strategy for the Development of Telecommunications** in the Republic of Serbia, from 2006 to 2010

(e) **Strategy for the Development of the Broadcasting Sector** in the Republic of Serbia by the year 2013

(f) **Strategy for the Development of Broadband Access** in the Republic of Serbia until Year 2012

(g) **The Strategy for Electronic Communication development** in the Republic of Serbia for the period 2010 – 2014 is in preparation.

A2.30 There are, furthermore, a number of relevant international documents, listed on pages 10 and 11 of the consultation document, that indicate how Serbia is planning to fit into the wider DSO framework. These are largely EU-originated, but also include the RRC-06 Plan referred to in Section 3 of the main report.

A2.31 Serbia has a number of regulatory priorities for the DSO strategy, including procedures for selecting network operators and multiplex operators for digital broadcasting; procedures for issuing licences for programme content; broadcasting fees; consumer protection; promotion of digital television functions that assist the elderly and disabled; and the allotment and usage of the digital dividend.

APPENDIX 3: PRINCIPAL DATA SOURCES USED

Republic of Serbia (2009) *Strategy for Switchover from Analogue to Digital Broadcasting of Radio and Television Programmes in the Republic of Serbia*, July 2009.

Republic of Serbia (2009) *Strategy for the Development of Broadband Access in the Republic of Serbia until Year 2012*

GSMA response to the consultation.

Enlargement Countries Monitoring Report III; *Supply of services in monitoring regulatory and market developments for electronic communications and information society services in Enlargement Countries*, Cullen International March 2010

Enlargement Countries Monitoring Report II; *Supply of services in monitoring regulatory and market developments for electronic communications and information society services in Enlargement Countries*, Cullen International June 2009

Serbia Telecommunications Report 2010, Business Monitor International (BMI).

Statistical Office of the Republic of Serbia

Republic of Serbia Telecommunications Agency (RATEL)

Economist Intelligence Unit

2010 CIA World Factbook for Serbia

Analogue Switch-off, Digital dividend and TV services, Gilles FONTAINE & Sophie GIRIEUD IDATE, Montpellier

Digital Dividend : Central and Eastern Europe – presentation to ITU Seminar, Roberto Ercole, Director of Spectrum Regulation, GSM Association, April 2009

The Mobile Provide: Economic Impacts of Alternative Uses of the Digital Dividend, SCF Associates, September 2007

Getting the Most Out of the Digital Dividend, Spectrum Value Partners, 2008.

Etude sur la valorisation du dividende numérique, Analysys Mason, 2008

The impact of broadband in Eastern and Southeast Europe, Frontier 2010, a report for Telekom Austria Group

Creative industries in Serbia - basic facts and recommendations, Svetlana Jovičić and Hristina Mikić, British Council, Belgrade, 2006 in *Potentials for creative-led development in Serbia,* Mikic, H, Economic policy and development of Serbia, Faculty of Economics, 2007, pp. 129-141.

Economic Impact of Mobile Communications in Serbia, Ukraine, Malaysia, Thailand, Bangladesh and Pakistan, Deloitte 2008, a report prepared for Telenor ASA