The Impact of Liberalisation of Alternative Terrestrial Infrastructure for Non-reserved Services

Final Report to the European Commission

This study, "The Impact of Liberalisation of Alternative Terrestrial Infrastructure for Non-reserved Services" has been prepared for the European Commission. It has been commissioned in response to a request made to the Commission following the Telecommunications Council of 16 June 1993.

The report does not necessarily reflect the views of the Commission, nor does the Commission accept responsibility for the accuracy of completeness of the information contained herein.

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TABLE OF CONTENTS

1 Introduction

1.1 Background

101 Following the recent review of telecommunications services provision in the European Community (Communication Com (93) 159, April 1993) the Council of Ministers adopted a resolution supporting progressive liberalisation of telecommunications services in the Community.

102 The Council has now requested that the Commission research the use of alternative terrestrial infrastructure for the carriage of services which have already been liberalised (VAS, Closed User Groups and corporate networks), with the objective of deciding early in 1994 whether the provision of alternative infrastructure should be liberalised for use in this way. Subsequently, the Delors White Paper initiative has added a further dimension to the context of the study.

103 Subsequently the Delors White paper on Growth, Competitiveness and Employment has added a further dimension to the context of this study. The White Paper highlighted the role of telecommunications and, in particular, the importance of establishing an appropriate information infrastructure to support European business and social affairs into the 21st Century. A vital aspect of this effort is the early creation of suitable regulatory frameworks to meet the requirements at major, innovative users who will lead in the adoption of new communications and information technology applications. This issue is at the centre of the present report.

1.2 Terminology and scope

104 It is helpful at the outset to define some of the key terms used within the study and hence to establish the precise scope of the issues under review.

105 Telecommunications infrastructure can be thought of as the physical facilities used to provide telecommunications services to users. In the scope of this study, the facilities under consideration are confined to those used in providing **leased circuits** for use in:

(a) corporate networks;

(b) the provision of Value Added Services, which may include Virtual Private Networks (VPNs); and

(c) cellular and other mobile services.

106 A fuller discussion of the nature of telecommunications infrastructure is provided in Chapter 2.

107 **Alternative** telecommunications infrastructure is considered to comprise telecommunications facilities other than those provided by public operators. Such facilities would include, for example, networks self provided by utilities and the railways. Terrestrial alternative infrastructure is defined here as infrastructure provided by land based systems (which might include terrestrial fixed radio, but not satellite systems).

108 Under the proposed form of liberalisation, organisations other than the PTOs would be able to provide telecommunications facilities, based on these alternative infrastructures, for use in non-reserved activities. In other words, operators of alternative infrastructure would be able to compete with the PTOs in the supply of leased circuits to end users for use in their corporate networks or to service providers for sale on to end users.

109 Within this scenario there are three possible variants as to exactly how alternative infrastructure might be used for commercial purposes:

(a) sale of spare capacity in existing infrastructure only is permitted; or

(b) construction of new infrastructure for commercial purposes is permitted, but only if its use combines commercial activities and applications for which self provision of infrastructure is already approved eg utility internal telecoms applications;

(c) construction of new infrastructure solely for commercial purposes is permitted. This case may involve the issuance of additional licences (or equivalents) as opposed to modification of existing licences or approvals as in case (b).

110 Throughout the report we will take account of all three of these variants.

111 It should be noted that the scope of this study explicitly excludes consideration of telecommunications infrastructure supplied, or potentially supplied, by Cable TV operators. Such issues are the subject of a separate study.

1.3 Objectives

112 Against this background Coopers & Lybrand have been retained to provide assistance to the Commission in the research of issues arising from the liberalisation proposal. Specifically, the main objectives of this report are to:

- assess the current performance of the infrastructure market in the EU;
- provide an understanding of who are the potential suppliers of alternative infrastructure and what they might bring to the market place should the proposed liberalisation proceed;
- assess how the development of the market for infrastructure in the EU might be impacted, taking into account in particular:
  - the implications for the Telecommunications Operators; and

- the wider economic benefits to end users and key economic sectors.

1.4 Structure of report

113 The remainder of the report is set out as follows:

- **Chapter 2: The existing market for infrastructure.** In this Chapter we review the conditions under which infrastructure for non-reserved services is provided at the moment, and assess the implications of the current arrangements for users. This analysis provides the reference point against which the impacts of the liberalisation proposals can be measured.

- **Chapter 3: The potential of alternative terrestrial infrastructure.** This Chapter reviews where and why alternative infrastructure might exist, or be constructed, and the extent to which it can be used in practice, to provide telecommunications facilities to third parties.

- **Chapter 4: Economics of alternative infrastructure provision.** Here we develop an analysis of the major technological, economic and regulatory factors which impact the viability of market entry as an alternative infrastructure provider.

- **Chapter 5: Market development scenario.** In this Chapter we draw on the analysis of the preceding Chapters to develop a view as to the likely development of the EU infrastructure market under the proposed liberalisation. We address the impact on the players in the market place and identify some of the wider economic benefits which might be expected to accrue.

- **Chapter 6: Conclusion** The final Chapter draws together the results of the preceding analysis and concludes as to the desirability of the liberalisation of infrastructure provision in the way proposed.

1.5 Acknowledgements

In preparing this report we have received wide ranging support and inputs from a number of groups which we gratefully acknowledge. In particular we would like to thank the Commission and all those who participated in the consultation process. In view of the short timeframe available for the study the scope for consultation has been more limited than we would have wished. Nevertheless we have gathered, we believe, a representative view on the key issues. Further, the publication of this document is in itself part of the consultation process.

2 The existing market for infrastructure

2.1 Introduction

201 This Chapter looks more closely at what telecommunications infrastructure is and charts the regulatory, supply and demand conditions under which the market for infrastructure, to support non-reserved services operates throughout the E.U. today. It also attempts to address how the market might develop if the proposed liberalisation of infrastructure were not to take place, so as to define a benchmark against which the impact of proposed liberalisation measures can be assessed.

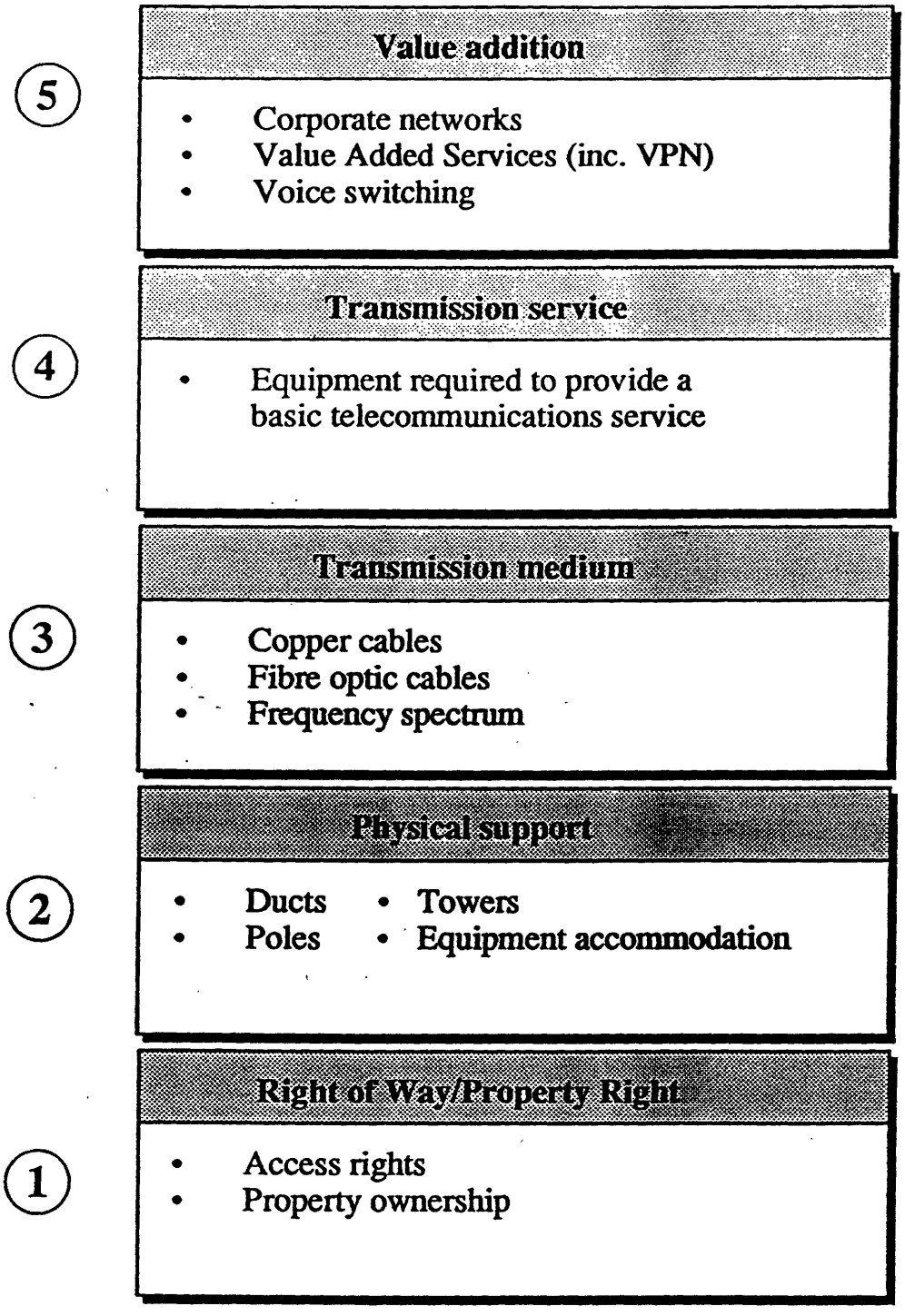
202 In the following sections we:

- review the nature of telecommunications infrastructure;
- summarise the current regulatory situation;
- describe the nature of the infrastructure market; and
- identify some of the factors which underlie the current development of the market.

2.2 The nature of telecommunications infrastructure

203 In order to present a clear picture of the current situation it is useful, first of all to identify the various elements which go together to make up telecommunications infrastructure. All telecommunications infrastructures, be they operated by the TOs, utilities or other organisations, can be thought of as following a common model in terms of their underlying structure. This model is depicted in Figure 1, and has five layers.

Figure 1 - Five layer model of telecommunications infrastructure



204 **(a) Right of way (or wayleave)/property right**

205 In order to construct, operate and maintain telecoms infrastructure an organisation must have the legal right to gain access to the land or building where the telecoms infrastructure is to be located. This can be achieved either by direct ownership of the relevant property by the telecoms infrastructure owner, or by the owner of the property contracting to give the telecoms infrastructure owner access to his property in return for some agreed compensation.

(b) Physical support

206 Once the telecoms infrastructure operator has secured the appropriate access rights he will need some mechanical means of supporting the equipment which will provide the telecommunications facilities. This layer of the model therefore includes assets such as ducts and poles to carry cables, towers to support microwave dishes, and buildings and street furniture to accommodate transmission and switching equipment.

(c) Transmission medium

207 The third layer in the model is the physical entity which carries the telecommunications signal, for example, fibre optic or copper cable. At this level in the model the transmission medium is considered to be unequipped/inactive. The reason for this distinction will become apparent in the subsequent discussion.

(d) Transmission service

208 At this layer of the model is all of the equipment necessarily required to enable the operator to provide a defined basic telecommunications transmission service to third parties. This equipment would include optical and/or electromagnetic transmission, cross connection and network management functions and some billing capability. From this it is apparent that a 'transmission service' can be defined as a full time connection between two or more points of defined capacity and interface features; in other words a leased circuit.

(e) Value addition

209 At this level in the model, transmission services are enhanced in various ways to develop services of added value to users. Such enhancements include the bundling of leased circuits into corporate voice and or data networks, the provision of Virtual Private Networks, the addition of various application specific functions and information etc. Also technically feasible, is the addition of voice switching facilities to provide telephony service connecting to the PSTN at both ends.

210 In the next section we review the current regulatory position relating to infrastructure provision in EU within this framework.

2.3 The current regulatory position

211 Table 1 summarises the current position regarding the supply of infrastructure services in the EU. The situation in each Member State is described after this summary.

Table 1: Regulation of alternative telecommunications transmission infrastructure

	General Alternative Provision	Class[1] Exemption For Utilities	Discretionary Licensing for Self-Provision	Discretionary Licensing for CUGs	Commercial Third party Provision
Belgium	-	Yes	Yes	-	-
Denmark	-	Yes	Yes	Restricted	-
Germany	-	Yes	Yes	Restricted	Yes
Greece	-	Yes	-	-	-
Spain	-	Yes	Yes	-	-
France	-	-	Yes	Yes	-
Ireland	-	-	Yes	-	-
Italy	-	Yes	-	-	-
Luxembourg	-	-	-	-	-
Netherlands	-	-	Yes	-	-[2]
Portugal	-	Yes	-	-	-
UK	Yes	-	Yes	Yes	Yes

1 The exact categories of exempt organisation and nature of exemptions from the general obligation to use TO services vary according to Member State.

2 Proposals are currently before the Dutch Parliament to permit alternative commercial telecommunications service provision on electricity, rail and CATV infrastructure.

212 In all Member States the TOs have the right to provide infrastructure services and Value Added Services based on these infrastructure services, ie they have the right to operate at all 5 levels of the model we described above.

213 In eight member states other organisations are permitted to own and operate their own national infrastructure, but in four cases, only for their own internal business needs. In other words, they are permitted to operate up to the fourth level of our model, but to provide infrastructure services only to users internal to their organisation. This arrangement is effected through either a class exemption for utilities or through discretionary licensing.

214 In the other four Member States where alternative national infrastructure is allowed (Denmark, Germany, France and the UK) it is permissible to use this infrastructure for services to third parties. In the UK there are no restrictions to this, but in France the applications are restricted to nominated closed groups of users, while in Denmark and Germany there are further restrictions. In Denmark a closed group, not exceeding ten enterprises can incorporate privately provided infrastructure but the network must not span more than 22.5 km, and is only permitted if teleDanmark has not established suitable networks in the relevant area. In Germany the exceptions to DBP Telekom's exclusive right to run transmission facilities. These are:

- The Fernmeldeanlagengesetz that allows special companies and entities (such as electricity companies, the railways and communities) to set up their own infrastructure, but only for internal, non commercial traffic; and

- from July 93 private infrastructure can be provided within a range of 25 km for own or third party use for any service except public telephony but this would allow for example a corporate voice network). Beyond the 25 km other premises can be connected into the private network, but only in a star form.

International infrastructure provision is not permitted without licence in any country.

215 Part of the 'value addition' layer in our model is liberalised in all Member States. Thus TOs, as mentioned before, providers of services to third parties and users themselves are able to purchase infrastructure services from the TOs (and alternative providers, in the cases specified above) for the purposes of supporting corporate networks and other value added services.

216 However, in all Member States except the UK (the position in Holland is under review) purchasers of infrastructure services cannot provide public telephony services at present (although this is being considered for liberalisation in the EU in 1998 in some states and 2003 in others).

Situation in member states

217 In the following paragraphs we describe the current situation in each of the member states regarding the regulation of non PTO-infrastructure. The origin of this discussion is the Regulatory Review conducted by Coopers & Lybrand in 1992, with some updating where the situation has changed.

Belgium

218 Under Belgian regulation (governed principally by the 1991 law on telecommunications and the 1979 law on radio communications) private facility transmission links may only be established following an approval granted by the regulatory authority - which may only be given if Belgacom is not prepared to provide a technically equivalent link at a normal tariff and within a reasonable period.

219 In general for fixed link networks, therefore, Belgacom's reserved facilities must be employed other than in exceptional cases (eg. of technical specification or geographic coverage). If permission for privately provided facilities is granted, then a decree may be adopted in order to require financial compensation to Belgacom by the operator of the alternative infrastructure.

220 However, a number of organisations in Belgium are exempted from these requirements to use the public infrastructure provided by Belgacom. Apart from military and security organisations, the following may employ privately provided inter-site infrastructure - but only to support telecommunications for their own internal purposes:

- national and local civilian government bodies;
- public railway and transport companies;
- public water, gas and electricity utilities;
- radio/television distribution network operators.

221 Operation of such private infrastructure networks is subject to a prior declaration to the regulatory authority and to terms which may be specified in applicable decrees. In addition, radio communications regulations apply where appropriate.

Denmark

222 Under the Act no. 743/1990 on telecommunications, all provision of inter-site infrastructure facilities is reserved to the public network operator organisations.

223 However, in addition to military/security installations, networks operated by the following (exclusively for their own internal use) are not considered to be of a public nature, and may incorporate privately provided transmission facilities:

- national and local civilian government bodies;
- railway operators;
- single enterprise (between own sites);
- closed group (not exceeding 10 enterprises, unless in special circumstances)

France

224 The Post and Telecommunications Code (as amended by the law of December 1990) establishes an exclusive right for provision of the general public infrastructure for France Télécom. It also provides for discretionary licensing of certain independent network infrastructures, subject to authorization by the regulatory authority and under any conditions stipulated.

225 Independent networks may only be used for private or shared internal use by a closed group. They may be interconnected with the public network under exceptional conditions (to be governed by regulation issued by the regulatory authority - and only to support use within the original group of parties); nevertheless, such interconnections are widely authorised.

226 Independent network infrastructures may be authorised for:

- private use by a single corporate entity;
- shared use by several entities who are members of a closed user group.

227 Networks for state security and military purposes are excluded from P&T Code licensing requirements. No special provisions are made for civil government bodies or for public utilities or public transport organisations.

Germany

228 The 1989 Telecommunications Installations Act establishes an exclusive right for the state to provide the physical transmission infrastructure, and (with the exception of installations intended for military/security purposes) in general transfers this right to DBP Telekom - to ensure fulfilment of the public tasks assigned to it (which include development of the necessary telecommunications infrastructure).

229 The Act does provide for discretionary licensing by the regulatory authority of individual telecommunications installations for certain routes or districts, subject to any conditions stipulated - which may impose restrictions on service provision or interconnection with the public network.

230 However, the regulatory body is required to grant such a licence for cable-based telecoms networks to be used for internal service purposes by public electricity supply utilities. This obligation is subject to not affecting the operational interests of DBP Telekom, and does not apply to radio installations.

231 Furthermore, certain cable-based network infrastructures may be operated without a licence exclusively for internal use by the following:

- local civil government bodies;
- water management organisations (dikes, sluices, drainage);
- transport companies (on own routes);
- single enterprises (between own sites, in limited area).

232 This exemption also allows transport companies to carry on internal communications within such a network. A single enterprise network, under the exemption, is limited to a span of 25 km; it may be formed by a single owner or by others forming one undertaking - providing that traffic exclusively concerns use of the linked premises and there are no commercial charges. Radio based networks are not included in this exemption.

233 Six months ago moves were made to ease these restrictions on the provision of private infrastructures. Up to a range of 25km, private infrastructure is permitted for self provision of internal needs, and for the provision of services on a commercial basis, with the exception of public telephony.

Greece

234 Under the framework law of 1973, an exclusive right for general infrastructure provisions is granted to OTE. However, apart from networks for military/security purposes, the law also provides that networks for internal use by the following organisations, can be constructed and run without reference to OTE:

- civil aviation authorities;
- railway company (on own track routes);
- electricity company (on own supply/distribution routes).

235 No specific authorization is at present required for provision of such infrastructure networks, but as publicly owned or controlled organisations, their operation is subject to individual regulation. Only internal traffic may be carried and OTE agreement is required for any interconnection with the public network.

Ireland

236 Under the Telecommunications Act of 1983, provision of physical infrastructure between premises is an exclusive right of Bord Telecom Eireann (BTE). However, the regulatory authority has power to issue discretionary licences to others to provide facilities or services which are within BTE's exclusive area (after consulting BTE and provided the public interest is served - including consistency with BTE's public duties, and on any terms to be specified). No such licences have in practice been granted.

237 In addition, the following category of service (and supporting network infrastructure) is exempt from a requirement for authorization:

- services provided and maintained by a business for use between employees for the purpose of the business and not rendering a service to any other person.

238 Implementation of such a network would be subject to regulation requiring approval of any radio installations, and any interconnection with the public network would require agreement from BTE.

Italy

239 Under the Postal Code, in addition to public licensing schemes for the authorization of the public telecommunications operators, there is provision for the granting of private licences to set up and run telecommunications systems.

240 Such private licences (which can authorise the operation of radio installations) may be granted at the discretion of the regulatory authority (and on any conditions to be specified) provided that there is no public service (or public service facilities are inadequate) between the points to be linked. Transmission may not be made on behalf of other parties, and interconnection with the public network is authorised only in exceptional cases. Applicants for private licenses may have to meet nationality requirements - but these do not in practice restrict applications by parties based in the EC.

241 The Postal Code also provides for certain cases (apart from military/security operations) where private infrastructure networks may be authorised without formal licensing, solely for internal use to support the service operations of:

- State Administrations (including those responsible for public utility functions);
- transport organisations.

242 In certain circumstances, the interconnection of such systems with the public network may also be permitted.

Luxembourg

243 The 1990 Regulation on general measures for public telecommunications services establishes an exclusive right for the PTT administration to establish the general infrastructure of public transmission facilities. However, we understand that utility networks can be operated for internal purposes exempt from the special authorisation.

Netherlands

244 The following paragraphs describe the current situation under the existing (1988) Telecommunications Act. This Act is currently under review. The new Act is likely to permit commercial service provision using alternative infrastructure.

245 Under the 1988 Act, the PTT is granted an exclusive right to provide the physical telecommunications infrastructure which crosses any public ground. However the Dutch Government is now considering the consolidation of existing alternative infrastructure providers into one organisation which will compete with PTT Netherlands

246 However, the Act also provides for the licensing in certain circumstances of special or limited telecommunications installations - either as privately provided facilities or in conjunction with the operation of cable broadcasting networks.

247 The licensing of privately provided cable or fixed-link radio installations by the regulatory body, is permitted only when the public telecoms operator is not prepared to make an equivalent facility available on reasonable terms. Such licensing may also be withheld in the public/economic interest of efficient provision of telecommunications facilities - as may the licensing of cable broadcasting operators for additional provision of special telecommunications transport facilities.

248 Where such additional or private infrastructure is authorised, it may not be employed to offer to third parties any of the basic telecommunications services which

may be provided by the public operator (or any direct transport service). Furthermore, such privately provided networks may only be interconnected with each other via the public service facilities.

Portugal

249 Under Law no. 88 of 1989, the general telecommunications infrastructure is provided on an exclusive basis by the public operators. However, infrastructure to serve the private telecommunications of:

- state or other public entities;
- private organisations with special public goals (such as enterprises for transport or energy distribution)

are exempted from this requirement.

Spain

250 Physical telecommunications infrastructure may be authorised under the Law on Telecommunications of 1987 (LOT) for public final and bearer services (which are currently provided under monopoly rights by the public operator) and for certain third-party value-added services (those not based on final or bearer services, but requiring installation of a network) provided that the public operator is not able to provide a 'reasonable solution'.

251 A licence is required for such a value-added service and any underlying network. These licences may be granted by the regulatory body following an assessment of the operator's requirements and the public operator's ability to serve that need. The licence may subsequently be withdrawn if public bearer services are introduced which could more efficiently replace the special infrastructure network.

252 In addition, the LOT provides for the potential authorization of privately provided network facilities, exclusively to support the internal business related communications of:

- railway companies;
- electricity supply companies.

253 A proposed draft amendment to the LOT would extend this measure to apply to all entities which operate public services based on plant requiring permanent control in real time - eg potentially also to water and gas utilities. Such networks would require prior authorization by the regulatory body (plus appropriate licensing of any radio installations). However, the necessary procedures for this approval process have not yet been issued.

UK

254 Under the Telecommunications Act 1984, the operation of any telecommunications installation requires authorization. The regulatory body may grant individual licences to network operators on a discretionary basis for telecommunications installations which provide fixed link transmission between premises - the accompanying conditions may permit the provision of third-party or public services over such infrastructure, or may require non-commercial operation solely for communications concerned with the business operations or a restricted set of users.

255 Also under the Act, two class licences have been issued (in 1991) which provide a general right without additional formalities for any operator:

- to employ privately provided radio or cable infrastructure links, which may be interconnected with the public network, provided no third-party traffic is carried or commercial service offered;

- to provide and operate satellite earth station facilities, via which third party traffic or services may be carried, provided the systems are not interconnected with the public switched network.

256 In the case of each of these class licenses, appropriate frequency licences and equipment approvals must also be held for any radio installations.

2.4 Infrastructure market development

257 Having summarised the current regulatory position we now turn to the other main purpose of this report which is to make an assessment of a number of impacts which might arise as a result of the liberalisation proposal being adopted. In order to make these assessments it is necessary to have an understanding of the effects of the current situation of the infrastructure market before any liberalisation is adopted. This we develop in the next few sections. Two features of the current situation are readily apparent.

258 Firstly, as we describe in the following section, there is a wide variation in the development of the infrastructure market and the telecommunications market as a whole, between Member States. In an effort to understand better the reasons for these variations in the development of the infrastructure market and to be able to properly analyse the impact of liberalisation, we have developed a framework which relates the development of the infrastructure supply market in a given country to a range of factors which reflects the overall development of the telecommunications market and the TO. This analysis sheds light on why such large variations in market development exist.

259 The second feature of the current situation is that it is dynamic. Even without any change in the regulation of alternative infrastructure, there exist a number of other drivers of change which will impact the current situation. These drivers include the regulatory reforms already in progress (eg ONP), technological change and changing market expectations. All of these factors will impact markets at different stages of development in different ways. Many of the changes, which could potentially

be ascribed to infrastructure liberalisation, are likely to happen in any case as a result of these other drivers. The true impact of infrastructure liberalisation is the extent to which these changes happen more quickly or in a different form than they would otherwise have done.

Current development of the infrastructure market

260 The overall Community leased circuit market can be segmented by type of transmission technology: analogue or digital. The digital market can be further split into low speed (from 9.6 to 64 Kbit/s) and high speed (i.e. 2 Mbit/s). In all Community countries analogue circuits dominate the market installed base. Over 90% of all Community leased circuits operate using analogue transmission technology as illustrated in Table 2 with the percentage of analogue circuits ranging from 75% (UK) to virtually 100% (Greece and Portugal).

Table 2: Leased circuit installed base

Analogue leased circuits (ALCs)	Low Speed Digital Circuits (DLCs)	High Speed DLCs
Estimated as 92% of the installed base	7%	1%

261 Revenues are more evenly distributed between circuit types (Table 3). According to Analysis[3] the mean leased circuit revenue per connection was 1,700 ECU in 1990. The overall market was worth 4.5 Billion ECU in 1990. EC estimates suggest that some 78% of leased circuit revenues were from the ALC area, 10% from the low speed DLC area and 12% from the high speed DLC area.

3 "Performance of the Telecommunications Sector up to 2010 under Different Regulatory and Market Options" by Analysis Ltd

Table 3: Leased circuit revenue estimates

ALCs	Low Speed DLCs	High Speed DLCs
Estimated as 78% of total revenues	10%	12%

262 High speed DLC revenues are heavily concentrated in the UK, where competition has resulted in wide availability and adoption of these services as the backbone for private networks. Approximately 80% of the Community 2 Mbit/s leased circuit installed base is in the UK and a further 10% is in France. The remaining 10 Community Member States account for only 10% of 2 Mbit/s circuits. In particular, four Member States: Italy, Spain, Portugal and Greece have an extremely low penetration of 2 Mbit/s circuits, as illustrated in Table 4.

Table 4: 2 Mbit/s leased circuit distribution by Member State at start 1992

Country	Number of 2 Mbit/s Circuits	Leased circuit penetration per 1,000,000 pop.	Percentage of all EC
Belgium	240	24.1	0.7
Denmark	1,106	214.6	3.3
Germany	1,100	6.7	1.6
Greece	0	0.0	0.0
Spain	90	2.3	0.3
France	3,600	63.5	10.9
Ireland	110	31.2	0.3
Italy	50	0.9	0.2
Luxembourg	30	78.5	0.1
Netherlands	240	22.6	1.0
Portugal	2	0.2	0.0
UK	27,000	468.9	81.6
EC Total	**33,100**	**95.9**	**100.0**
US	45,145	179	
Japan	7,160	76	

Sources: EC, PROBE Research for US data

263 Similarly the importance of leased line revenues relative to PSTN revenues is, in general, greatest in those countries where liberalisation is furthest advanced as illustrated in Table 5 below.

264 In the UK, leased circuit revenues represent 11.4% of PSTN revenues, far higher than elsewhere in the EU (except Luxembourg which is unrepresentative) and reflecting the relative regulatory freedom. The high proportion shown in Luxembourg may reflect the relatively high concentration of international businesses and hence reflect differences in demand. In France, leased circuit revenues fall to 6.5%, whereas in Germany and Denmark, where competition is further restricted, this falls to 5% and 2.8% respectively. The high proportion shown in Luxembourg may reflect the relatively high concentration of international businesses and hence reflect differences in demand.

Table 5: Network and market development

Country	% Local Switching Digital	Total PSTN Revenues (m ECU)	Total Leased line revenues as a % of PSTN
Belgium	45	2,119	6.6%
Denmark	50-60	1,853	2.8%
France	75-85	14,873	6.5%
Germany (Fr)	60-65	19,758	5%
Greece	7-10	1,017	0%
Ireland	80-90	1,017	2.5%
Italy	40-50	13,111	5.9%
Luxembourg	70-80	124	21.7%
Netherlands	80-85	4,311	4.8%
Portugal	50-60	1,165	2.3%
Spain	35-45	6,579	7.5%
UK	70-80	18,380	11.4
Japan	80-90	39,686	8.2%

Source: OECD, 1991

265 As this data demonstrates, it is possible to achieve high levels of network modernisation without liberalisation, eg in France. However, liberalisation always tends to be associated with modern networks and higher penetration of digital leased circuits.

266 Although modernisation has been achieved in Europe without liberalisation, prices remain high. Table 6 illustrates that European high capacity leased circuit prices are an order of magnitude greater than in the US.

Table 6: High Capacity Leased Circuit Prices[1]

EU half circuits	Rental to nearest EU	Rental to furthest EU
B[2]	21,793	29,380
DK	17,800	20,005
D	27,920	33,450
GR	26,165	33,224
E	30,370	30,995
F	24,185	31,715
IRL	3,820	30,580
I	27,695	33,780
L	16,996	27,250
NL	19,075	25,308
P	21,135	31,795
UK (BT)	10,041	40,778
UK (M)	8,817	23,958
EU	**20,532**	**29,987**

EU total circuit price[3]	**41,064**	**59,974**
US	**3,809[4]**	**5,666[5]**

Source: Omicom

1 Prices are in ECU for monthly rental over a three year contract period, correct at 01.01.94. Connection charges are spread over three years. European prices are for E1 half circuits (operating at 2 Mbit/s). US prices are for full T1 circuits operating at 1.5 Mbit/s and assume a total network spend of approximately 22,000 ECU.

2 In Belgium connection charges are decided on a case-by-case basis. These have not been taken into account.

3 Sum of two EU average circuit halves.

4 Example AT&T T1 circuit taken over Seattle to San Francisco route (1,105 km).

5 Example AT&T T1 circuit taken over San Francisco to Kansas City (2,423 km).

Current levels of TO development

267 As can be seen, the market for infrastructure in the EU shows a high degree of variation, and significant under-development in many cases. This reflects the variation in the level of development of telecoms markets generally and, because of the basic service monopoly situation in most Member States, in the TOs also. In understanding the current situation and in evaluating liberalisation impacts, it is important to recognise the relationship between the level of development of the TO and the infrastructure market.

268 We have therefore sought to characterise the various levels of TO development which are encountered in the EU to enhance our understanding of the current situation and to facilitate analysis of impacts. The framework we develop in this section identifies a number of stages through which TOs are likely to progress over time. These stages are defined in terms of a number of key characteristics and variables. These include, for example, the service and revenue mix, the development of the network and the nature of costs, prices and profits both overall and in relation to particular services.

269 The evolutionary path we identify can be thought of as depicting a life cycle that a typical TO is likely to follow and reflects the changing interaction between market, technological and regulatory factors. The life cycle has been developed by drawing on the experience of telcos around the world and judgements based on our understanding of the European environment.

270 The TOs of each of the Member States will be at different points through the life cycle and it is important to recognise that the impact of liberalisation on the TO (and its response) will vary according to its maturity. Potentially the impact could be positive or negative ie liberalisation may provide an overall benefit to the TO by stimulating the market and by giving a competitive spur to the TO improve its own performance, provided the TO has the management capabilities and financial resources to respond. Alternatively, competitors could make a significant negative impact on revenues if the TO were not in a position to compete, depriving it of

sources of investment funds. This argument is often used to defend continuing monopolies in less developed markets. In constructing our analysis in this way we are able to address such issues explicitly.

271 Table 7 illustrates the main features of the life cycle model. There are four levels of development which we have named 'initial', 'modernising', 'mature' and 'advanced'. These levels are somewhat arbitrary and in reality there will be a continuum of development. We have characterised the state of the TO at each of these stages in terms of:

Services and revenues: the range of services offered and the relative balance of revenues between them.

Network development: the state of the network in terms of the modernity and sophistication of the switching and transmission infrastructure.

Productivity: an indicator of the cost efficiency of the TO, which we measure in terms of lines per employee.

Costs and prices: another important indicator of TO maturity is the extent to which prices of services are aligned with costs.

272 Other characteristics could help define each of the stages of development, (for example quality of service), but the above four characteristics are sufficient, we feel, to portray the situation adequately.

Table 7: Stages of TO development

	Initial	Modernising	Mature	Advanced
Services and revenue	99% PSTN Few leased circuits, nearly all analogue No advanced services	95% PSTN Equal analogue and digital leased circuit revenues Pilot advanced services	90% PSTN Digital leased circuits revenues dominate analogue revenues Advanced services commercially established	90% PSTN Digital leased circuits strong VPN key business service Other advanced services significant
Network development	70% + of switching and transmission analogue Limited fibre penetration in backbone	50-30% analogue switching, 60-70% digital transmission fibre majority of backbone Limited trials of IN	30-10% analogue switching, 90-100% digital transmission nearly all fibre, partial SDH and CCSS7 IN overlays	<10% switching analogue, 100% SDH digital transmission backbone mainly fibre, some fibre in local loop CCSS7 signalling IN platform
Productivity (lines per employee)	100-125	125-175	175-250	250-300
Costs and Prices	Strong cross subsidy to access/local services from long distance telephony Leased circuits inflated to choke of demand	Early telephony rebalancing Digital prices used to manage demand	Further rebalancing Digital circuits Moving towards costs Advanced services prices rationed	Telephony and leased circuit cost based Advanced services commercially priced

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Initial stage

273 At the earliest stage of the development cycle the TO is providing a fairly basic service. Nearly all revenues are generated by the PSTN. Leased circuits are likely to be few and analogue and in many cases fault prone. The bulk of switching and transmission in the network is analogue, but there may be some fibre in the transmission backbone. Costs will be relatively high as the prevalence of analogue technology and probably old equipment, adversely impacts productivity. Prices for telephony services will typically be highly distorted with significant cross subsidy to access and local service from long distance services. Leased circuit prices will be high, reflecting low volumes and probably a desire to manage demand. The priority for a TO in this situation will be funding large scale investment in updating the basic network in order to achieve minimum quality levels, meet service obligations and improve profitability through better productivity. This description probably fits only one or two TOs in the EU, as indicated by the data on the availability of digital infrastructure presented earlier.

Modernising stage

274 As the TO begins to modernise, increasing investment in digitalisation of the network becomes evident, both in switching and transmission. As a result digital leased circuits become increasingly available, although their prices will often be used to manage the migration of users from analogue leased circuits and to protect PSTN revenues. There is likely to be an excess demand for digital infrastructure at this stage. Advanced services are likely to be introduced on a trial basis. Productivity improves as a result of increased digitalisation. The major objective of a TO in this position will be to manage a major investment programme and to try to balance its financial position with meeting the growing expectations of users.

275 A number of European TOs are currently at or around this level of development and exhibit a number of the characteristics described above. This is consistent with low availability and high prices of digital services in some areas

identified in the review of the current market. Some improvement in availability and prices of digital infrastructure can be expected but is unlikely to be rapid because of the TOs' interest in managing the migration to digital infrastructure and protecting PSTN revenues.

Mature

276 As the TO modernises further, the network becomes almost all digital, with a very high proportion of fibre in the backbone. Technology to support advanced services is introduced selectively - eg SDH, CCSS7 and IN overlays. Digital services are strongly marketed as their prices move towards costs (driven by competition or conformance with ONP). Advanced services become available on a commercial basis. The key focus of the mature TO will be broadly to develop services to business and residential customers in order to begin to earn a return on the heavy investment costs taken on during its modernisation phase.

Advanced

277 By this stage, which reflects the state of the art, the TO would be operating a fully digital all SDH fibre intensive network, supporting for example CCSS7 and IN. ATM would not be far off. Digital services would be marketed as a commodity, VPN would be a key business service and other advanced services would be strongly marketed. Costs and prices would be fully aligned. Productivity would be extremely high reflecting the use of advanced technology, much of it cost saving (eg SDH in the network). The TOs focus would be on marketing, innovation and cost control as means of securing continuing profit growth.

278 A significant number of European TOs are at or reaching the 'mature' stage. A few, the UK, France and the Netherlands, for example are approaching the 'advanced' level, but none can be described as state of the art. As a result of a number of European TOs reaching maturity, the technical constraints on the supply of digital infrastructure have probably been relieved in many markets. The lack of

development of the market may therefore reflect not inability but rather reluctance on the part of TOs to market digital infrastructure aggressively, perhaps mindful of the potential impact on PSTN revenues.

279 We will return to this model later in this report when we undertake to analysis of the impacts of liberalisation.

User Survey

280 In order to obtain a perspective from users of infrastructure, we interviewed (by telephone and by correspondence) a number of companies interested in the liberalisation of infrastructure within Europe. Our research indicated that the majority of large corporations are users of leased circuits.

Survey results

281 The general consensus among major users seems to be that increased competition in provision of infrastructure would reduce the price of services to users and the proportion of costs represented by telecoms procurement would drop. Users pointed to experience in other markets, where service availability and prices had improved significantly under competition.

282 A number of interviews highlighted the different technical standards and different levels of service quality existing within Europe that make it different to construct and operate a pan European network. These need to be addressed to provide a more consistent and satisfactory service across the E.U. However, competition alone may not be sufficient to do this because, initially, there would be no credible intra-European infrastructure operator.

Table 8: Intra-European digital circuits/network costs compared to equivalent circuits/network costs in domestic USA

Route	Capacity (M/bits)	Cost pkm (Kecu)	Distance (km)	Equiv US Cost pkm (Kecu)
Bru/Par	2	23.2	273	1.9
Bru/Ams	1	15.7	158	1.4
Bru/Lux	1.5	19.0	188	1.6
Bru/Lon	2	24.5	340	1.9
Lon/Ams	2	23.9	370	1.9
Lon/Fft	2	31.6	644	2.3
Lon/Gva	2	32.5	735	2.4
Lon/Par	5	77.3	336	5.4
Lon/Sto	4	45.2	1461	6.7
Par/Lux	1.5	17.2	289	1.8
Par/Gva	2	24.3	402	2.0
Par/Mad	1	21.1	1044	2.3
Fft/Ams	2	27.0	367	1.9
Fft/Gva	2	30.2	482	2.1
Fft/Lux	1.5	25.2	177	1.6
Fft/Vie	1	30.2	620	1.9
Ams/Lux	1	14.4	315	1.5
Gva/Bar	1	27.9	635	1.9
Gva/Mil	2	31.8	237	1.8
Zur/Vie	1	25.4	603	1.9
Local Loop Totals		567.6		16.1 62.2

Notes

1 Bookrates against £ used; Belgium 52.8, France 8.6, Germany 2.5, Holland 2.8, Spain 198, Sweden 12.1, Switzerland 2.2, Luxembourg 52.8, Austria 17.4, Italy 2385, USA 1.5.

2 European costs are actual (ie include discounts where appropriate).

3 USA costs are from AT&T bookrates, without discounts ie USD3.65 per airline mile plus USD2600 fixed cost.

4 USA costs based on T1 rate; costs for 1M/bit circuit calculated from T1 rate less 13%, costs for 2M/bit circuit calculated from T1 rate plus 5%.

5 USA local loop charges are based on an average of USD750 per T1 circuit end per month.

6 Converted from £ at 0.770 ecu/£

Reuters, London

EC02006.TAB

283 For GEIS the value added service operator, the average cost of telecommunications as a percentage of revenue is higher than most other businesses. It stated that "current arrangements within the EU are extremely unsatisfactory in general with regard to the prices of longer distance and inter-state leased lines, which inevitably form a significant percentage of the costs of service provision. This in turn renders some applications which could otherwise be provided in other markets (eg. the USA) uneconomic to provide and use. Quality of service and supply conditions are variable, both in and between countries, and many merit improvement".

284 GEIS also pointed out that in its view, where competition exists, prices are usually lower, and quality improves more rapidly. Tariff rebalancing programmes have initiated some improvements, but pricing is far from reflecting "best practice" costs. Leased line tariffs in particular have a pervasive influence on the costs of value added services, and, for example, inter-cellular connections and hence mobile services. Nevertheless other tariffs, PSTN in particular, impact value added services markets because of the general need for interconnections."

285 Reuters also states that there are a number of areas of dissatisfaction with the current situation. Most notably it wishes to see more competitive offerings in the belief that competition has the effect of reducing prices and improving service. In particular, the company thinks that there is little justification for a price differential of a factor of ten between networking in Europe and the USA. (See Table 8, data supplied by Reuters)

286 INTUG similarly believes there is a negative impact on members' businesses. They report that users are very dissatisfied with the current situation, believing that it generates a considerable disadvantage to European businesses due to:

- the limited range of services available with regard to speed and quality; and

- the extremely high prices relative to other parts of the world (especially North America).

The ability to choose another network provider would, according to INTUG, improve the range and function of services, service quality and price, as has been demonstrated in similar situations following the introduction of competition.

287 We have attempted to summarise the current performance of the infrastructure market in terms of a number of performance indicators. Users of infrastructure will have five key requirements of the infrastructure market:

Low cost:	infrastructure at cost based prices;
Quality of service:	high reliability and responsive customer service;
International 'seamlessness':	the ability to readily construct trans-national networks without undue difficulty;
Ubiquity:	availability of infrastructure in all geographic areas;
Availability of advanced services:	access to very high speed circuits and other new services.

288 Different types of user will assign different levels of priority to each of these performance criteria. We have identified five groups of users of infrastructure:

- Value Added Service providers, which may be national or international;
- Multi-national businesses which are likely to be of manufacturing nature, many using advanced processes;
- Financial Services organisations which may be of international or national nature;

- National businesses which are likely to have multiple sites in a given country; and

- the higher education/research community.

289 Table 9 summarises the importance attached to each of the performance criteria by each of the user groups. For VAS providers the priorities are cost, quality and where their activities are international, the ability to set up trans-national networks. They are probably less concerned about ubiquity of coverage since their own business will focus on the main economic centres, and the availability of advanced services.

290 Multinationals although perhaps marginally less price sensitive, will focus on the ease of international networking and quality of service. Those MNCs involved in advanced process industries such as car manufacture or petrochemicals will have particular demand advanced services for applications such as remote CAD/CAM. Ubiquity of service will be of little concern since their businesses are likely to have only a few sites in each country.

Table 9: Importance of aspects of infrastructure market performance by user group

	User Group				
Performance Criteria	**VAS**	**MNC**	**Financial Services**	**National Business**	**Education/ Research**
Low cost	High	Medium	Medium	High	High
Quality of Service	High	High	High	High	Medium
International Seamlessness	High	High	High Medium	Low	High
Ubiquity	Medium	Low	Medium	High	Low
Availability of advanced services	Low/ Medium	High	Low	Low	High

291 The financial services industry will assign highest priority to quality of service and, where they are international, the ability to develop trans-national networks. Such businesses are not likely to be prime users of advanced services.

292 Similarly, national businesses will assign less priority to advanced services than to having widespread national coverage of infrastructure of high quality and low price.

293 The education and research community will perhaps be less sensitive to price and quality issues but will attach great importance to inter city national and international inter-connectivity and Table 10 summarize the current performance of markets at each stage of development with respect to the user requirements which have identified the availability of high bandwidth services on this basis.

Table 10: Performance of infrastructure market by level of development

	Market Development			
Performance Criteria	Initial	Reservicing	Mature	High
Low cost	Low	Low	Medium	High
Quality of service	Low	Medium	Medium	High
International seamlessness	Low	Low	Low	High
Ubiquity	Low	Medium	High	High
Availability of advanced services	Low	Low	Medium	High

294 By comparing the user priorities with current market performance it is possible to infer which users are being least well served and which aspects of the market's performance are most significant:

- a market at the 'initial' stage of development poorly serves all users in all respects;

- lack of international inter-connectivity in almost all levels of development disadvantages those with markets with international

communications requirements (MNCs, education/research and international VAS and financial services businesses);

- poor cost performance affects all users but probably has the greatest impact on VAS operators and national businesses;

- the lack of availability of advanced services most strongly impacts MNCs and education and research users;

- the lack of ubiquity of service is most significant to multisite national businesses.

Economic effects of the current situation

295 As illustrated by the user survey the data presented earlier and the analysis of user needs it is clear that the provision of leased circuits within Europe is underdeveloped relative to other countries including the EU's major economic competitors and that the European market suffers from:

- low service quality and availability of digital infrastructure;

- obstacles to the establishment of trans-national networks; and

- repressed potential demand due to the artificially high level of prices.

296 This results in:

- European users of leased circuits being put at a relative competitive disadvantage to, for example, their North American counterparts. Because digital leased circuits are not readily available European enterprises are unable to match the inter-site communications capability enjoyed by their non-EU competitors. This causes relatively higher

costs, reduced flexibility and impairs the competitiveness of European businesses;

- the existence of prices well above costs generates the economic inefficiency associated with monopoly power, ie dead-weight losses that are borne by the European economy as a whole:

  - reduced demand for other goods and services because the cost of leased circuits absorbs a higher proportion of potential expenditure than if prices were cost based, reducing disposable income available for other purchases;

  - unsatisfied potential demand for leased circuits from those users who are not prepared to pay current prices, but whose potential benefit from the use of leased circuits exceeds the cost of provision of leased circuits; and

- slower technical innovation in the supply of infrastructure and a poorer "fit" between the services supplied and the requirements of the user.

2.5 Conclusions - the current situation

297 Although there are wide variations, in virtually all Member States users are dissatisfied with the current provision in particular, of digital infrastructure. Service quality and availability of service is poor, it is difficult to establish trans-national networks and prices are exceptionally high. As a consequence European users of leased circuits are being put at a significant disadvantage to their economic competitors. The extent of this disadvantage is illustrated by the 10 to 1 price ratio in the prices of 2 mb/s leased circuits in Europe compared to the US.

298 One of the key issues which this study seeks to address is the impact that liberalisation of infrastructure provision will have on TOs at various stages of the 'natural' development process, ie will the impact on the development of TOs be

accelerated or inhibited - by liberalisation. We address this issue in Chapter 5. Before that however we turn to assess the potential of alternative infrastructure (Chapter 3) and the economics of infrastructure based market entry (Chapter 4).

3 The potential of alternative infrastructure

3.1 Introduction

301 The purpose of this chapter is to review issues relating to the feasibility of exploiting existing, or constructing new alternative infrastructure for the provision of transmission services. We also refer to the possibility of organisations other than utilities constructing infrastructure to self provide for their own telecommunications needs. These issues include technical, economic, legal, regulatory and institutional factors. We focus on the economic validity of alternative implementation provisions in the next chapter.

302 In the preceding chapter we developed a multi-layered model with which to review the existing infrastructure market. Utilities typically possess assets in each of these layers, which potentially could be exploited in the provision of third party telecommunications services. Such exploitation would appear to be an attractive way of increasing the supply of infrastructure, compared to the construction of new Telecoms infrastructure on a stand alone basis. However there are a number of potential obstacles which we explore in the remainder of this section. We also provide some examples of ventures in which these obstacles are being overcome with the prospect of achieving a significant impact on the market.

303 Tables 11 and 12 identify the various assets possessed by rail and electricity utilities which can be potentially used in providing infrastructure services. At each layer of our multi-layered model we identify the asset and how it is used in the core activity of the utility. We then show how these assets can be used for telecoms purposes and finally identify some of the practical obstacles which are likely to be encountered in exploiting the asset in this way.

Table 11: **The potential for the electricity utilities to exploit existing assets for alternative infrastructure provision**

	Property Right	Right of Way	Physical Support/ Accommodation	Transmission Medium	Transmission service
Asset and core business application	• Land surrounding office, generating and substation sites	• Overhead infrastructure - right to overfly land - right of access to towers/poles • rights to dig or bury cables and install ducts	• Space inside buildings, substations, • Towers/poles for transmission and distribution • Ducts used for transmission and distribution	Fibre optic cable installed for internal communications purposes	Capacity in fibre or microwave systems used for administrative and operational applications
Potential for use in commercial telecommunications	• Construction of accommodation for telecoms equipment • Downtown substation sites attractive for Points of Presence	• Overhead RoW not attractive without physical support • digging rights may be attractive	• Installation of fibre optic cable on towers and poles (wrap, ADSS or OPGW) • Mounting microwave or cellular radio attenae on tower/poles • Threading fibre optic cable through ducts	• Sale of unequipped (dark) fibre or fibre strands • Joint construction of fibre	• Leasing of spare capacity to 3rd parties • Construction of additional capacity under a range of financing arrangements
Obstacles to use of assets in commercial telecoms	• Need to control access to critical hostile sites	Need to ensure that electricity RoW can be used for commercial telecoms, this may involve additional cost/time delays	• Suitability of overhead infrastructure for fibre • controlling access during construction/maintenance • Physical strengths of towers to bear weight of attenae • Often poor condition of duct, lack of space and spare geographic coverage.	• Availability of fibre • Availability of partners to share construction costs • Operational issues in sharing fibre	• Some operational issues in sharing capacity

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Table 12: The potential for the railways to exploit existing assets for alternative infrastructure provision

	Property Right	Right of Way	Physical Support/ Accommodation	Transmission Medium	Transmission service
Asset and core business application	• Land surrounding, offices, stations, signal boxes. Land along tracks may be owned	• Where trackside not owned, RoW will exist	• Trackside ducts used for internal telecoms • New duct • Space in buildings • Towers for microwave systems	• Fibre optic cable installed for internal communications purposes	• Capacity in fibre or microwave systems used for administrative operational applications.
Potential for use in commercial telecoms	• Trackside useful for constructing trunk networks • Buildings more often out of town centres and of limited attraction	Trackside construction for trunk networks	• Laying fibre in existing ducts • Mounting attenae on towers • Equipment in building	• Sale of unequipped (dark) fibre or strands • Joint construction of fibre	• Leasing of spare capacity to 3rd parties • Construction of additional capacity under a range of financing structures.
Obstacles to use of assets in commercial telecoms	• Operational issues during trackside construction.	• Operational issues • Need to convert RoW for commercial telecoms	• Operational issues • Quality of existing ducts • Strength of existing towers	• Availability of fibre • Availability of partners to share construction costs. • Operational issues in sharing fibre	• Some operational issues in sharing capacity

3.2 Property rights

304 As can be seen from the summary charts, all utilities are likely to own property on which telecommunications facilities can be constructed. In this respect they are similar to many other multi-site organisations, however, the geographic coverage of their assets is likely to be amongst the most extensive. Where their core business gives them a presence in city centres, they will possess sites in close proximity to attractive telecommunications markets and therefore of considerable commercial value.

305 Typical users of these facilities are likely to be telecommunications infrastructure operators or organisations seeking to self provide their own telecoms infrastructure, requiring space to construct accommodation for switching or transmission equipment or to construct towers to support radio equipment. Potential users would therefore include fixed network operators and cellular and other mobile network providers.

306 Commercial arrangements between the infrastructure operator and the utility would typically be via a lease. Although the revenue potential is relatively small, very little, if any, investment is required by the utility. The only risk that must be managed is access by third parties to sensitive and potentially hostile environments (for example electricity substations)

3.3 Rights of way

307 Utilities will also possess a range of Rights of Way (RoW) which allow them to access sites, overfly land with cables, or dig in private or publicly owned property. Where private land owners are involved, the RoWs are typically negotiated and are based on contractual terms which specify the rights and obligations of the utility and the compensation that the grantor of the Right of Way will receive.

308 In publicly owned land the utility will typically be given specific rights to gain access, together with certain obligations such as speed and quality of reinstatement of

roads and footpaths. These may be specified in municipal, regional or national legislation or within the utilities' charters. In most cases the arrangements are likely to have long historical precedent and be highly complex.

309 Clearly RoW's have considerable potential for commercial telecoms. There are, however, a number of obstacles to the exploitation of these RoWs in commercial telecoms by the utilities themselves, or by third parties.

The major obstacles to exploiting RoWs include:

- **conversion to telecoms use:** the RoWs granted to utilities will almost certainly be for carrying out their core activity; telecommunications may be included, but only to the extent to which it supports the utilities' main function. If they are to be used for commercial telecommunications purposes RoW grantors are likely to wish to re-negotiate their agreements and seek greater compensation in view of the additional revenue being earned by the utility. This process will obviously add costs and may cause significant delays or uncertainty, making the RoW considerably less attractive for use in telecommunications by the utility or third party.

- **operational concerns:** exploitation of RoWs for telecommunications purposes by third parties require that these parties have access to sensitive and potentially dangerous sites such as rail trackside and electricity transmission infrastructure, where any disruption could seriously jeopardise the utility's core activity. For these reasons it may not be practical for a utility to sell on its RoWs to third parties in many cases.

The most attractive opportunities are for track side, canal side long and overhead electricity network based distance network construction, and the use of digging rights in public highways, particularly in urban and suburban environments.

3.4 Supporting infrastructure

310 The next group of assets are those which can be used to support or accommodate telecommunications equipment or transmission media. Such assets include:

- space inside buildings such as substations, and signal boxes where equipment can be accommodated;
- towers or high buildings supporting existing private telecoms radio equipment;
- PTO ducts
- ducts used for electricity distribution/transmission or alongside rail tracks in which fibre or copper cables can be laid;
- electricity transmission towers or poles which can support:
  - self supporting fibre (All Dielectric Self Supporting, ADSS) strung between them;
  - fibre optic cable embedded in the earthwire of transmission lines Optical Ground Wire, (OPGW);
  - fibre optic cable wrapped around the earthwire (wrap).

311 Exploitation of water, sewerage and gas pipes may also be possible but technical problems have so far prevented significant exploitation for telecommunications purposes. The costs of sharing existing assets is marginal and installation of fibre in existing ducts or on overhead lines can be substantially cheaper and quicker than traditional methods. In either case the need to dig is obviated and so these network construction methods are insignificantly less environmentally

disruptive than more conventional techniques. Methods for installing fibre are now well established and high reliability levels can be achieved. The use of PTO ducts, radio towers and poles by other infrastructure providers also has significant potential but has far reaching regulatory and commercial complications. Many PTO's would resist this strategy for commercial reasons.

312 A number of obstacles commonly arise which mean that in some cases it is not technically feasible or economic to exploit utilities' or PTO's assets for the construction of alternative telecoms infrastructure. These obstacles vary on a case by case basis so it is not possible to draw overall conclusions without specific evaluation. Common problems which do occur include:

- congestion in ducts;
- absence of ducts to customer premises (e.g. electricity cable is often directly buried to improve heat dissipation);
- absence of a ground wire on electricity transmission systems to support wrapped or composite fibre;
- insufficient strength in poles and towers to support additional loading; and
- inadequate commercial structures.

313 The major implication of these problems is that utility or PTO assets can sometimes be of less practical use than might have been expected, particularly in providing an easy solution to the 'last mile' problem.

3.5 Transmission medium

314 The next type of asset that can be exploited commercially in the provision of telecoms services is transmission facilities used for internal telecommunications. The

most likely example is use of strands in fibre optic cables installed on either electricity or rail supporting infrastructure. At this layer of our model these strands would not be equipped with opto-electronics (and are known as dark fibres). Dark fibres can be provided under a number of possible commercial arrangements. These range from the utility financing the fibre construction itself and speculatively seeking purchasers for strands, to 3rd parties funding the construction and taking effective ownership of the fibres with the utility receiving a few strands for its own internal use (this latter model is common in N. America). It should also be observed that some PTO's have spare fibre, or could easily install additional fibre, which could be leased to alternative infrastructure providers. As with ducts, most PTO's would be strongly opposed to dark fibre leasing for commercial reasons.

3.6 Transmission services

315 At this level the alternative operator uses digital transmission capacity in its existing, or specially constructed telecommunications facilities provide third party services. The provision of such services requires that the telecoms network is managed to provide service to both the core business and commercial customers. This approach appears feasible at low volumes of third party business. At large volumes problems may arise.

316 The criticality of many core business telecommunications applications means that there is likely to be internal pressure on the telecoms operation to assign priority to serving these applications, possibly to an extent which may conflict with the provision of a commercial service. For this, and cultural reasons (see below) it may be attractive to a utility entering the telecoms market to establish a separate network, run as a relatively independent operation, for example as a subsidiary, in order to ensure that the levels of quality and customer service required to run a successful commercial telecoms business are not compromised by pressures from the core business. This is the model pursued by UK National Grid Company which set up Energis as a subsidiary company (see below). Another motive for establishing a new, relatively independent network is that an existing network configured to serve internal needs may have insufficient spare capacity and lack the appropriate transmission,

switching and management capability required to support a commercial telecoms operation of significant scale.

3.7 Regulatory issues

317 Many utilities are publicly owned and might be required by government to provide access to infrastructure assets equally to all third parties, for the construction of alternative telecommunications networks (in a liberalised telecoms environment). This could cause commercial difficulties to utilities (if they wish to enter the telecoms market themselves) or practical difficulties (of several organisations required access to assets).

3.8 Cultural and organisational issues

318 At the higher levels of the model the alternative infrastructure provider is operating as a commercial telecommunications organisation. It will need to perform the functions of such an entity such as marketing the service to customers, negotiating and delivering service on contractually binding commercial terms. For many utilities, operating in this way in its core activity, would represent a major cultural change; to do so in another, more complex, market would be extremely ambitious for many. For this reason many utilities considering entry into telecoms will seek telecom operating partners, either from within or outside of the EU.

319 Another objective for partnership is to share financial risk. Where additional capacity is constructed primarily for commercial use, the financial outlay could be very considerable and unattractive to a typically risk averse organisation. Sharing the financing of such a construction with a partner would go some way to mitigating utilities risk.

3.9 Actual and potential alternative infrastructure operators

320 The previous discussion highlighted that there exists considerable potential for exploitation of a number of utility assets in the commercial provision of many elements of alternative infrastructure, although in some cases a number of difficulties will need to be overcome. In this section we profile a number of the declared potential alternative infrastructure operators. These are:

- Energis (UK);
- Hermes/Hit Rail (Europe wide).

321 Notes on a number of other potential entrants are provided in Annex A.

Energis

322 Energis is the telecommunications company of the National Grid Company (NGC) in the UK. NGC owns and operates the national electricity transmission network in England and Wales and is owned by the 12 Regional Electricity Companies. Energis is a subsidiary of NGC and its relationship with its parent is on an arms length, commercial basis.

323 Energis has been authorised to spend around £200m on developing a fibre optic network linking major cities and towns in England and Wales, over which it will offer a full range of telecommunications services in competition primarily with BT and Mercury. Commercial launch is planned for 1994.

324 The network is being constructed of a combination of wrapped and composite fibre optic cable mounted on NGC transmission towers and earth wires. The fibres will typically be 24 strand and constructed in a ring configuration. These two factors in combination with SDH transmission equipment will result in a network of very high capacity and quality. Energis has sought to outsource most of the network development to minimise costs and share risk. Northern Telecom is responsible for the network transmission and switching, while Digital secured the contract for the

provision of IT to the organisation. Energis has also sought an operating partner and been in negotiations with AT&T, although these are understood to have broken down.

325 Energis is planning a full range of service offerings. The high capacity of its network and SDH technology will allow it to provide high speed leased lines to specialist and large corporate customers. It has already secured a contract worth an estimated £100m for the provision of such services to the BBC. Its network technology will also allow it to provide state of the art advanced services as demand develops. It also plans to offer telephony services to business and residential customers, deploying a variety of access methods. Where volumes are large enough, it will construct direct connection to customers. Alternatively it will interconnect with BT's local infrastructure and that of the cable companies. Telephony provides a significant proportion of the company's anticipated earnings and is an important part of its business plans.

Hermes

326 Hermes is a company founded by a consortium of 11 European railway companies with the objective of offering trans-European high bandwidth services. The company intends to construct a new fibre optic network using trackside Rights of Way owned by its rail company parents. The network will be trans European with the possibility of expansion into Eastern Europe. The network will use high fibre count fibre optic cable (40 strand) and SDH digital transmission equipment so enabling the provision of very high capacity leased circuits. The anticipated cost is some ECU 500m. The main customers are expected to be large user groups, large companies, specialist middle sized firms, alternative carriers, research organisations and existing TOs.

327 The implementation of the business plan, however, is currently stalled. Hermes is still seeking an operating partner to halve the investment costs and to bring commercial telecommunications network operating experience. The organisation had been in advanced discussion with Nynex, the Regional Bell operating company, but the US company has now withdrawn, although a number of European TOs have shown

interest. The management of Hermes cite the current uncertainty surrounding infrastructure liberalisation in Europe as the major obstacle to securing the commitment of partners and proceeding with their plan. A further related difficulty faced by the organisation, is the necessity of dealing separately with the regulations in each of the member states. In the management's view the introduction of common European approach, would greatly assist companies such as theirs in developing pan-European services.

A Southern European electricity generating and distribution company

328 The company which is privately owned and prefers not to be named, is typical of a number of electricity companies which are quite aggressively pursuing opportunities in telecommunications, but which are currently inhibited in exploiting the full value of their assets by the regulatory situation.

329 The company has developed a number of other diversified businesses and became involved in telecommunications fairly recently. Since then it has become involved in consortia bidding for, or has obtained, licenses to operate paging services, PMR service and a second cellular network. In participating in these businesses it will use its physical assets (eg substation sites, town offices, transmission towers etc) to support various items of telecommunication equipment. It will not, however, be able to use spare capacity in its existing internal telecommunications network, even though it is available and suitable. The national regulatory environment prohibits such use and requires that these operators lease transmission capacity from the TO.

330 Unusually in our experience, this company has a local telecommunications infrastructure in a number of major towns in addition to the commonly encountered intercity network. Should the regulatory environment change, the company would be keen to invest in its telecoms infrastructure, particularly in the local access component, to provide telecommunications services to major users.

3.10 Conclusions

331 The major points emerging from the preceding discussion of the potential of alternative infrastructure are as follows:

- existing utility telecommunication networks are unlikely to offer significant capacity for commercial exploitation; further investment in additional facilities by the utilities would be required;

- utility assets can be used to construct new telecommunications infrastructure more quickly, more cheaply, and with less environmental disruption than conventional methods, although these benefits are more likely to be available in the construction of long distance rather than local infrastructure. Exploitation of long distance infrastructure will require either construction of local access or use of existing TO customer connections.

- when constructing new telecommunication infrastructure for commercial purposes, utilities are likely to seek a telco operating partner to provide expertise and capital and seek to establish a independent telecommunications network for commercial purposes in order to overcome of operational and cultural barriers associated with sharing assets between the core functions of the utility and a commercial venture;

- while a number of utilities in Member States such as France, Germany and others, are known to be considering such an investment, none outside of the UK has as yet been allowed to undertake network construction.

332 To analyse the likelihood of utilities and their partners undertaking the considerable commitment necessary to cover alternative infrastructure, we shall now analyse the economics of market entry as an alternative infrastructure provider.

4 The economics of alternative infrastructure provision

4.1 Introduction

401 In this section we review the economics of market entry as an alternative infrastructure provider. The purpose is to develop an understanding of the interaction between technologies, costs and the level of market development. This understanding will then allow us to predict if, and how, alternative provision is likely to develop in each of the four market types we identified in Chapter 2.

402 We focus on two types of entry - alternative local provider and long distance carrier. In the scenario under examination in this report the alternative local provider would offer transmission services and could also offer value added and advanced services currently in the liberal domain. These services could be offered on a purely local basis only, or the alternative local provider in addition, could provide access to alternative long distance infrastructure and services. It would not be able to offer public switched telephony in either case.

403 We concluded in the previous Chapter that utilities are unlikely to have an existing local or metropolitan area network from which an alternative local provider business could sell spare capacity. An alternative local provider would therefore need to construct a network specifically for commercial purposes, although it might exploit a number of utility assets. When discussing alternative local providers we are assuming, therefore, that the form of infrastructure liberalisation adopted permits such construction. If the form of liberalisation is restricted to the sale of transmission services on existing telecoms networks, or new networks sharing commercial and internal applications, ie excluding solely commercial networks, then entry as an

alternative local provider in this way is excluded, because there is unlikely to be a significant utility application for such infrastructure.[1]

404 The long distance carrier in our analysis would supply long distance transmission services and could also supply value added or advanced services in the liberal domain. Again it would not be able to supply public switched telephony, at least initially. According to the form of liberalisation adopted, the basis of the business could be spare capacity on existing infrastructure, newly constructed infrastructure combining commercial and internal applications or specially constructed infrastructure. The analysis presented below assumes a newly constructed network either for combined or solely commercial use.

Alternative local provider

405 The economic drivers of market entry as an alternative local provider are depicted in Figure 2. Entry of this form will require commitment to investment in some form of ring or backbone infrastructure in a defined geographic area. The ring/backbone will probably be fibre optic cable of a high fibre count. Customer access will be either via fibre or via high capacity digital radio depending on the environment and the intended applications. The alternative local provider is likely to seek the most economic method of installing fibre and will consider electricity ducts, if available, overhead lines and even sewers if cheaper than new civil works to instal ducts. Whichever method is used, entry of this form will involve a considerable fixed cost, which will dictate the minimum economically viable market size.

406 The value of the market to the alternative local provider in a given centre will clearly depend on the number of potential customers and the level of their telecoms expenditure, which in turn depends on the sophistication of their telecoms needs and the alternative local providers ability to meet the services users' requirements on competitive terms. Most critical however, will be the economics of interconnect agreements for services outside the area.

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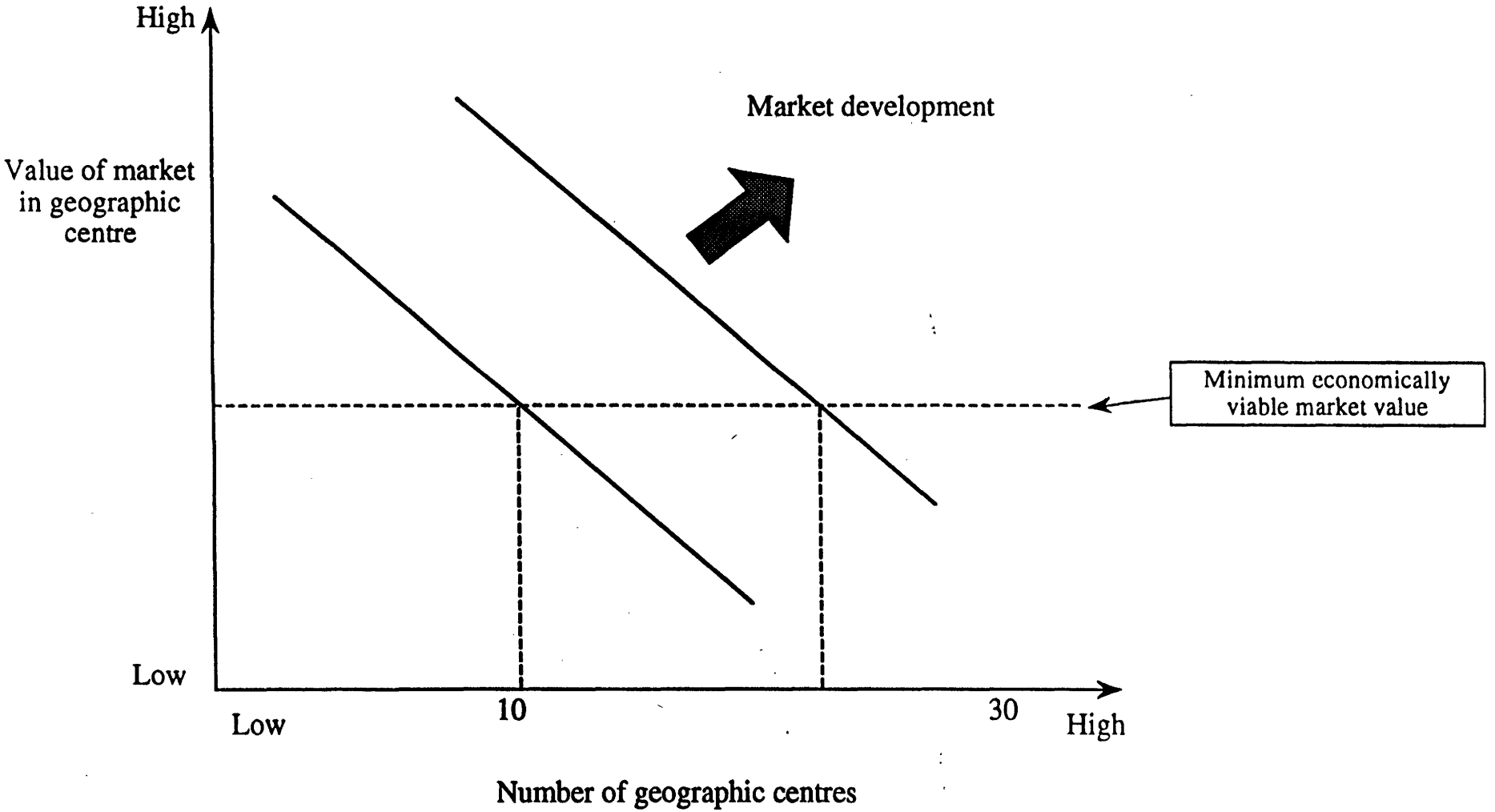
1 Remote energy metering is potentially an application requiring local infrastructure. However, the bandwidth requirements of such applications are very low and are unlikely to justify significant investment.

Figure 2 - Alternative Access Provider - Market entry scenario



407 Typically the alternative local provider will exploit its more modern, more capable and cheaper infrastructure to compete on the basis of:

- offering significant discounts for directly competing services and/or
- offering additional services and higher quality.

408 In the first case the level of telecoms expenditure must be significant for the savings to users resulting from discounts to be sufficient to offset the fixed cost of switching to the alternative local provider. Large users are also more likely to appreciate the benefits of having a diverse source of supply in terms of security of service and the stronger negotiating power with both suppliers.

409 In the second case, the customer will need to be a sophisticated user of telecoms in order to cost justify the investment in new telecommunications services.

410 Thus as the telecom market in a given area develops it becomes more attractive and/or the sophistication of users increases. Consequently, as the figure shows, as the market develops a higher number of centres within a national market may be sufficiently attractive to justify alternative local provider entry. There is some evidence that entry can be viable in major city centres, as evidenced by new entrants such as MFS and Colt in the USA and UK. However, it must be stressed that they do not limit themselves to leased current services. The validity of leased current only businesses is unproven.

Long distance carrier

411 For a utility the rationale for entering the telecoms market as a provider of long distance transmission services will be to realise further value from the assets which it already possesses. This may take the form of sale of spare capacity in existing networks or, of potentially greater impact, exploiting assets such as RoWs or supporting infrastructure by investing in the construction of new telecoms

infrastructure on the basis of these assets. The commercial rationale for market entry will be based on one or more of the following differentiators:

(a) use of existing infrastructure, or the construction of new infrastructure exploiting existing assets will give the new entrant a lower cost base than the encumbent TO provided efficient Scale can be achieved in the market;

(b) the use of modern technology (eg SDH, fibre optics etc) will allow differentiation on the basis of the provision of innovative services such as a very high capacity leased circuits;

(c) technology will also permit higher levels of reliability and flexibility than that offered by TOs;

(d) modern technology will also permit lower network management costs.

Realising the value of these differentiators, and hence sustaining the viability of market entry, requires that the market, or certain segments of it, has reached a certain level of maturity and sufficient demand has developed. The more widely developed the market, the more broadly based will be the sustainable form of market entry.

412 In evaluating the potential for market entry, a prospective long distance operator will therefore first review the structure and development of the market. The economics of entry as a long distance carrier are depicted in Figure 4. From the perspective of a potential long distance carrier considering market entry solely as an infrastructure provider, a key factor by which to segment the market is average revenue per site, since this factor has a significant bearing on the feasibility of market entry.

413 As the figure shows, there will typically be a handful of specialist customers in the market whose business means that they have a networking requirement for high capacities linking relatively few locations and hence generating significant revenues per

site. Examples may include broadcasters, carriers' backbones academic/scientific networks.

414 At the next lower level of revenue per site there will be large corporate users which may have larger absolute telecoms expenditure than the first group of customers, some of these will have more sites and make greater use of public switched services, and will have a lower average expenditure per site.

415 At the bottom of the scale small and medium enterprises will generate relatively low revenue per site because of their smaller scale.

416 The significance of this segmentation becomes apparent in considering potential entry strategies for a long distance carrier. In any national market there is likely to be a minimum core network that an entrant will need to construct. The nature of this network will depend on the economic geography of the market (ie where demand is located), and engineering considerations such as the need to develop a ring architecture to achieve high levels of resilience. The investment in this core network will be a minimum fixed cost in any long distance market entry strategy, but requires that further long distance cost be incurred in achieving access to customers in order to make the infrastructure saleable. Potential entry strategies can be differentiated by the level of incremental investment required in achieving customer access over and above the core network. Three possible strategies can be identified:

- niche entry;
- entry serving directly connected customers only;
- broadly based entry.

Niche entry

417 The strategy which requires the minimum incremental investment is to focus on the specialist sector of the market. Here customers have few sites with high

average revenue and high quality and capacity requirements. Thus, for a small additional investment in providing access to these sites, high value can be gained and a premium realised for the high quality and capacity of the core network.

The viability of this strategy depends upon:

- there being sufficient specialist customers of this type in the market able to take advantage of alternative supply;
- achieving sufficient revenue under long term contracts from the available customers to cover core network costs; and
- the entrant being able to withstand any competitive response from the encumbent TO.

Direct connect customers only

418 The next potential strategy would be to also address the high end of the corporate market where revenues per site were sufficient to justify direct connection. Such a strategy would require further investment in extending the reach of the network. With a direct connection the new entrant would be able to exploit its capability to provide advanced services and end to end quality. Less specialist (ie 2Mbits) services could also be offered.

The viability of this strategy depends on either:

- there being a sufficient density of customers so that the cost of network extensions could be spread sufficiently to ensure that less specialist services are cost competitive; or
- there being sufficient customers with sophisticated needs for new services to cost justify the increased level of investment; or

- a viable combination of the two factors.

Broadly based entry

419 The third levels of strategy for new entrants such as Mercury have initially pursued such strategies together leased current and long distance telephone revenues form large businesses. New entrant would be to address the smaller user end of the market. Although a potentially much larger market in terms of customer numbers, revenue per customer will be much lower and insufficient to justify construction of a direct connection. Access to the customer would be achievable by leasing a connection from the entrant's point of presence to the customer's premises from the TO or other local provider. In this case the range of services and quality levels that the entrant could offer will be constrained to the levels offered by the access provider. Price therefore becomes the key differentiator. The new entrant would again need to make further investment and significantly increase the scale of operation to support the larger customer numbers.

The feasibility of this strategy depends upon:

- the availability of a digital access infrastructure provided by the TO (or other provider) at cost related prices; and

- cost competitiveness on the part of the new entrant in the provision of a commodity product.

- the new entrant being able to able to achieve sufficient share of the closed circuit market to justify increased investment in the network. In the absence of telephone revenues, and because of the relatively small amount of smaller businesses the share of the closed circuit market required to achieve a vichy? broadly based entry energy? providing closed circuits only may be unobtainable in many cases

420 The success of all forms of long distance carrier entry is critically dependent on achieving a number of conditions, and success and/or failure can readily be brought about by relatively small changes in the operating environment. For example, a long distance entry strategy aimed at providing Pan European connection would be much more likely to succeed if uncertainty over international licensing were to be reduced through a common European approach. More broadly based entry strategies are heavily dependent on the supply of access infrastructure by the TO. Any problem in agreeing interconnection terms, or achieving adequate quality of interconnection could seriously jeopardise such a business. Similarly if access to suitable radio frequencies (for microwave access) is difficult, again entrants will be deterred. It could be argued that, as has been seen in the UK, there is a need for the regulator to support entrants and eliminate as many of the potential obstructions as possible.

Conclusions

421 This discussion of the economics of market entry as either an alternative local provider or as a long distance carrier has made clear how and why the form of market entry by an alternative infrastructure provider will vary according to the level of development of the existing market. The key points to note are as follows:

- alternative local providers are most likely to be successful in major city centres in advanced markets where there is high availability of supporting infrastructure (eg ducts) on economic terms;

- the exclusion of alternative local providers from public telephony services will reduce significantly the number of markets into which entry is viable;

- viability of market entry as a provider of long distance infrastructure is dependant on the existence of demand which can be served on an economic basis, whether on a small scale as a niche operator or on a larger scale in the case of more broadly based entry;

- in our view, it is not the case that in all markets that a viable combination of demand and supply will necessarily exist, in other words, it may not be viable to enter some markets as a long distance infrastructure provider through any strategy. Other markets, of course, may provide attractive opportunities;

- the viability of long distance entry will be improved if the provision of international services were allowed, and/or alternative infrastructure providers were permitted to offer, public telephony services;

- all forms of entry are dependent upon the availability of interconnection with TO networks in an economic and timely way. Regulatory support of new entrants may be required to achieve these conditions.

In the next chapter we apply this analysis to each of the four types of market we identified in Chapter 2 in order to derive the likely impact of infrastructure liberalisation as proposed.

5 Market development scenario

5.1 Introduction

501 In Chapter 2 we established that the current performance of the E.U. infrastructure market is highly variable, and in virtually all cases, one or more aspects of the market's performance results in significant dissatisfaction on the part of end users. We also established that much of the variation in performance is strongly related to variations in the level of development of the TOs in the Member States. In the third chapter we reviewed the potential for the assets of the utilities to be exploited in the provision of alternative infrastructure, focusing on some of the practical obstacles which might be encountered. We also discussed some of the practicalities relating to the self provision of infrastructure. In Chapter 4 we reviewed the economics of market entry as an alternative infrastructure provider, looking at, in particular, how market entry strategies would be likely to vary with the level of development of the market.

502 In this, fifth chapter, we draw together many of the strands developed in the preceding chapters to develop scenarios which describe how infrastructure supply might develop in each of our four market types should the proposed liberalisation measure be implemented. In each case we identify how, and if, market entry might occur and analyse the impact on both the TOs and the various groups of users and the consequent economic effect.

503 Table 13 summarises our views on the market entry strategy most likely to be adopted by an alternative local provider, on long distance carriers in each of the four market types.

504 Table 14 summarises the impact on each of the types of TO in terms of a number of factors. These factors include:

- **revenue** - both PSTN and leased circuits;

Table 13: Impact on TOs of liberalisation of infrastructure

	Initial	Modernising	Mature	Advanced
Volumes	• No impact on PSTN volumes • May impact existing services to specialist customers if any. Corporate impact small because not already served	• wider availability of digital infrastructure and lower prices may impact PSTN revenues • Migration to digital from analogue leased circuit will accelerate. TO will share in this if digital service available.	• Erosion of PSTN volumes accelerated • Digital leased circuit market very dynamic, TO should share in growth neutralising share loss, provided it can be competitive. • New service market also stimulated	• Additional growth in new services market is TO competitive • Digital research circuits virtually saturated, so little incremental impact
Prices	No impact on PSTN prices Pressure on existing specialist services	• May be pressure to accelerate PSTN rebalancing • Downward pressure on digital and analogue leased circuit prices	• Some additional PSTN rebalancing pressure • Pressure to cost align digital leased circuit tariffs • Competition for embryonic market reduces new service prices	• Telephony and leased circuit prices already cost aligned, so pressure transferred to costs • New service prices keener
Revenue	Minimal impact overall since PSTN most significant	• Some loss of PSTN and leased circuit revenue, but overall impact small because of dominance of PSTN revenues	• Significant proportion of leased circuits revenue at stake, if TO not price or quality competitive, but still small in overall terms	• Over 10% of revenue subject to competition • Losses in leased circuit market particularly offset by growth in new services

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Table 13: Impact on TOs of liberalisation of infrastructure (Cont'd)

	Initial	Modernising	Mature	Advanced
Costs	Small or even positive if reliable serve unprofitable specialist customers	• Pressure to improve efficiency in leased circuit operations.	• Further pressure to improve productivity in leased circuit operations, although major change will be in SPTN related activities.	• Pressure to reduce costs throughout the business
Investment	Vast majority of investment will be in improving basic network for productivity and quality gain. This will happen anyway.	• Some investment brought forward or refocused to improve quality/availability of digital circuit • Higher priority given to advanced services • Overall impact small relative to level of investment which will happen anyway.	• Some investment in advanced services brought forward. • Major network modernisation would have already been achieved.	• Further investment in roll out of new services • Major investment already complete.
Summary	Leased circuit market insufficiently developed to attract much competitive interest. Where entry does occur will focus on large user segment. Negative impact on TO of migration from PSTN could be significant.	• Main effect is to bring refocus forward slightly or development which would happen anyway as a result of the need to improve efficiency	Market is very dynamic and potential to given or lose revenues is quite hight. However, a mature TO should be relatively efficient and well placed to exploit its economies of scale to compete.	Advanced TO should be well placed to face competition. Having enjoyed monopoly during maturity phase, should dominate the market and be least cost provider.

Table 14: Market entry scenario by market type

	Initial	Modernising	Mature	Advanced
AAP	• Largest towns only, if at all • Constrained by quality of interconnecting infrastructure • Focus on interest groups eg financial community • Low priority	• Largest towns only • Demand beginning to develop more broadly • New services offered • Actively reviewing the markets	• In several markets, seeking to interconnect • Advanced services significant part of revenues	• In many markets Interconnecting operations, either through self provision of alliance within long distance carriers
Long distance	• Specialists and very large direction connect customers only, if cost feasible • International service attractive for MNC's	• As for 'immature' but corporate market increasingly active • Availability of digital infrastructure makes limited access to smaller customers feasible, but pricing a barrier	• Looking to roll out into smaller customers • Specialist and large corporate established with new services available • Basic infrastructure market increasingly competitive	• Facing increasing competition on service and price, even in advanced services. • Looking for alliances with access providers.

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- **costs** - overall operating expenditures;
- **investment** - the scale, nature and timing of capital expenditure;
- **volumes** - the quantity of services provides, both PSTN and leased circuits; and
- **prices** - the structure and level of prices for all services.

5.2 Development scenario, 'initial' market

Form of market entry

505 Overall we would anticipate that poorly developed markets would be of relatively low priority for those considering entry as an infrastructure provider either as an alternative local provider or long distance carrier. There are two main reasons for this, firstly demand for infrastructure services is unlikely to be sufficient to justify significant investment and secondly, the lack of TO infrastructure inhibits the development of competitive provision.

506 For an alternative local provider only the largest towns with the greatest concentrations of telecoms intensive users are likely to be attractive. If the existing TO infrastructure is poor there is little incentive for customers to take advantage of the alternative access provider's higher quality because the quality of any interconnecting call or circuit will fall to the quality of the weakest link in the chain. Only where there is the prospect of the alternative local provider providing end to end service between customer sites or groups of customers is there any quality advantage to be gained.

507 Similarly for a long distance carrier there will exist no digital access infrastructure to allow it to economically serve small customers. It must therefore connect directly with its customers which leaves only the 'specialist' segment of the

market and a few large corporates with specialist needs, for example car companies. Such customers are most likely to be MNCs so the availability of international interconnection for such infrastructure would be particularly attractive. The bulk of the corporate market will be insufficiently developed to generate the scale of usage required to justify direct connection overall. The business case for long distance entry is likely to be marginal and depends to a large extent on local geography and market conditions.

Impact on TO

508 Given that limited competitive entry into the infrastructure services market is likely, the impacts on the TO are also likely to be limited. Any impacts that result are likely to be small in relation to the changes that such a TO will be addressing in any case.

509 Given the under developed nature of the market, any entrant offering digital services will have little impact on existing TO revenues given the overwhelming dominance of PSTN earnings at this stage in the development of the TO. However, where the alternative provider is able to offer interrelated transmission services there may be an increase tendency for its MNC customers to substitute PSTN with a corporate network.

510 It might be argued that, to the extent that new entrants cream off the largest, specialist customers, the potential demand for services that the TO might develop is being pre-empted. The counter-argument is that the TOs focus at this level of development will be on improving basic services and that to have to address specialist needs would be difficult and would be a distraction from that major aim. In this situation new entrants offering advanced viable services might be seen as relieving the pressure on the TO.

Impact on end users

511 In terms of the market performance indicators we developed in Chapter 2, the impact from the perspective of end users of liberalisation in such a market will be somewhat limited. The focused form of market entry, and the constraints on the TO's ability to respond, mean that little change can be expected in the general level of prices, quality of service, and ubiquity of service availability.

512 The major benefits will be improved availability of advanced services and possibly international connections for a limited number of customers. The major beneficiaries will be the MNCs and the education/research community (if adequately funded). The economic impact will be to potentially remove one of the obstacles to international involvement, which may be of considerable value in these typical underdeveloped economies.

5.3 Development scenario, 'modernising' market

Form of market entry

513 Again market entry is likely to be constrained by the lack of development of the market and supporting infrastructures. Alternative local providers will again focus on the most attractive centres, but are likely to review opportunities in other areas as the market begins to develop more broadly.

514 Long distance carriers will again focus on the specialist sector and the largest of corporates, and will enter if they can cost justify their network on this customer base. They will also begin to assess opportunities as demand begins to develop in the broader corporate market. The availability of some digital infrastructures from the TO will make access to smaller customers feasible. However, the coverage of this infrastructure will be limited and prices will still be high and therefore represent a barrier.

Impact on TO

515 The main impact on the modernising TO will be to hasten a number of developments which would occur naturally and to perhaps re-focus some activities.

516 Even without liberalisation of infrastructure, the modernising TO will be investing heavily in digital infrastructure to improve productivity and quality of service. As a consequence the digital leased circuit market would be expected to develop as supply constraints are eased. There would be some cannibalization of analogue leased circuit revenues and some increased use of leased circuits to substitute for PSTN. The TO would use prices to regulate the speed of these developments. With liberalisation of infrastructure and increased supply of digital leased circuits, these processes would tend to accelerate. In response the TO will need to accelerate its investment in digital infrastructure and, in order to compete, will face increased pressure to:

- accelerate PSTN rebalancing to protect revenues
- reduce digital leased circuit prices, thus losing the ability to regulate the migration from analogue circuits;
- improve efficiency in leased circuit activity in order to retain profitability; and
- give higher priority to the development of advanced services.

517 Overall the scale of any revenue loss will be relatively small given the dominance of PSTN revenues. Provided the TO can be competitive, it should be well placed to share in the stimulation which the digital leased circuit market will enjoy as a result of market entry. However, as prices fall, particularly in countries where the range of liberalised services is broadly defined to include, for example, CUGs, some substitution of PSTN by corporate networks could be expected. The impact on investment brought about by accelerating or refocusing expenditure plans is likely to

be small relative to the large sums which will remain committed to network modernisation.

Impact on users

518 The benefits to users will be more broadly spread than would be the case in a less developed market, but would still be limited to the larger users. These users would be the first to benefit from the offerings of market entrants and would be the focus for competitive response from the TO. The major thrust of this response is likely to be improved quality of service and reduced prices to some extent. This focused response will benefit large users in established business centres, since their areas will be the focus of the TO's network modernisation. Users whose key requirements is for ubiquity of service, such as national businesses, are unlikely to see much benefit.

5.5 Development scenario, 'mature'

Form of market entry

519 A mature market in many ways offers the greatest potential for competitive entry. Demand for digital services is well established and supporting TO infrastructure is in place.

520 The alternative local provider may be able to justify investment in several centres and will be looking to interconnect them in order to provide end to end services and reduce access charges. There is also likely to be uptake of new services which the alternative local provider will be competitively well placed to provide.

521 Long distance entrants will be looking to roll out into smaller corporate customers using TO access infrastructure. The specialist and large corporate market will still be attacked with a focus on high capacity and new services. The market for basic infrastructure services will become increasingly competitive and will tend to be commoditised.

Impact on TO

522 With the proposed form of liberalisation of infrastructure, the mature TO is likely to face a very dynamic market where the potential to lose or gain profits is quite significant. However, such a TO would have completed its major investment and modernisation programmes and should be reasonably well placed to compete through exploiting its market dominance and its economies of scale and scope. Indeed, some mature TOs commented to us that they would welcome infrastructure competition because of the stimulus it would provide to the market and their own performance.

523 Again the main impact will be to accelerate processes that will already be taking place. These impacts are:

- accelerated substitution of PSTN;
- strong growth in the digital leased circuit market, but in which the TO should be able to share, provided that it is efficient;
- stimulation to the new service market;
- increased pressure to rebalance PSTN and to cost align leased circuit tariffs;
- reduced scope for premium pricing of new services;
- Some additional/earlier investment in new services will be required for TO to remain competitive, but this will be small in absolute terms relative to the major investment already made to modernise the network; and
- Reduction of costs in leased circuit activities through improved efficiency.

Impact on end users

524 The vast majority of infrastructure users are likely to benefit from liberalisation of infrastructure services in a mature market. Given the competitive spur of broadly based market entry and the results of the network development programmes, the TOs should be able to achieve significant improvements in their performance. Prices, service quality and availability of digital infrastructure should improve considerably, so that in particular, users of high volumes of relatively low capacity digital circuits such as VAS providers, other carriers and national businesses will be able to benefit.

5.5 Development scenario, 'advanced' market

Form of market entry

525 Market entrants facing an advanced TO with a relatively full range of services and operating efficiently, will find it hard to establish a foothold in the face of the TOs market dominance and economies of scale and scope. In order to compete on a broad base of infrastructure services and long distance, operators will need to achieve a lower cost base than the TO, which may be difficult given the factors mentioned above. Each will seek to ally with complementary operators in order to reduce costs.

526 There may be niche opportunities in high value sectors. Some demand for infrastructure to achieve diversity for technical and commercial reasons. However, it is questionable whether these could sustain large scale infrastructure investment. A more likely scenario in this case is that these niche requirements will be served by service providers exploiting TO provided infrastructure.

Impact on TO

527 If the TO has had the benefit of infrastructure monopoly in its maturing period it should be well established in the market place. It should satisfy all demand for digital infrastructure, and prices should be cost aligned. If entrants follow a low cost strategy there will be pressure to accelerate cost improvement. With niche entry by

infrastructure providers, prices and market share will increase the need to develop new services, ahead of their normal progression and past pressure on.

End user impact

528 Given that in an advanced market the needs of all user groups should be well served in all aspects of performance, most users will notice little impact from liberalisation of infrastructure. Where there will be a noticeable improvement, however, is the rate of innovation and development of advanced services by new operators working in niches of the market place.

6 Conclusions

601 The objectives of this study have been to:

(a) provide an understanding of the current market for infrastructure, and how it might evolve if alternative infrastructure provision were not liberalised;

(b) identify the scope for market entry by alternative infrastructure providers in the circumstances where their activity was limited to the provision of infrastructure for services already liberalised;

(c) assess the impact that such entry might have on the participants in the market place, particularly the TOs and users;

(d) review the wider economic benefits;

(e) make recommendations as to if and how such liberalisation measures shall be adopted.

602 In respect of each of these objectives our conclusions are as follows:

- **The current situation in the market**

603 Across the EU widespread provision of alternative telecommunications, infrastructure to third parties is not generally permitted under existing national regulatory frameworks, outside of the UK. However, in a number of Member States self provision is allowed at the discretion of the regulator where the TO cannot supply an adequate solution.

604 There are wide variations in the availability, functionality and price of digital infrastructure across the EU. In many cases service availability is poor and

prohibitively expensive. As a result users are highly dissatisfied. European businesses are competitively disadvantaged relative to their major competitors because their telecommunications are either more expensive and/or less capable than those of their competitors outside of the EU. This disadvantage is evidenced by the 10 to 1 price ratio of digital infrastructure in the EU relative to the US.

Many of the variations in the availability of digital infrastructure reflect the range of development of the TOs in the EU, and are strongly related to a wide range of other factors such as tariff imbalances and the level of network development. Through the effect of a combination of economic, regulatory and technical drivers less advanced TOs will 'naturally' develop through time and the supply of infrastructure will improve. However, this process will take time during which users will continue to be disadvantaged, perhaps to an increasing extent.

605 In other markets where the TO is more developed, many users, with some justification, feel that the development of digital infrastructure services is being inhibited by the TO's unwillingness to market them aggressively in order to protect PSTN revenues rather than by the existence of supply constraints. It should be noted that all TOs in Europe fall short of world class performance in terms of customer service and efficiency

Scope for entry by alternative infrastructure providers

606 The key issue addressed by this study is what will be the impact on this generally unsatisfactory situation if the supply of infrastructure for services in the liberal domain was to be opened to alternative providers.

607 To address this issue we considered if and how market entry by alternative providers would occur if this form of liberalisation were to take place. Two related questions were addressed:

- what form of market entry is feasible from a technical and operational standpoint; and
- what are the economic and commercial realities of such market entry?

Our conclusions in respect of the first of these questions are as follows:

- existing utility telecommunication networks are unlikely to offer significant capacity for commercial exploitation; further investment in additional facilities would be required;

- utility assets can be used to construct new telecommunications infrastructure more quickly, more cheaply, and with less environmental disruption than conventional methods, although these benefits are more likely to be available in the construction of long distance rather than local infrastructure. Exploitation of long distance infrastructure will require either construction of local access or use of existing TO customer connections.

- when constructing new telecommunication infrastructure for commercial purposes, utilities are likely to seek a telco operating partner to provide expertise and capital and seek to establish a independent telecommunications network for commercial purposes in order to overcome of operational and cultural barriers associated with sharing assets between the core functions of the utility and a commercial venture;

- while a number of utilities are known to be considering such an investment, as yet only Energis (the subsidiary of the UK's National Grid Company) has committed to network construction.

In examining the commercial and economic realities of market entry as an alternative infrastructure provider under the proposed form of liberalisation, we conclude as follows:

- alternative local providers are most likely to be successful in major city centres in advanced markets where there is high availability of supporting infrastructure (eg ducts) on economic terms.

- the exclusion of alternative local providers from public telephony services will reduce significantly the number of markets into which entry is viable;

- viability of market entry as a provider of long distance infrastructure is dependent on the existence of demand which can be served on an economic basis, whether on a small scale as a niche operator or on a larger scale in the case of more broadly based entry;

- in our view, it is not the case that in all markets a viable combination of demand and supply will necessarily exist; in other words it may not be viable to enter some markets as a long distance infrastructure provider through any strategy. Other markets, of course, may provide attractive opportunities.

- the viability of long distance entry will be improved if the provision of international services were allowed and/or alternative infrastructure providers were permitted to offer public telephony services;

- all forms of entry are dependent upon the availability of interconnection with TO networks on economic terms and in a timely manner. Regulatory intervention may be required to help new entrants achieve these requirements.

We applied this analysis of these issues to each of the four types of market we identified in Chapter 2 in order to derive the likely impact of infrastructure liberalisation as proposed.

608 In markets at an **initial** stage of development, entry by either long distance operators or alternative local providers is likely to be limited. Only where there exists an economically serviceable concentration of customers, most likely to be MNCs, will entry occur at all. The ability to offer international services will be an important consideration for new entrants. From the perspective of end users and economic

impact, the availability of high capacity, inter city and international (at least pan EU) infrastructure services is likely to be the key benefit. The TO's leased circuit earnings would be minimal and therefore some loss of market share would have a small impact on overall revenues. The most important negative impact is likely to occur if the provision of international infrastructure were allowed and there was widespread substitution of international PSTN by corporate networks by MNCs. The loss of profits might be considerable, especially where there were constraints on the rate at which tariffs could be rebalanced. There exists, therefore, a direct trade off between end user and economic benefit and profitability of the TO in the early stages of development.

609 As the market and TO move beyond the initial position through **modernisation** and **maturity**, the scope for market entry as an alternative infrastructure provider becomes progressively greater as the availability of interconnecting infrastructure, and level of demand increases. Market entry, however, will not be inevitable and will continue to depend on the existence of economically serviceable demand. It will be more likely to occur where international (pan EU) services are permitted, the regulatory regime supports interconnection and there is a future prospect of liberalisation of infrastructure for public telephony services. The benefit of alternative supply will spread from a few specialist, high value users to customers whose priority is for more widespread availability of less specialist services at economic prices. Consequently the economic benefit will be enjoyed not just by a few leading sectors, but more broadly by industries such as financial services and other multiple site national businesses. The main impact on the TOs will be to provide an incentive to accelerate many of the processes of change which modernisation brings about, such as PSTN tariff rebalancing, productivity improvement and enhancement of customer service.

610 Overall then, there appears to be little reason to argue against the liberalisation of alternative infrastructure provision in the way proposed in markets where the TO is modernising strongly or has reached maturity. Although market entry is not guaranteed (and certain things could be done to make entry more likely), where it does occur in such circumstances, the impact on end users and hence the European

revenue less economy would be positive and potentially significant. The impact on the TOs will be some but also to accelerate processes which are in many ways inevitable and may on balance be positive.

611 In markets where the TO is at a relatively early stage of development and is constrained in its ability to respond by either technical or social factors, then the position is less clear cut. Because of the nature of the market, entry, where it did occur, would focus on providing advanced, international services to the TOs prime customers. The economic benefit which could be achieved is probably greatest in this area, but the potential impact on the TO in terms of PSTN substitution is also significant. Policy makers therefore face a trade off between supporting the TO and meeting the immediate needs of end users in such circumstances.

Advanced services

The advanced services we have considered in this assessment include:

- High speed leased lines eg leased lines at speeds of 34Mbit/s, 140Mbit/s, 155Mbit/s, and above.
- Virtual Private Networks (VPNs) which offer abbreviated dialling (eg extension number) and attractive tariff packages for voice telephony.
- Frame Relay Service which is a streamlined version of today's X.25 packet switching data service.
- Switched Multimegabit Data Service (SMDS) or the ETS defined version known as Connectionless Broadband Data Service (CBDS) which is designed to provide high speed data service.
- Public ATM service which is expected to support multi-media (voice, data and video) applications and expected to support the future Broadband networks (eg B-ISDN).

All of the above services potentially from TOs and other service providers could be employed in corporate networks.