THE ECONOMIC IMPACT OF RADIO

A Study Produced by
The Radiocommunications Agency

February 2001

Table of Contents

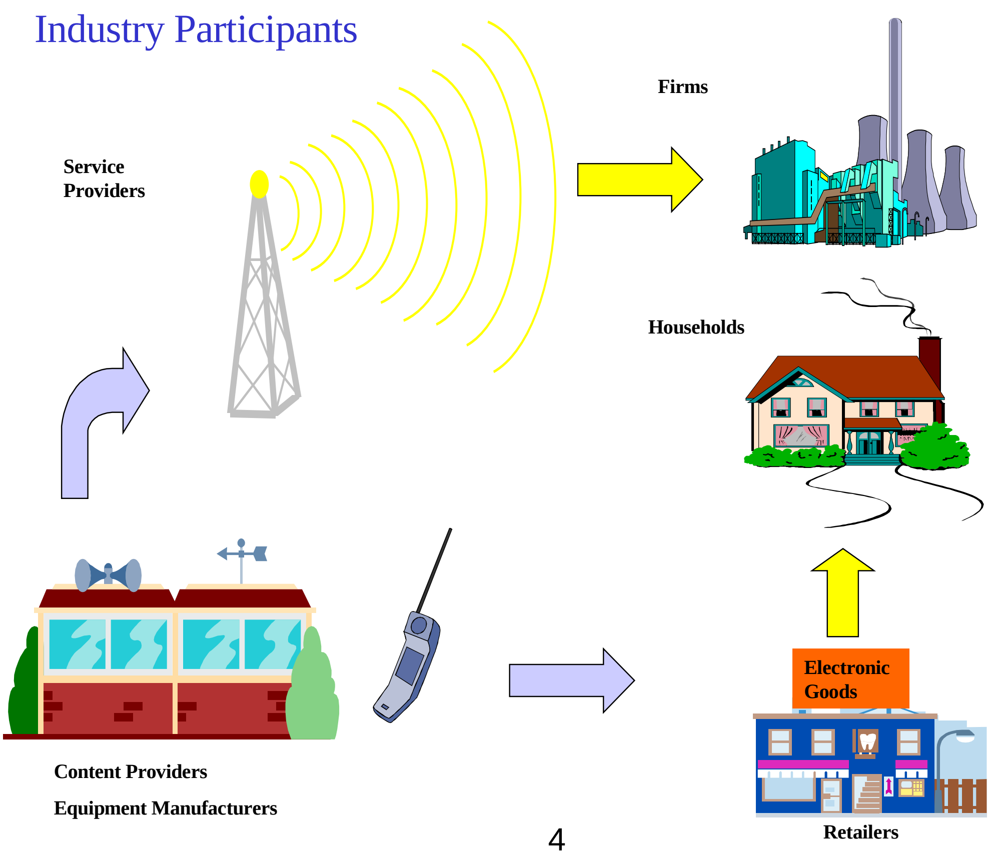
1. Introduction

1 Increasing demand for radio spectrum makes it important for the RA to understand the current uses of radio and its benefits. The RA is therefore committed to evaluating the contribution of the radio industry to the UK economy at regular intervals. The purpose of this study is to describe the latest such estimate. The current study indicates an estimated benefit of the radio industry of about £20 billion in 2000.

2 The radio industry is defined to be those firms that make use of the radio spectrum to supply a radio service as well as the equipment manufacturers and service companies who supply them. For illustrative purposes take the case of cellular telephony. Firms might include the following (as also represented in Diagram 1):

- operators providing cellular radio services;
- owners of antenna sites
- software and service companies providing content, text messaging and other capabilities for the cellular mobile system;
- radio transmitter and receiver equipment manufacturers supplying infrastructure to the cellular operators;
- handset manufacturers supplying mobile users with receiving and transmitting equipment
- retailers who sell handsets.

Diagram 1: Illustration of the Structure of the Radio Industry.



3 As shown in Diagram 1 there are two types of consumers who benefit from the services of the radio industry. Consumers include:

- individuals, such as private mobile phone users, TV viewers, amateur and CB radio operators;
- firms who use radio to further their (non-radio) business, including commercial mobile phone users and private mobile radio users.

Thus the term "consumer" can refer either to individuals or to firms.

4 The approach used in this study is to calculate the total benefit to the Radio Industry producers and their consumers.[1] Producers accrue benefits (producer surplus) if the price they receive for the good or service they produce exceeds the cost of supplying it, including a charge for what their productive plant and equipment would earn as a return in its next best alternative use. Producer surplus is calculated using data up to 1998, and then scaled up to reflect inflation and expected growth of about 3.5% per annum. (The method is outlined in more detail in Annex A.)

5 Consumers accrue benefits (consumer surplus) from the Radio Industry if the price they are willing to pay for a good or service exceeds the price they actually paid. Estimates of consumer surplus are based in all cases except fixed and satellite links on a stated preference survey. (A description of the surveys is contained in Annexes B through C and F through J.) In the case of fixed and satellite links estimates of consumer surplus are made on the basis of calculated cost savings. (The method is described in Annexes D and E.)

6 Table 1 presents the results of the RA's evaluation of the economic value of the Radio Industry to the UK economy in 2000. The results are partial since they exclude a number of important applications of radio; namely,

- Commercial Aviation,
- Ministry of Defence and other government use of radio
- Consumer benefits of some licence exempt services, e.g. Low Power Devices, PMR 446.

As shown by the table, the total economic value of the remaining sectors of the Radio Industry is in excess of £20 billion at 2000 prices.

7 Considering only the sectors for which estimates are available, Table 1.1 shows that the two sectors which contribute most benefit to the UK economy are public mobile and broadcasting. Together they account for 76% of estimated benefits. However it should be pointed out that the aggregation process does not define distinct, non-overlapping divisions between sectors. This means that benefits could have been attributed to several sectors. For instance, satellite television is included in the broadcasting sector but could also have been **included in the satellite links sector. Similarly fixed links**

---

[1] Taxpayers also benefit. However the amount they receive is a transfer payment and there is no net benefit to the economy.

are widely used by cellular mobile operators and their value could have been attributed to either sector of the radio industry.

Table 1.1: Estimated Net Economic Benefit to the UK Economy, Selected Sectors of the Radio Industry, 2000 (£ billion)

Sector	**Value**	**Percentage**
Of which		
Total Radio Industry*	20.3	100
Public Mobile	8.2	40
Broadcasting	7.4	36
Satellite Links	1.8	9
Fixed Links	1.6	8
Private Mobile Radio	1.1	5
Other**	0.2	1

Note: * Totals may not agree due to rounding.
** Other is defined to include amateur , citizens' band, aviation, maritime and other equipment and services (defined in Section 11).
Source: RA Estimates

2. Public Mobile

8 The size of the public mobile sector has grown substantially in recent years, most notably in the cellular mobile area. At the time when estimates of consumer benefits were made for this study the number of cellular mobile subscribers had grown to about 33.5 million. However cellular mobile is but one component of the sector; the sector as a whole includes:

- Cellular Mobile;
- Paging;
- Data Network;
- Public Access Mobile Radio (PAMR)
- Content Providers;
- Retailers for the above;
- Equipment manufacturers and retailers.

9 The results of the current study indicate that public mobile generates about £8.2 billion in total benefits, as shown in Table 2.1. As can be seen most of the value is attributed to consumer benefits, 88%, while producer benefits account for the remaining 12%. However the results include only benefits for cellular mobile and business paging uses. This estimate is based on a sample of 550 UK cellular mobile users.

Table 2.1: Estimated Net Economic Benefits to the UK Economy of Public Mobile, 2000 (£ billion)

Sub-Sector	Value	Percentage
Total Benefits	8.2	100
Of which		
Consumer Benefits	7.2	88
Producer Benefits	1.0	12

10 Second Generation GSM mobile phones generated licence fees totalling about £30 million. In relative terms this is much less than the benefits generated by consumers and producers and as a consequence of rounding to one decimal place has not been included in Table 2.1. (For 3G licence revenue see below.)

Producer Benefits

11 The producer surplus results are calculated using published company accounts. (A detailed description of the method used to calculate the results is specified in Annex A.) As shown by Table 2.2 cellular mobile generated the greatest proportion of producer benefits, almost 80%. This sum includes benefits to equipment manufacturers, which amounts to about £260 million.

Public Access Mobile Radio and Paging were the two next most significant sub-divisions, accounting for 12% and 5% respectively.

Table 2.2: Estimated Net Producer Benefits of Public Mobile, 2000 (£ million)

Sub-Sector	Value	Percentage
Total	991	100
Of which		
Cellular Mobile	773	78
Public Access Mobile Radio	119	12
Paging	51	5
Data Network	21	2
Content Providers	23	2
Retailers	4	0

Consumer Benefits

Consumer Surplus to Cellular Mobile and Pager Users Survey

12 Estimates of consumer benefits for cellular mobile and paging services are made using the results of stated preference surveys of consumer surplus. This technique of survey consists of offering the person being interviewed a number of choices between services. Such an approach is designed to eliminate bias that might result if people were simply asked how much they were prepared to pay for a service or product. In the case of cellular mobiles Hague Consulting and Accent Marketing conducted a total of 550 interviews. With respect to pagers market researchers made over 3,500 calls but due to small number of users only managed to conduct 20 interviews (see below for more details). No attempt was made to conduct a survey for data services or PAMR. Table 2.3a presents consumer surplus results for cellular mobile and business paging. This shows total benefits of over £7 billion for cellular and about £20 million for paging. The results with respect to paging should be interpreted with caution, however, due to the small sample size of the stated preference survey.

Table 2.3a: Estimated Net Consumer Benefits of Public Mobile, 2000 (£ billion)

Sub-Sector	Value	Percentage
Total Benefits	7.2	100
Cellular Services	7.2	100
Paging Services	0.02	0

Cellular Mobile

13 The RA has derived population estimates based on survey data obtained by Hague Consulting Group and Accent Marketing and Research. They undertook a pilot survey of 50 cellular users and then conducted a main survey of 300 residential and 200 business users. Subsequently Hague and Accent discounted a number of outlying observations to obtain a final sample of 275. (See Annex B for a description of the marketing study.) The survey indicates that the consumer surplus per user is:

£14.90 per month per private individual
£42.22 per month per business user.

14 Table 2.3b shows the derivation of consumer benefits attributable to cellular mobile phones. Column (a) shows classes of companies by number of employees. Column (b) shows the number of firms in each class, based on DTI figures, and column (c) the percentage of companies subscribing to cellular mobiles. Column (e) contains Oftel data on the number of cellular phones per company (except for companies employing more than 500 people, which is an RA estimate). All these data are used to calculate in column (f) the total number of cellular mobiles subscribed to by each business class. Column (g) contains the annualised consumer surplus figures collected by Hague and Accent, while column (h) contains the estimate of total consumer benefits, calculated as the product of the average number of phones per class and the annual benefits per phone.

15 Table 2.3c shows the derivation of estimates of consumer benefits to private cellular mobile users. In this case total benefits equal the number of subscribers times the annual average benefits per subscriber.

Table 2.3b: Derivation of Consumer Benefits to Cellular Mobile Business Users, 2000 (£ million)

Employees	**Companies (millions)**	**Percentage of Companies who Subscribe**	**Number of Companies who Subscriber (million)**	**Average Number of Cellular Telephones Per Company**	**Total Cellular Telephone Users (million)**	**Annual Consumer Benefits per Subscriber (£)**	**Total Consumer Benefits (£ million)**
(a)	(b)	(c)	(d)=(b)*(c)	(e)	(f)=(d)*(e)	(g)	(h)=(f)*(g)
1	1.26	63	0.79	1	0.79	507	401
2-10	0.88	63	0.55	2	1.10	507	558

11-25	0.18	63	0.11	3	0.33	507	167
26-50	0.13	63	0.08	5	0.42	507	213
51-100	0.02	63	0.01	13	0.12	507	61
101-200	0.03	63	0.02	17	0.32	507	162
201-500	0.01	93	0.01	29	0.22	507	112
500-	0.01	100	0.01	50	0.18	507	91
Total*	2.51		1.58		3.48		1,765

Note*: Totals may not add up due to rounding.

Table 2.3c: Derivation of Consumer Benefits, Cellular Mobile Private Users, 2000 (£ million)

Number of Subscribers (millions)	Annual Consumer Benefits per Subscriber (£)	Total Consumer Benefits (£ million)
(b)	(g)	(h)=(b)*(g)
30.1	179	5,388

Paging

16 The market researchers made 3,225 calls to business pager users and 1,299 calls to private users. The researchers found among businesses that about 3% used pagers, a further 3% had stopped using pagers and that 94% were not current or past users. Among private consumers about 1.5% used pagers, 1.4% owned a pager but did not use it, 2.8% had owned a pager but did not use it and about 92% had never owned a pager. Because of the low number of private paging users RA decided to focus research on business users.

17 The methodology for estimating consumer benefits accruing to users of business pagers is similar to that for estimating benefits to business users of cellular mobile telephones. A summary of the calculations is presented in Table 2.3d. However information about paging was not available from OFTEL, and hence the RA was required to assume that:
the percentage of companies using pagers is constant across employment bands;
the average number of pagers used by each company by employment band is the same as that for cellular telephone use.

Table 2.3d: Derivation of Consumer Benefits by Business Pager Users, 2000

(£ million)

Employees	Companies (millions)	Percentage of Companies who Subscribe	Number of Companies who Subscriber (millions)	Average Number of Pagers Per Company	Total Pager Users (million)	Annual Consumer Benefits per Subscriber (£)	Total Consumer Benefits (£ million)
(a)	(b)	(c)	(d)=(b)*(c)	(e)	(f)=(d)*(e)	(g)	(h)=(f)*(g)
1	1.26	3.1	0.039	1	0.039	134	5.2
2-10	0.88	3.1	0.027	2	0.054	134	7.2
11-25	0.18	3.1	0.006	3	0.018	134	2.4
26-50	0.13	3.1	0.004	5	0.020	134	2.7
51-100	0.02	3.1	0.001	13	0.013	134	1.7
101-200	0.03	3.1	0.001	17	0.017	134	2.3
201-500	0.01	3.1	0.000	29	0.010	134	1.3
500-	0.01	3.1	0.000	50	0.010	134	1.3
Total*	2.51						24.1

Note*: Totals may not add up due to rounding.

Licence Fees

18 The above analysis of consumer and producer surplus does not include a provision for licence fees. As discussed above licence fees are a transfer payment to the Government. Since we include fees as a benefit (and hence add them back) their inclusion or exclusion makes no difference to the *total* value of benefits; what is a cost to one party is a benefit to another.

19 The producer surplus calculations above were made on the basis of 1998 financial data. These data do not include the cost of acquiring 3G licences. If we were to take the present value of the £22.5 billion licence fees paid at auction in equal annual amounts over the twenty year licence period this would amount to £1.8 billion each year, assuming a 6% interest rate. Taking account of this fee the value of producer surplus would decrease by £1.8 billion and benefits to taxpayers increase by £1.8 billion.

20 In addition to the 3G licence fees there are licence fees totalling about £30 million which the RA received during 2000.

3. Broadcasting

21 The broadcasting sector includes many different sub-sectors along the supply chain. These include:

- Transmission companies;
- Terrestrial and satellite television broadcasters and schedulers;
- Radio broadcasters;
- Programme makers, including television advertisers;
- Television and radio receiver equipment manufacturers;
- Programme making equipment manufacturers;
- Television and radio receiver retailers.

22 On the basis of the preceding definition the current estimated value of total benefits from broadcasting exceed £7 billion, which accounts for about 40% of the total calculated benefits of the radio industry as a whole. Nearly three quarters of this value is derived from consumer benefits and just over one quarter from producer benefits. However producer benefits do not include the BBC since it is not a private company. When BBC costs are subtracted from TV licence fees that are used to fund the BBC the result is a small estimated surplus of £400 million. Table 3.1 presents the results.

Table 3.1: Estimated Net Total Economic Benefit to the UK economy of Broadcasting, 2000 (£ billion)

Sub-Sector	Value	Percentage
Total	7.4	100
Of which		
Consumer Benefits	5.1	69
Producer Benefits	1.9	26
Licence Fees	0.4	5

Producer Benefits

23 Table 3.2 shows a breakdown of producer benefits from broadcasting by sub-sector. Television broadcasters, schedulers and transmission companies are grouped together. This group includes both terrestrial and satellite broadcasters but excludes cable TV providers. Radio broadcasting includes the 205 national and restricted radio stations but excludes BBC radio stations which are not commercial firms. The programme makers and advertisers category includes those who make the programme content and TV advertisements. Benefits accruing to advertising companies from TV advertisements, is estimated to be 30% of the benefits to advertising companies. This is based on the value of TV advertising revenue as a proportion of total advertising revenue as shown in the *Advertising Statistics Yearbook 2000*.

Table 3.2: Estimated Net Producer Benefits of Broadcasting, 2000 (£ million)

Sub-Sector	Value	Percentage
Total	1,874	100
Of which		
TV broadcasting, scheduling & transmission	262	14
Radio broadcasting	303	16
Programme making & advertising	1,192	64
Equipment manufacturing	118	6
Retailing	-1	0

Consumer Benefits

Survey to Determine the Consumers Surplus accruing TV Viewers and Radio Listeners

24 The RA has calculated consumer benefits to satellite and terrestrial TV viewers and radio listeners using surveys designed and carried out by MVA of behalf of the Agency. In the case of television the survey was of the stated preference type in which respondents are asked to choose from a range services and willingness to pay is calculated from the choices made by viewers. However it was not possible to design a stated preference survey for radio, and so MVA carried out a radio survey in which listeners were simply asked how much they were willing to pay for radio services. In all they interviewed over 500 people, including 206 terrestrial TV viewers, 209 satellite TV viewers and 105 radio listeners. (See Annex C for the text of the survey report.) The benefits from television amounted to 75% of the total and benefits to radio listeners for the remainder. Table 3.3a presents the overall results.

Table 3.3a Estimated Net Consumer Benefits of Broadcasting, 2000 (£ billion)

Type	Value	Percentage
Total*	5.1	100
Of which		
TV	3.8	75
Radio	1.4	27

Note: *Totals may not add up due to rounding.

Television

25 MVA derived estimates of monthly consumer willingness to pay for TV per adult. It was found that there were on average two adults and about 0.7 children per household. Calculation of total consumers benefits were based on the assumption that on average two people per household would be able to pay. (It was therefore assumed that children would not be able to pay, and therefore did not contribute to the economic benefit of television.) RA then deducted the cost of a television licence, as well as subscription charges to satellite and digital viewers, for each household to determine the net benefits to viewers.

26 The derivation of net viewer benefits is shown in Table 3.2b. Column (a) shows the average annual willingness to pay per person, taken from the MVA survey results. Column (a) is multiplied by the average number of people per household who are willing to pay for TV, shown in column (c), to derive the total benefits per household. From this number the sum of the average licence fee and subscription charges per household, shown in column (f), is then subtracted to determine the average net consumer benefits per household, shown in column (g). Finally, total consumer benefits for all households is found by multiplying the number of TV households, shown in column (b), by net consumer benefits in column (g). The result is shown for four categories of viewers; namely,

- Analogue terrestrial viewers,
- Digital terrestrial viewers,
- Infrequent satellite television viewers (called “light” users in the MVA report),
- Frequent satellite viewers (called “heavy” users in the MVA report).

Table 3.2b: Derivation of Estimated Consumer Benefits from Television, 2000 (£ million)

	Annual Average Willing-ness to Pay (£/ person)	*TV House-holds* (millions)	Average Number of Persons per House-hold	Annual Cost of Servic e (£/Hou se-hold)	Annual Licence Fee (£/House-hold)	Total Annual TV Expens e (£/Hous e-hold)	Net Annual Consum er Benefits (£/House -hold)	Total Consumer Benefits (£ millions)
	(a)	(b)	(c)	(d)	(e)	(f)=(d) + (e)	(g)=(a)* (c)-(f)	(i)=(g)* (b)
Terrestrial								
Analogue	125	16	2	0	104	104	146	2,336
Digital	194	0.7	2	108	104	212	176	123
Satellite								
Frequent	311	2.3	2	146	104	250	372	856
Infrequent	195	2.3	2	71	104	175	215	495
Total								3,810

Radio

27 A similar calculation for the total benefits of radio is presented in table 3.2c. In this case, since there is no licence for radio, there is no cost of receiving the service. The total net consumer benefits are estimated to be £1.4 billion. It was mentioned above that it was not possible to devise a stated preference questionnaire to estimate willingness to pay, and consequently MVA used a simpler form of survey. Since the reason for using a stated preference survey is to reduce the possibility of bias from using the simpler form of survey it is possible that the estimated total benefits of radio are underestimated.

Table 3.2c: Radio Population Data and Calculations, 2000 (£ million)

Annual Average Willingness to Pay (£/person)	*Radio Households* (millions)	Average Number of Persons per Household	Total Annual Consumer Benefits (£/Household)	Total Consumer Benefits (£ millions)
(a)	(b)	(c)	(d)=(a)*(c)	(e)=(d)*(b)
28	25	2	56	1,400

Licence Fees

28 Based on the current annual licence fee for colour televisions of £104 this amounts to approximately £2.2 billion in licence revenue from terrestrial and satellite television viewers. However television licence fees are used to fund the cost of the BBC. These costs are estimated to be approximately £1.8 billion[2] in respect of non-cable households who receive their television services via radio signals. Subtracting BBC costs from licence revenue implies net licence fee revenue of £0.4 billion.

4. Satellite Links

29 The Agency classifies satellite links according to the type of Earth station that are used for the up-link. Three types of Earth stations are usually distinguished; namely,

- Permanent Earth stations

[2] BBC 1998/99 Annual Report

- Transportable Earth stations
- Networks for Very Small Aperture Terminals (VSAT).

The Agency licences only Earth stations and networks of VSATS, not individual VSATS.

30 Calculation of consumer benefits is limited to VSATS and excludes benefits from the use of permanent or temporary Earth stations. This is principally because of the difficulty the Agency found in calculating plausible values. It has been suggested, for example, that some satellite links are used because they can provide a service quickly, although they are more costly than other means of communications. At the moment the Agency has no means of calculating the value of this flexibility. However the effects of limiting consumer benefits to VSATS may itself be limited; for some permanent and temporary Earth stations are operated for the benefit of companies in the radio industry. For example broadcasting companies use permanent and transportable Earth stations. These benefits would have to be excluded in order to avoid double counting.

31 Now VSAT operators can either provide a service to help their own business or sell a service to a third party on a commercial basis. To the extent that operators use Earth stations to provide a commercial service the resultant benefits to them are included in the producer surplus calculations. Benefits to their customers, or benefits to operators who use satellite links for their own benefit, are included under consumer surplus. Estimates of producer and consumer benefits are shown in Table 4.1 below.

Table 4.1: Estimated Net Benefits of Satellite Links, Excluding Benefits to Other Radio Sectors, 2000 (£ million)

Type	Value	Percentage
Total	1,798	100
Of which		
Producer Benefits	6	0
Consumer Benefits	1,788	100
Licence fees	4	0

Producer Benefits

32 However there is a potential to double count the benefits of satellite and other radio services. For example, many operators of transportable Earth stations supply newsgathering services for broadcasters. In such cases the producer benefits of these companies are included in the calculation of benefits to the broadcasting sector. As a result the benefits accruing from the

provision of satellite services, as shown in Table 4.1 above, are low and do not represent the full worth of satellite services.

33 A second reason why the estimate of producer benefits is low is that benefits are *net benefits* to all producers. The figure includes company losses as well as profits.

Consumer Surplus

34 As shown in Table 4.1 consumer benefits are much larger than net producer benefits. The estimate of consumer benefits is not based on a survey of consumers since the response rate to a survey in this area was too small to give meaningful results. Rather, the method for deriving consumer benefits is based on a calculation of cost savings from the use of satellite links. This is a measure of the willingness to pay for satellite services. The method is described more fully in Annex D.

Licence Revenue

35 Licence revenues in satellite links amount to about £3.7 million per annum. This amount is a cost to operators and has been deducted from producer surplus; but it is a benefit to taxpayers, and so it is included in Table 4.1. However the costs and benefits cancel each other and there is no net effect of the licence fee on overall welfare.

5. Fixed Links

36 Like satellite links, some fixed links are used for the benefit of the operator's business, e.g. back-haul by telecommunications companies, while others are leased to third parties. Where fixed links are used to help the operator run their business the benefits are measured by consumer surplus. Similarly benefits accruing to those customers who lease fixed links, such as a company that uses fixed links to provide communications between its offices and factories, are also measured by consumer surplus. Only the benefits to the company leasing fixed links on a commercial basis to another company would be measured by producer surplus. In practice this means that the benefits of fixed links accrue in very large measure to consumers. The results shown in Table 5.1 below therefore relate only to consumer benefits and to licence fees and do not include producer benefits.

Table 5.1: Estimated Consumer Benefits of Fixed Links, 2000 (£ billion)

Type	Value
Total	1.63
Of which	
Consumer Benefits	1.62
Licence Fees	0.01

Consumer Benefits

37 The response rate to a stated preference survey among fixed link users was too low to produce meaningful results. Estimates of consumer benefits are therefore based on calculations of the cost savings from using fixed links as compared with land lines. This leads to an estimated value of just over £1.5 billion. The method of calculating benefits is shown in Annex E.

Licence Fees

38 The RA expects to receive in 2000 licence fees in the region of £14 million. This is based on fees between £225 and £3,075 per link.

6. Private Mobile Radio

39 Large firms, small companies and public organisations use Private Mobile Radio to help them in their day to day business. There is a relatively small group of "dealers" who help to service this community of users; but the principal beneficiaries are the users. The largest benefits therefore accrue in the form of consumer benefits. These are estimated in Table 6.1 below. Producer benefits are included under "consultants" and other categories in the chapter on "other" beneficiaries.

Consumer Benefits

Survey to determine Consumers' Surplus accruing to PMR and CBS radio operators

40 MVA carried out a stated preference survey on behalf of the Agency to determine the consumer benefits from PMR. The firm obtained a response from 150 users. While not large this number of responses is sufficient to give some indication of benefits. The report of the MVA survey is attached as Annex F.

41 The derivation of total consumer benefits of about £1.0 billion at 2000 prices is shown in the table below. The results of Table 6.1 are disaggregated by user type. For each type of user the average annual consumer benefit per user, estimated in the MVA survey, is multiplied by the number of licences for the corresponding type and the average number of users per licence type to give total consumer benefits.

Table 6.1: Estimated Net Consumer Benefits of Private Mobile Radio, 2000 (£ million)

Licence Type	Average Annual Consumer Benefits	Total Licences	Average Users/ Licence	Total Consumer Benefits
	(£)			(£ million)
	(a)	(b)	(c)	(d)=(a)*(b)*(c)
Total				1,041
Of which				
Police and Fire	411	119	2,965	145
National & Regional	411	59	2,965	72
Wide Area	1,143	15,230	32	557
UK General	1,143	3,785	32	138
On Site	121	25,319	28	86
On site paging	121	10,558	28	36
Local				

Communications	121*	2,029	28	7

Note*: Based on a licence fee of £80.

Licence Fees

42 Licence fees amount to about £10 million for PMR users. Since these fees have been deducted from total benefits to arrive at the consumer surplus figures they need to be added back to obtain total benefits, as shown in Table 12.1 below.

7. Maritime

43 As a result of maritime radio producer benefits accrue to maritime radio equipment manufacturers and retailers while consumer benefits accrue to commercial ship and amateur boat operators. A transfer payment is made from ship and boat operators to the RA for licence fees. Table 7.1 summarises these net benefits for the year 2000. As shown by the table producers make an economic loss that exceeds the benefits accruing to users. However the radio licence fee income, which is deducted from consumer benefits, is just sufficient to make the net total benefits positive.

Table 7.1: Estimated Net Benefits of Maritime Radio, 2000 (£ million)

Type	Value
Total	1
Of which	
Consumer Benefits	5
Producer Benefits	-6
Licence Revenue	2

Producer Benefits

44 Based on 1998 data, as shown by Table 7.2, it is estimated that maritime radio equipment retailers made a small profit. However equipment manufacturers made a small, but larger net loss. As a whole therefore retailers and equipment manufacturers did not earn sufficient income to cover their costs, including a charge for the return fixed assets could have earned in their next best alternative use.

Table 7.2: Estimated Net Producer Benefits of Maritime Radio, 2000 (£ million)

Sub-Sector	Value
Total	-5.6
Of which	
Equipment Manufacturers	-6.2
Retailers	0.6

Consumer Benefits

Consumers' Surplus of Maritime and Amateur Aviation Radio Users

45 Estimates of consumer benefits are derived from a survey of consumer surplus conducted by Steer, Davies Gleave (SDG) using the stated preference method. SDG obtained returns to their questionnaire from 35 commercial shipping companies, 102 coastal station radio operators and 354 private boat owners. Table 7.3 presents the average benefits by class of user. Since the results are significantly different for those operating satellite equipment and those who do not, the results for these two groups of commercial shipping operators are classified separately.

46 Average annual consumer surplus per user are shown in column (a) for each licence type and class. These data are taken from the SDG survey report, which is attached as Annex F. They are net figures obtained after the deduction of those costs attributable to owning and operating radio equipment. The number of users for each licence type is shown in column (b). Total consumer benefits is then shown in column (c) as the product of average consumer benefits per user and the total number of users. The total value of net benefits over all users is about £5 million.

Table 7.3: Derivation of Net Consumer Benefits of Maritime Radio, 2000

(£ million)

Licence Type	Private/ Commercial	Class	Average Annual Consumer Benefits (£)	Number of Users	Total Consumer Benefits (£ million)
			(a)	(b)	(c)=(a)*(b)
Total					5.16
Of which					
Ships Radio	Commercial	Satellite	2,514	600	1.51
		Non-Satellite	314	6,399	2.01
	Private	Boat Owners	27	56,001	1.51
Coastal		International	56	921	0.05
		UK	70	930	0.07
		Marina	13	1,149	0.01

Licence Fee Revenue

47 Licence fee revenue for maritime radio is about £2 million. As mentioned above this is a transfer payment that does not alter the value of total net benefits. However since this value is deducted from consumer benefits it must be added back into the total to obtain a more accurate estimate of total benefits.

8. Aviation (Excluding Commercial Aviation)

48 The figures shown below include estimates of producer benefits for equipment manufacturers and the consumer benefits arising from private aviation. The benefit of air traffic control to commercial aviation is a complex area and will be dealt with at a future date. Because of this omission Table 8.1 below shows that the total estimated benefits of about £15 million is largely the result of producer benefits

Table 8.1: Estimates of Benefits of Radio in Aviation, Excluding Commercial Aviation, 2000 (£ millions)

Type	Value
Total	16.2
Of which	
Producer Benefits	15
Consumer Benefits	0.2
Licence Fees	1

Producer Benefits

49 Producer benefits accrue to manufacturers of radio equipment for aviation uses. This includes both civilian and military equipment. The value of these producer benefits, based on 1998 financial data, is estimated to be about £15m at 2000 prices.

Consumer Benefits

Consumers' Surplus of Maritime and Amateur Aviation Radio Users

50 Estimates of consumer benefits to private pilots from the use of radio have been estimated using a stated preference survey conducted by Steer, Davies Gleave (SDG). The survey included pilots of powered aircraft, gliders and balloons. Pilots of powered aircraft were further classified according to the value of their radio equipment on board. In all the survey covered 78 glider and balloon pilots and 245 pilots of powered aircraft. A full description of the survey is found in Annex F.

51 The benefits of radio accruing to private aviation are estimated to be about £0.24 million. In part this result is due to the relatively small numbers of private pilots in comparison, for example, with the number of private boat owners. However it is also due to the low value of consumer benefits found by the survey. This may be due to bias in the survey but it might also reflect other factors such as low frequency of aircraft use or the possibility of not using radio in some airspace.

52 Table 8.2 shows how consumer benefits were estimated. Column (a) shows the estimates of average consumer benefits per radio user by category, taken from the SDG survey. Column (b) shows the number of radio licence holders. Column (c) then shows the total consumer benefits, which is the product of average benefits per user and the number of radio users.

Table 8.2: Derivation of Consumer Benefits, Excluding Commercial Aviation, 2000 (£ million)

	Average Annual Consumer Surplus (£)	Number of Users	Total Consumer Surplus (£ million)
	(a)	(b)	(c)=(a)*(b)
Total		6,649	0.24
Of which			
Powered – (Equipment, Cost >£2,000)	55	2,334	0.13
Powered – (Equipment Cost < £2,000)	27	2,169	0.06
Glider and Balloon	23	2,146	0.05

Licence Fees

53 The RA collected licence fees from private aircraft users totalling about £1 million for the year 2000. This is the figure shown as a benefit in Table 8.1.

9. Amateur Radio

54 Amateur radio is a hobby and sometimes passion enjoyed by tens of thousands of people in the UK. The RA commissioned MVA to conduct a stated preference survey among amateur radio operators to determine the value they place on this hobby (see Annex H for the full text of this report). In all MVA interviewed 234 amateur radio licence holders from the A, B, A/B and novice categories. Table 9.1 below shows the derivation of consumer benefits based on this work. Producer benefits from the manufacture of equipment are included in the chapter on "other" beneficiaries.

Consumer Benefits

Survey to determine the Consumers' Surplus accruing to Amateur and CB Radio operators

55 The estimated total consumer benefits of amateur radio are about £2.6 million. This value is calculated by, first, taking the difference between willingness to pay (as found in the MVA survey) and the annual licence fee and, secondly, multiplying this by the total number of licence holders.

Table 9.1: Estimated Net Consumer Benefits of Amateur Radio, 2000 (£ million)

Licence Type	Average Annual Willingness to Pay (£)	Number of Users	Annual Licence Fee (£)	Total Consumer Benefits (£ million)
	(a)	(b)	(c)	(d)=((a)-(c))*(b)
Total		57,936		2.56
o/w				
A	81.04	30,574	15	2.02
B	33.96	24,186	15	0.46
A/B	82.44	251	15	0.02
Novice	35.57	2,925	15	0.06

Licence Fees

56 The Agency collects about £870,000 in licence fees annually from amateur radio operators. To obtain the total value of amateur radio the value of these fees should be added to the total consumer benefits estimated in Table 9.1, and consequently are included in the summary table of benefits shown in the concluding chapter.

10. Citizen's Band

57 There are about 34,000 licensed citizen's band (CB) operators in the UK. The RA commissioned MVA to undertake a stated preference survey of these operators to determine the value they place on CB radio (see Annex G for the full text of this report). MVA interviewed 153 people. The survey showed that the value of the CB service was marginally higher than the cost of the CB licence.

Consumer Benefits

Survey to determine the Consumers' Surplus accruing to Amateur and CB Radio operators

58 Table 10.1 below shows the derivation of consumer benefits using the results of this survey. The individual's annual willingness to pay for the use of CB radio, estimated by the MVA survey, is shown in column (a). Total net consumers' benefits are equal to the product of the average individual's willingness to pay, net of the licence fee, and the total number of users.

Table 10.1: Derivation of Estimated Net Consumer Benefits of CB Radio, 2000 (£ million)

Average Willingness to Pay (£)	Number of Users	Licence Fee (£)	Total Consumer Benefits (£ millions)
(a)	(b)	(c)	(d)=((a)-(c))*(b)
16.40	33,949	15	0.05

Licence Fees

59 Licence revenue from CB operators is about £0.5 million per annum. Thus the total benefits including both net consumer benefits and fee income are about £0.55 million.

Producer Benefits

60 Benefits accruing to equipment manufacturers are included in the benefits shown in the chapter on "other" beneficiaries.

11. Other

61 As previous sections have indicated it was not always possible to separate the producer benefits accruing to specific sectors of the radio industry. This was because producers often produce a range of equipment or services for use in different sectors. Equipment manufacturers, for example, produce aerials and receivers for various purposes. Similarly consultants provide services to more than one sector. In addition radio is used for defence in many areas beside aviation. Table 11.1a below shows the producer benefits accruing to equipment manufacturers, including producers of military radio equipment and low power radio devices. Table 11.1b shows the producer benefits accruing to consultants.

Table 11.1a: Estimated Net Benefits to Other Equipment Manufacturers, 2000 (£ million)

Sub-Sector	Values
Total	203.5
Of which	
Military	150.8
Low Power Radio Devices	56.2
Aerials and Related Equipment	2.5
Private Business	-6.0

Table 11.1b: Estimated Net Benefits to Other Service Providers, 2000 (£ million)

Sub-Sector	Values
Total	2.6
Of which	
Consultants	2.6

Fixed Wireless Access Operators

62 An estimate of the producer surplus for FWA operators has not been produced, as the 1998 accounts information would not accurately reflect the level of economic activity in 2000. The recent issue of licences in 2000 indicates that this is a sector that is likely to make an economic contribution in 2000 and beyond.

12. Summary

63 The results of this study include estimates of many but not all the benefits of radio. The results do not include, for example, benefits from the use of radio by the military or commercial airlines and air traffic controllers. Measured benefits total about £20 billion. Table 12.1 below shows how this figure is derived from consumer benefits of £17 billion, producer benefits of £3 billion and licence fee revenue, which have been deducted to arrive at consumer benefits, of £1/2 billion (excluding 3G licences; but see the discussion in Chapter Two above). The two largest sub-sectors both in terms of producer and consumer benefits are public mobile and broadcasting.

Table 12.1: The Estimated Net Economic Benefits of Radio to the UK Economy, 2000 Selected Sectors (£ million)

	Producer Benefits	Consumer Benefits	Licence Fees	Total
Total	3,086	16,761	456	20,303
Of which				
Public Mobile	991	7,177	30	8,198
Broadcasting*	1,874	5,123	393	7,390
Satellite Links	6	1,788	4	1,798
Fixed Links	-	1,624	14	1,638
Private Mobile Radio	-	1,041	10	1,051
Maritime	-6	5	2	1
Aviation	15	0	1	16
Amateur Radio	-	3	1	4
Citizen's Band	-	0	1	1
Others	206	-	-	206

Note: * The consumer benefits of broadcasting differ to those stated in Section 3 due to rounding.

64 The producer surplus estimates in the 2000 Economic Impact Study are based on 1998 calendar year accounts data. Time and the repetition of the exercise will reveal if the growth in economic activity in the Radio Industry and in particular sectors will continue at the same rate.

ANNEX A - Method of Calculating Producer Surplus

1 For the purpose of this study, producer benefits accrue to producers who sell radio services or who sell goods and services to other companies in the radio industry. Producer benefits are measured in terms of what economists call producer surplus. This surplus is equal to revenue less economic cost. Revenue is equivalent to company turnover and can be obtained from company accounts.

2 Economic costs reflect the fact that resources can be used to produce value in a number of alternative, competing ways. The economic cost of inputs used by the radio industry is therefore the value of these goods and services in their next best alternative productive use. There are four categories of costs:

- Labour
- Other non-labour inputs of goods and services, e.g. materials or broadcasting content
- Capital goods such as buildings, vehicles and plant and machinery
- Stocks.

Labour Costs

3 In the case of labour, the first cost category, employees could work elsewhere. If they work for the radio industry then they cannot work elsewhere and the economy foregoes the benefits of their labour in these other sectors. The market rate of wages and salaries of labour is a measure of the value of this potential output. Pension and other payments also reflect a cost to the economy. Thus labour costs are the sum of:

- Directors emoluments,
- Wages,
- Social security costs.

Other Non-Labour Costs

4 The “other” operating and overhead costs of a company reflect the market value of the non-labour services employed by the company. In the calculation of producer surplus a deduction is therefore made for:

- Costs of sales,
- Administration costs,
- Selling costs,
- Other expenses such as heating and light.

5 However since these costs in the company accounts include labour a deduction is made for labour.

6 Moreover, since depreciation is associated with capital, depreciation is also deducted from other non-labour costs.
Capital Cost

7 Companies hold capital in a number of forms with different depreciation rates. Separate capital costs are therefore calculated where possible for:

- Plant & Machinery,
- Vehicles,
- Land & Buildings,
- Other Tangible Fixed Assets.

8 In the case of capital, such as plant and machinery, there are two charges; namely, for depreciation and financial cost. Depreciation is charged because a fraction of the capital inputs are lost each year due to wear and tear or technical obsolescence. This depreciation charge is equal to the product of the depreciation rate and the estimated value of resources tied up in physical capital.

9 A financial charge is deducted because the capital assets of the company could have been invested in another use, and so could have earned a return. This financial return is a measure of the value to the economy of the capital assets in their next most profitable, alternative use. The financial charge is calculated as the product of the stock of assets and the cost of capital.

Calculating the Stock of Capital

10 The first task in calculating the capital cost is to identify the stock of each type of capital. The balance sheet in the company accounts shows the value of tangible assets at historic cost less provision for depreciation. The method used in the calculation of producer surplus is slightly different. Taking the example of vehicles, though the method applies to each item of capital, the stock of vehicles is valued according to the following equation:

Vehicles at year t = (Vehicles at year t-1)(1-proportion vehicle depreciation)

+ (Additions to vehicles made during year t in real terms)

11 The first term on the right is the fraction of vehicles from the previous year that remains after depreciation, where the depreciation rate is constant. The second term is what is added to the stock of vehicles during the current year measured in real terms. This investment in vehicles is recorded in the balance sheet. The first year for these iterative calculations is assumed to be 1978. The initial values is set to zero for each stock of capital, except for Land & Buildings which is set to its 1978 value in the initial year in real prices.

Cost of Capital

12 The cost of capital is the market rate for investments of a similar risk. In this study the cost of capital, R, is calculated according to the capital asset pricing model (CAPM). It is given by the following formula:

R(t) = Risk free rate of return + Beta*Equity premium

where:

the risk free rate of return is the real return on Treasury bonds,
beta is a coefficient that reflects risk
the equity premium is the additional rate of return required to induce investors to hold equities.

13 Having calculated the stock of vehicles and the cost of capital, the capital cost is:

Cost of Vehicles at year t = (cost of capital in year t)(Vehicles at year t)

+ (depreciation rate of vehicles)(Vehicles at year t-1)

The right-hand side is the return that the capital invested in the stock of vehicles could have earned in its next best alternative use plus the depreciation cost.

Stocks

14 Producers also incur a charge if they have stocks left over at the end of the accounting period. Just as capital assets such as vehicles could have been invested, so the resources used to produce stocks could have been used to produce other goods. The cost of the stocks is equal to the value of these resources in their next most profitable use. The cost of stocks is calculated as:

Cost of stock in year t = (cost of capital at year t)(stocks at year t)

Accounting Period

15 In the equations above it is not clear what is meant by “year t”. This is more than an academic question since different companies file their accounts at different times of the year. For the purpose of calculating producer surplus company accounts are apportioned to calendar years on a pro rata basis. Thus for example if the financial year ends on 30 September, 1997 three-quarters of the 1997 financial results would be added to one-quarter of the financial results of the following year to obtain an estimate of the accounts for the 1997 calendar year.

Real Prices

16 Another issue is how to compare company accounts data over time. In the calculations of producer surplus all the accounting data except for investment were first divided by the producer price index to give variables in real terms at 1999 prices. An estimate was then made of price changes during 2000 to restate the results in terms of 2000 prices. The specific elements of capital were deflated using capital price indices.

Sampling and Estimation of Total Producer Surplus

17 As explained in the introduction to this document the chosen sub-sectors of the Radio Industry do not define distinct boundaries between the various types of radio operations. Noting this, the companies belonging to each sub-sector were identified using RA licence data and DTI data on industrial classification. The RA then drew a sample of companies from this population and calculated producer surplus for each one. The results were then scaled up to produce estimates of producer surplus for the industry as a whole. In all the RA collected data on about 1,500 companies.

ANNEX B – Stated Preference Survey of Cellular Mobile and Paging

ANNEX C – Stated Preference Survey of TV Viewers and Radio Listeners

ANNEX D - Method Of Calculating Consumer Benefits For Users Of Satellite Links

1 As mentioned in the chapter on satellite links, estimates of the consumer benefits from satellite links are not based on survey results. This annex describes the method used to calculate consumer benefits without survey data.

2 The method consists of making an estimate of the cost savings from the use of satellite links rather than the next most profitable means of communications. Total cost savings are obtained by multiplying the cost saving for each type of satellite link by the number of links of that type. Savings are then summed over all types of link. This gives total costs savings, and hence total consumer benefits.

Costs of Satellite Links

3 The first step in the method is to calculate the costs of using the satellite and next best service. Costs of a satellite link are calculated as the sum of

the capital costs of the initial investment
the variable cost.

4 The capital cost consists of two annual elements: an interest charge and a depreciation charge. The interest charge reflects the opportunity cost of the investment, i.e. what the money could have earned if it was invested in the next most profitable use. The depreciation cost reflects the deterioration in the asset. In order to annualise the capital cost the present value of the sum of these annual charges is taken over the lifetime of the investment and then divided by the length of the lifetime of the asset.

5 The variable cost for a satellite link consists of the annualised value of the sum of the rental charge for a transponder on a satellite, the annual licence fees for the earth station and the annual costs of the receiving station or terminals.

6 RA data and parameter estimates are used to derive capital and variable costs.

Costs of a Landline

7 In making the estimates of consumer benefits it is assumed that the next most efficient communications system is a network of landlines. The initial investment required for a landline network consists principally of laying each line. In making the calculations it is assumed that there is a simple linear relationship between capacity and installation cost per kilometre. Installation cost for a landline of given data capacity is the product of its length in kilometres and the installation cost per kilometre. The annualised value of

the capital charge for this investment is then calculated using the method described above with respect to satellite links.

8 The variable cost for a landline network consists of the rental charge for each line. This cost is also assumed to vary by length and data capacity. A linear relation is assumed between the rental charge and capacity per kilometre. The rental charge for a given length and data capacity of landline is given by the product of the length in kilometres and the rental charge per kilometre. The annualised value of the variable cost over the lifetime of the landline is then calculated.

Final Calculations

9 Once the annual capital cost and annual variable cost are obtained for each type of satellite link the efficiency benefits are obtained by deducting the cost of a link from the cost of a comparable landline network. Total efficiency benefits are obtained by multiplying the average efficiency benefits of each type of link by the number of links of that type.

10 Cost parameters and data on the number of links are based on RA estimates and licence data.

ANNEX E - Method of Calculating Consumer Benefits In Fixed Links

1 Calculation of the benefits accruing to fixed links users is not based on a survey. As discussed in the annex on satellite links the method is based on the cost savings from the use of a fixed link as opposed the next best alternative technology.

2 The next best alternative technology is assumed to be a landline. Cost saving from each fixed link is equal to the cost of a comparable landline minus the cost of the fixed link. Total benefits are calculated by multiplying the average cost savings from the use of fixed links and the number of links.

Cost of a Fixed Link

3 Costs of a fixed link are calculated as the sum of

the capital costs of the initial investment
variable cost.

4 The initial investment cost of a fixed link is the cost of transmitter sites, other infrastructure, equipment and its installation. These costs are assumed to vary with data capacity but to be independent of the length of the link. To obtain the annual cost the present value of the capital cost is calculated and then divided by the estimated lifetime of the link.

5 The variable cost of a fixed link is assumed to be largely determined by the licence fee, which varies with bandwidth. A maintenance cost is also included that is equal to 10% of the original installation and equipment cost. The average annual variable cost is found by calculating the present value of the annual charge over the lifetime of a fixed link and then dividing this number by the lifetime of the link.

Cost of a Landline

6 The method for calculation of the cost of a landline is the same as that given in the annex on satellite links.

Number of Fixed Links

7 The RA maintains licence data on fixed links that shows how many licences are issued to particular companies and the data capacities of the individual links. Using these data it is possible to exclude from each class of fixed link the links that are operated by companies in the radio industry. These links are excluded from the calculation of total benefits since the producer benefits of these companies are included elsewhere in the total benefits over all radio sectors. This avoids double counting.

Calculation of total Benefits

8 To calculate cost savings, first the average cost of a fixed link in each class is subtracted from the cost of a comparable landline. This difference is then multiplied by the number of fixed links in the class. Cost savings are then summed over all classes of links. This figure is divided by the total number of links to obtain the average efficiency benefits per fixed link.

ANNEX F – Stated Preference Survey of Maritime and Amateur Aviation Radio Users

ANNEX G – Stated Preference Survey of Amateur and CB Radio operators